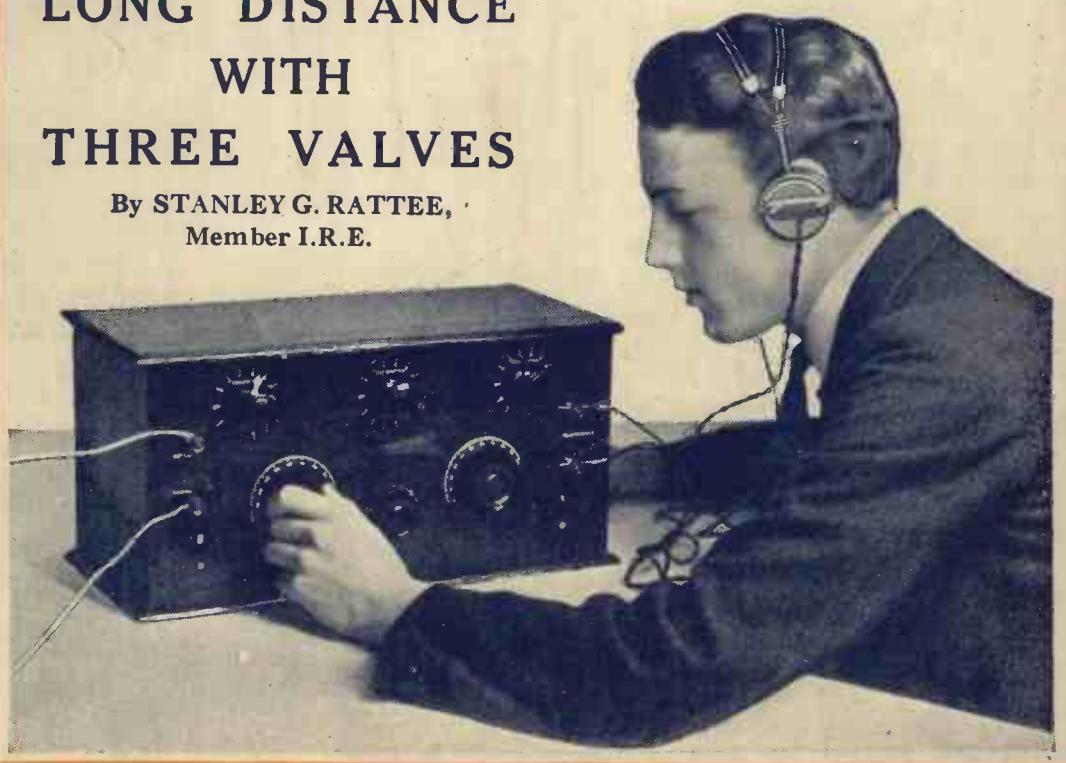
Wireless Weekly, 6d. Net. Wednesday June 3rd, 1925

Wireless Weekly

Vol. 6. No. 9.

LONG DISTANCE WITH THREE VALVES

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



The Balkite Battery Charger

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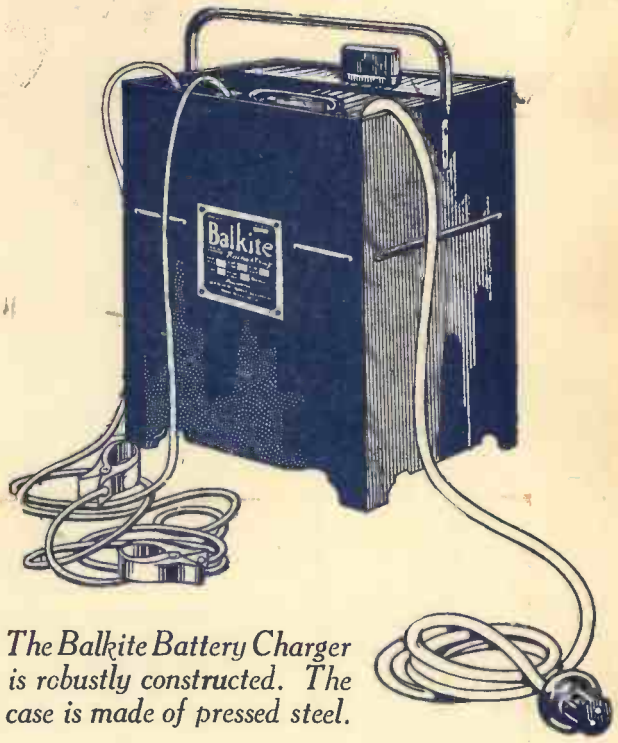

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A Prudent Decision

IT was made known last week that the now notorious Wireless Bill was to be dropped for an indefinite period, and the Government is to be congratulated upon the prudence of this wise, if somewhat belated, step.

It is generally realised at the present time that some form of legislation is called for to clear up the position of the private use of the ether for purposes of wireless communication; the Act which now governs the use of wireless is dated 1904, and it is needless to dilate upon the impossibility of such a measure providing a satisfactory means of governing up-to-date conditions, drafted as it was with no anticipation of the developments which have taken place in the meanwhile.

A fair and sane measure would therefore have been accepted almost without discussion, and would, indeed, have been welcomed. Given such an opportunity, it is difficult to see how a Government could have devised a Bill from which the spirit of rational adaptation to modern conditions was more completely excluded.

The evils of the old Act were simply aggravated and perpetuated by the new measure, the object of the new provisions being so thinly disguised that the whole astonishing document was immediately designated "a sneak Bill." Briefly, the whole trend of the Bill was to enable the Post Office to prosecute the most exaggerated course of bureaucratic interference at any time which they might choose, and to place behind them the whole weight of the criminal law. Apart from the much discussed right of search, to which we ourselves attach less importance, the Bill contained such pernicious clauses as that which constituted the mere possession or "maintenance" of any apparatus which can be used for wireless telegraphy, such as the most trifling accessories, an offence punishable by the absurd penalty of twelve months' hard labour. It is idle to maintain that such provision is only intended to apply to the more serious cases which arise in time of national emergency, for the wireless experimenter has had too long an experience of the ways of the Post Office to depend upon its forbearance in any such matter. That such an indiscriminating clause should be inserted in a measure professing to deal in a reasonable manner with modern conditions was nothing short of monstrous.

An even more pernicious clause was that which bade fair to perpetuate the system of "legislation by regulation," which may be endured in war-time, but is unthinkable under normal conditions. Any such provision is entirely wrong in principle, since it gives the Postmaster-General the opportunity to slip all kinds of injurious regulations through the House at any time, and the sole protection of the experimenter would lie in the vigilance of Members of Parliament. We have here a most fundamental departure from constitutional methods, which demand that any alteration to the Statutes shall be expressly approved by the Legislature. Here again, experimenters have no illusions as to the forbearance of the Post Office, since long and bitter experience has convinced them that this Government Department is far from favourably disposed towards their interests.

The news of the dropping of the Bill was received with profound relief by all who desire the welfare of the experimental movement, and nowhere with greater satisfaction than in those quarters where energetic campaigns of opposition to the Bill were being organised. It is indeed cause for satisfaction that it will not be necessary to set these campaigns of opposition into operation, in view of the very prudent action of the Government.

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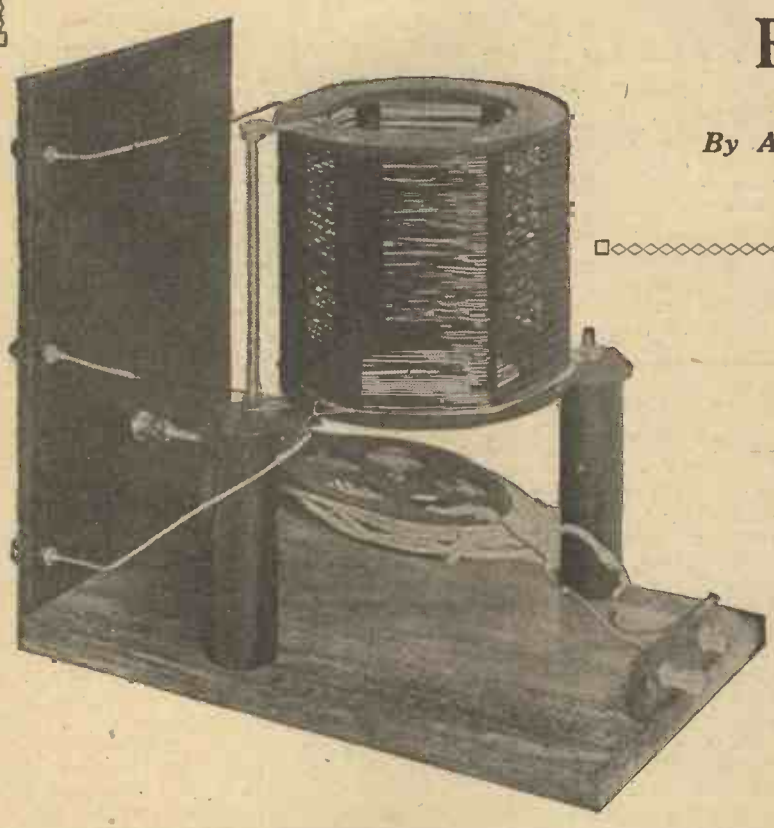
Low-Loss Inductances and Distant Reception

By A. D. COWPER, M.Sc.,
Staff Editor.



The vario-coupler used by Mr. Cowper. The lower coil is used for aperiodic aerial coupling, the two terminals on the extreme right being for the aerial and earth connections.

THE receiver to be described here is the result of an attempt to make the fullest use of the extraordinary selectivity and sensitivity of a simple detector circuit with reaction, obtainable with the modern type of ultra-low-loss tuning inductances when used in conjunction with small total tuning capacity and with the sensitive Reinartz type of reaction. By carrying to the limit the principle of loose-coupling as applied to an "aperiodic aerial" arrangement, and with a wave-trap (arranged across the "aperiodic" coil) of extremely sharp tuning, it has proved possible to cut out the local station completely and at close range, whilst still obtaining distant stations at good loud-speaker strength on the four valves used.

The task which the writer set himself was to eliminate the London station, when using a large outside aerial at 13 miles, and to receive Manchester at reasonable loud-speaker strength without any murmur of London—and, if possible, to repeat the feat with Cardiff. The aerial in question is an unusually efficient one of the transmitter type, a 70-ft. three-wire "sausage" of over .0005 μF capacity, 40 ft. high, and fairly unobstructed on high ground, used with a three-wire counterpoise. On a low-loss crystal-tuner of the "proportional crystal-tap" type, late at night and when London is on full power, the writer has obtained as much as $\frac{1}{2}$ milliampere rectified current from this aerial, so that the interference problem is fairly acute. On any ordinary set, with or without a high-frequency stage, London jams all other stations hopelessly over most of the broadcast belt. Northolt is also almost within sight of the receiving station, so that it represents a good field for experiment.

Controls

Two, or at the most three, tuning controls were specified, and not more than four valves. The wave-trap and filament resistances are not included in this count, as the first is set once for all (though with exceeding care and accuracy to be effective under the circumstances indicated) and the latter are rarely touched, though the detector valve filament temperature can with advantage be used for fine control of reaction with some types of valves.

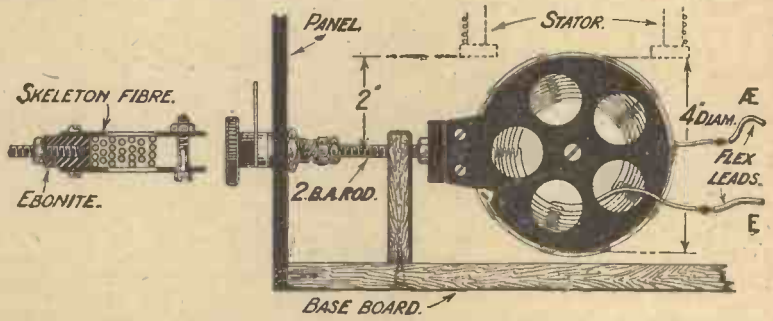
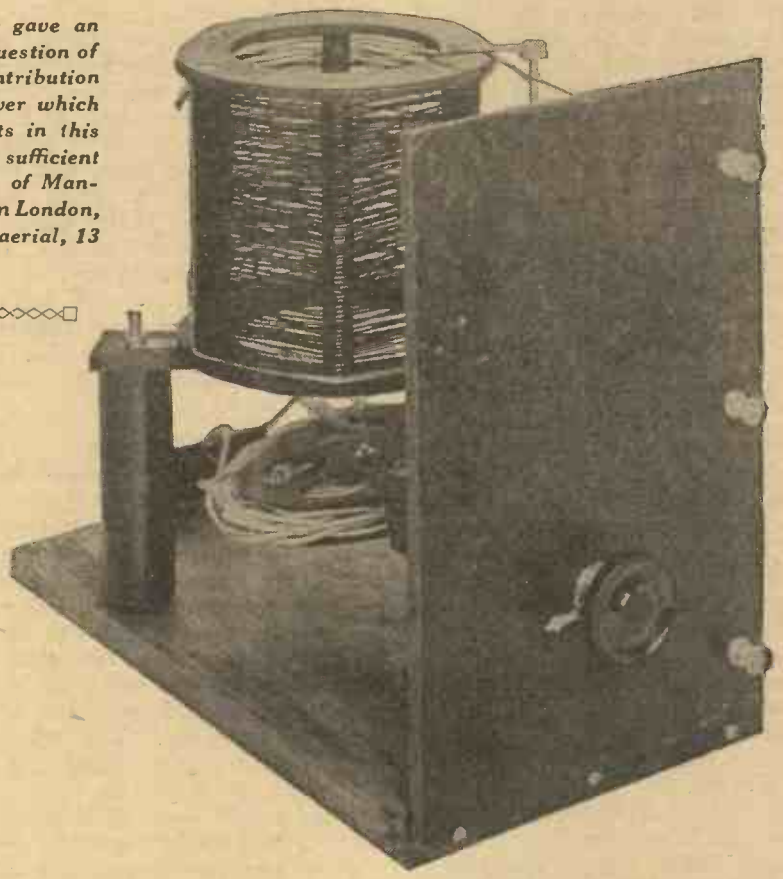


Fig. 1.—Constructional details of the rotor, which consists of a double basket coil of 25 turns of No. 14 d.c.c. wound upon a former 2 inches in diameter. The spokes are removed after winding.

In our April 29 issue Mr. Cowper gave an account of his researches on the question of low-loss inductances, and in this contribution he gives details of a low-loss receiver which is the result of further experiments in this direction with a view to securing sufficient selectivity to allow of the reception of Manchester without any interference from London, when used with a large outdoor aerial, 13 miles from 2LO.



The knob seen on the front of the panel gives a variation of the coupling between the stator and rotor. The air-spaced windings of the former may be clearly seen in this photograph.

Coupling

Ordinary loose-coupling with a three-coil tuner, as indicated in the article "Volume Without Distortion" in *Wireless Weekly*, Vol. 5, No. 21, while effective in the hands of the experienced at a reasonable distance from the nearest interfering stations, proved insufficiently selective when subjected to this *extreme* test. The most modern type of really low-loss inductance does not lend itself to the conventional three-coil holder mounting, and the proximity of the leads at the pivots of the coil-mount produces a fatal degree of coupling, so that shock excitation results in the grid-circuit and the powerful local station cannot be completely excluded. With the auto-transformer type of "aperiodic aerial" coupling, at the cost of

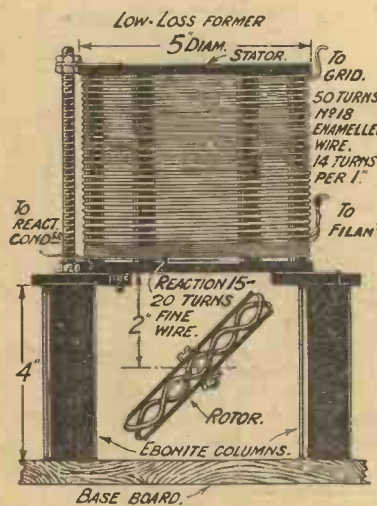


Fig. 2.—All details as to turn numbers for the stator are given in this illustration.

a small or negligible loss of signal strength, a sufficient degree of selectivity can be obtained in the simplest manner for ordinary long-distance work, and the local station can be confined to a fairly narrow band of interference by the use of a low resistance, series acceptor circuit across the "aperiodic" aerial turns; still this does not allow of a ready fulfilment of the severe conditions specified above, *i.e.*, Manchester through London at 13 miles on a large outside aerial.

The Vario-Coupler

More extreme loose-coupling is indicated, together with real low-loss inductances to sharpen the tuning, so that the band of sensitivity is really narrow. The result of following out this principle to its logical sequence is shown in the figures illustrating a vario-coupler of unusual design whose stator (secondary) is a low-loss coil (50 turns of No. 18 enamelled, spaced) of a type which gives, experimentally, about the minimum resistance for a given inductance (*Wireless Weekly*, Vol. 6, No. 4, p. 121), with its small, Reinartz type reaction coil of fine wire (15 to 20 turns only) wound continuously with the other winding and close up below that winding on the same former—a hexagonal squirrel cage, 5 in. in diameter, of ebonite rods—the rotor (primary) being a large basket coil made with 25 turns of No. 14 d.c.c. wire and self supporting, merely clamped between skeleton side plates screwed to an ebonite block on the end of its spindle.

The Rotor

The very thick wire is used partly for mechanical reasons, partly to give a fairly low H.F. resistance by virtue of the automatic spacing which the clumsy thick d.c.c. wire necessarily dictates; a proper "low-loss" coil of spaced No. 18 wire is hardly practicable here. This basket coil acts as an "aperiodic" aerial coil, and can be arranged so as to give an extremely light

magnetic coupling to the secondary grid coil; it is mounted with its centre 2 in. below the bottom of the stator, on a horizontal shaft (built up of ordinary 2 B.A. screwed rod and fittings) so as to be controlled from the front of the panel, and rotates at will through 90 deg.

The Trap Circuit

The trap, a series acceptor circuit made up of a No. 75 coil of low resistance and a .0003 μF (or thereabouts, say, .0002-.0005 μF) variable condenser in series with it, is connected across this coil, as shown in the circuit diagram. In extreme cases of interference a genuine low-loss inductance, of similar design to the grid inductance, *i.e.*, a 5-in. low-loss former, with 50-60 turns of No. 18 enamel insulated wire, spaced about 14 to the inch, can be used with advantage in place of the plug-in coil. This gives razor-sharp extinction of the local station, with extremely careful tuning. One great advantage of this arrangement is that the trap tuning does not alter with the receiver tuning, nor does it affect the latter appreciably, except that the whole trap circuit, together with the "aperiodic" coil, forms a tuned circuit resonant for a particular wavelength above that of the interfering station to which it is set, so that the receiver refuses to oscillate just at that point. This can be bridged by using a slightly different inductance value in the trap over the particular range. The wavelength of the "aperiodic" aerial circuit must be maintained just below that of reception; when a point is reached on the *short* waves, when the receiver refuses to oscillate at all, a series condenser (of fair size, *e.g.*, .001 μF, variable) in the aerial sets matters right. The aerial circuit should never be "tuned" in this circuit.

Wavelength Range

The wavelength range as shown, with a .0002 μF (actual) standard type of tuning condenser is unusually large; the short-wave amateur transmissions on wavelengths well below Radio-Belge were received at excellent loud-speaker strength, while Aberdeen was just reached, with moderate L.S. strength, at the other extremity. The tuning scale is fairly linear. Tuning is, of course, as sharp as can be handled conveniently with either a fine-geared tuning condenser or with a two-plate condenser with long handle in addition to the main .0002 μF condenser. Great care must be taken to eliminate hand-capacity effects by earthing the moving plates of the tuning condenser, providing earthed guard plates, removing the tuning inductance some inches away from the panel, etc., and in bringing in the aerial lead well away from the local circuit. The trap coil should similarly be well isolated, and at right angles to the tuning inductance. Neither should be boxed up in a small cabinet.

L.F. Stages

The inevitable loss in signal strength due to the use of an aperiodic aerial and extreme loose-coupling is made up readily by several stages of efficient transformer-coupled L.F. amplification, three being indicated for really long-distance work with the loud-speaker. The usual low-frequency buzzing or instability is cured in a simple manner already indicated by the writer (*Wireless Weekly*, Vol. 5, No. 21) by putting a variable grid-leak or high anode-resistance across the anode connection and OS of the first or second L.F. transformer; this will produce frying noises, unless a reliable make be used. For rapid work a plug and jack arrangement on the L.F. side is invaluable, and is indicated in the circuit diagram.

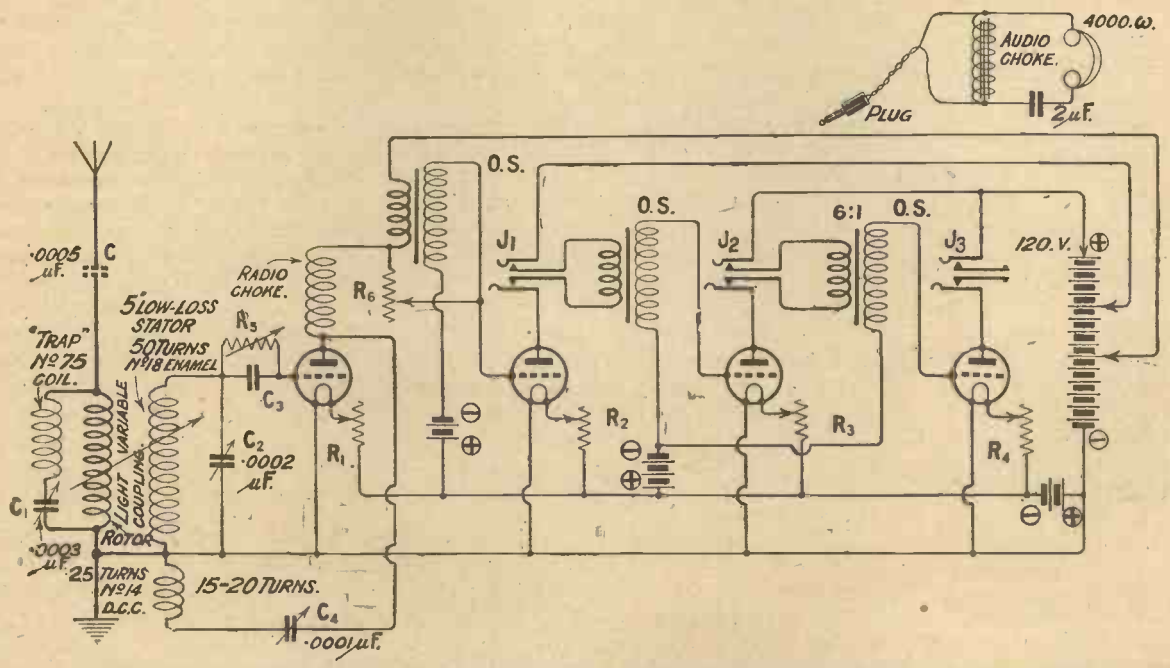


Fig. 3.—The complete circuit. J1, J2, J3 are ordinary telephone jacks, while R6 is the stabilising resistance. The value of H.T. voltage for the detector valve should be varied in conjunction with the grid-leak, for a smooth control of reaction.

The components actually used in the experimental receiver, which fulfilled the required conditions and which is described here, were :—Low-loss formers, 5-in. diam., Precision Screw Co.; variable square law condensers, J.B.; fine adjustment condenser and radio-choke, Lissen; board-mounting components, Peto-Scott; grid-leak and anode resistances, Dubilier; valves, two Ediswan ARDE and two PV6DE; L.F. transformers, Pye No. 1, Grafton Electric 6 : 1, and a Telefunken.

Results

The actual results were as indicated :—Complete exclusion of London on the big aerial at 13 miles, with Manchester at good loud-speaker strength, with but two adjustments, grid tuning and reaction. Cardiff was readable, with a slight background of London. A Continental station, on 370 metres, but giving no call-sign, presumably Scandinavian, gave excellent, clear and undistorted music on the L.S. without a whisper of 2LO. All the other main B.B.C. stations, some relays, and a number of Continental stations, besides the usual transmissions of Radio-Belge and Hanover, came in at good loud-speaker strength with careful tuning, and free from London. Rome was good, though but moderately loud, and, as usual, much marred by Morse. Even the Dundee relay station could be understood through interference, though with some difficulty; Aberdeen was quite clear. It was actually possible to listen to a distant oscillator between 365 and 370 metres without being swamped by London; and London occupied about 2 degrees on the tuning scale, with the trap in use. Without the trap, he spread over a large part of the scale, even with extreme loose-coupling. Naturally, when the receiver is tuned to the local station, the last two valves must be cut out to avoid bad overloading.

Degree of Coupling

Whilst the range of such a receiver will evidently be less on a less favourable aerial for good loud-speaker reception, the elimination of local interference should be as complete.

The degree of coupling used was generally less than 30 degrees, zero coupling being indicated by 0 degrees, and maximum by 90 degrees, this with the rotor 2 in. below the bottom of the stator.

□ □ □

RADIO NOTES AND NEWS.

MR. BALDWIN announced in the House of Commons on May 25 that the Government's Wireless Bill is dead so far as the present session is concerned.

In reply to a question by Mr. Forrest, the Prime Minister stated that, in view of the decision to hold a general inquiry into the broadcasting system towards the close of the year, the Government had decided not to proceed this session with the Wireless Telegraphy and Signalling Bill. A short Bill would be introduced instead, with the single view of removing any doubt with regard to the validity of the existing licences.

* * *

At a meeting of the board of directors of the Marconi International Marine Communication Co., Ltd., on May 22, Mr. Frederick Sandland Hayburn was appointed manager of the company.

Mr. Hayburn has been associated with the company for twenty-one years, and has been assistant general manager since December, 1922. He joined the Marconi International Marine Communication Co., Ltd., in 1904.

The Earl of Meath, the founder of Empire Day, who broadcast from the London station on May 25.

A Useful Extension Handle

WITH the increasing popularity of broadcasting on very short wavelengths, a description of a handy extension handle will not be amiss. It is designed for use where the condenser dial is held rigid by screwing down the knob. Take a piece of ⅛ inch ebonite about 12 inches long by 1 inch wide, and cut to the

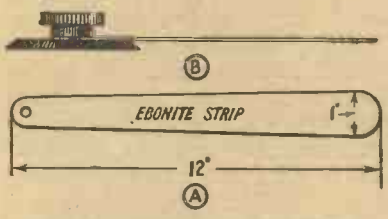


Fig. 1.—The extension handle illustrated.

shape shown in diagram A of Fig. 1. As will be seen, a clearance hole is drilled to take the condenser moving spindle. The handle is now tightly fastened in between the dial and the knob, as in B, Fig. 1.

This arrangement, besides giving a vernier movement, will be found in practice to minimise hand-capacity effects, so prevalent in ultra-short wave receivers.

G. T. K.

Reception Conditions Week by Week

By W. K. ALFORD (2 DX).

A short review of the general conditions of reception during the week ended May 24.

THE culmination of the heat wave on Monday, May 18, in heavy thunderstorms all over the country has brought a temporary improvement in reception so far as "X" interference is concerned, and several nights during the week have been exceptionally clear and favourable for long-distance reception. Thursday night (21st) was particularly good, KDKA, on his short wave, being heard as early as 10.45 p.m. at excellent strength.

Empire Day

The event of outstanding interest so far as our own broadcasting is concerned was on Sunday afternoon, when the Empire Day thanksgiving service was broadcast from the Stadium at Wembley. This inspiring ceremony was transmitted excellently, the quality improving vastly as time went on, the last address being of wonderful clarity.

Although there has been very little interference between broadcasting stations for quite a time now, the occasional heterodyning this week of Leipzig by an unknown station reminds me of the urgency of the problem. Quite a number of people have asked me whether there is any sort of "boundary" which can be allocated to a number of stations working on a band of wavelengths. The answer is wrapped up in the somewhat mystic word "kilocycles."

Kilocycles

Now, every telephony station "buys up" a certain small band of wavelengths each side of its true wavelength, and this band is commonly termed the "speech-band." It is inconvenient to refer to the width of this speech-band in metres, so we speak of "kilocycles," and here we are referring to the number of thousands of cycles or alternations which are affected by the "speech band."

Number of Stations

It is generally accepted that the average broadcasting station requires a 10-kilocycle band to accommodate its transmission, so that the band of wavelengths allocated to the broadcast service can be sliced up into 10 kilocycle parts, and it will be clear that as the wavelength of stations increases, the wider these "parts" become. In other words, a far greater number of broadcasting stations can be accommodated on a band of short waves than on a band of long waves. As an example, 150 broadcast stations could be accommodated in the band of 100 to 200 metres on the above assumption, whereas only 10 could be fitted into the range of 500 to 600 metres. This is another of the very striking points of interest in connection with the use of short waves, although the difficulties of conducting a broadcast service on extremely short waves are something to be contended with which may even be worse than the interference difficulty. Perhaps the greatest trouble is to be able to supply the average listener with a receiver which, apart from relative efficiency, is as easy to tune on, say, 100 metres as it is on 300.

American Conditions

America is, of course, affected by the interference trouble to a far greater extent than here in Europe, there being roughly 200 more stations than there is really room for.

The studio at Radio-Lyons, which is equipped with all modern improvements. This station has been in operation since April and works upon a wavelength of 290 metres. Note the microphone on the right hand side of the photograph.

Jottings by the way

Signs and Portents

FOR some time past I had felt that there was a mystery about my friend, Mr. Hercy Parris. I had an inkling that something epoch-making was afoot, though I could not guess just what it was. I must confess that my detective faculties are those of a Watson rather than those of a Holmes. What I mean is that when events have really happened I recall all the little signs and things that led up to them most clearly, and then say: "Why, what an ass I am; of course I ought to have seen that

. . . *At first we suspected Oxfords* . . .

that was coming." Let me tell you what has been taking place, in order to give you also the pleasure of Watsonising. For some months a gradual change has been taking place in the outward appearance of Mr. Parris.

Oxford Trousers

His coats, for example, which used to fit his beautiful figure to perfection, have become steadily roomier and roomier, with more and more padding in their shoulders. I thought at one time that he was going to be a victim of the Oxford trouser disease, for his nether garments had become generally baggier and longer. His footwear, too, gave me a good deal of concern owing to the growing knobbiness of the toe caps of his boots (which he began to call shoes).

Very Suspicious

All these things, had I but realised it, were those straws which show the way the wind blows. I thought myself that they were probably the result of spending half the night in listening for U.S.A. stations, and the other half in building Anglo-American Sixes. I was still more worried when he took to going every evening to the "movies." I regarded this as a very bad sign, not knowing at the time that Mr. Parris paid these visits purely for the purpose of studying the Caveman, the Strong Silent Man, the Square-chinned Man, and all the other hundred-per-cent. fellows who, though we never see them here, are common objects upon the main street of every American town. Do not imagine that he gave up wireless. He always took with him to the pictures a portable set which he had made up specially, not in an attaché case, but in a "grip." Of course, you know what a grip is. It is a funny little bag that forms the sole luggage, if the films do not lie, of every American citizen, male or female, for any journey.

A Complete Wardrobe

Though it is a little bigger than what we should call a handbag in this country, it appears to be capable of holding a complete cowboy outfit in addition to at least three suits for every-day wear and evening dress of the type which for some strange reason is invariably described as immaculate. There is also plenty of room for a selection of hats, boots, revolvers and so on and so on.

Headwear

I have told you most of the symptoms that occurred, but I have left to the last what is perhaps the most important of them, the one which most makes me kick myself and ask indignantly why I was unable to put two and two together. This symptom took the form of a gradual and progressive change in the headwear favoured by Mr. Parris. Hats on the whole have never been a strong point with him, but of late they have become funnier and funnier. For many years now earnest men of science have been devoting an enormous amount of brain power to the study of a very curious anthro-

. . . *Roomier and roomier* . . .

pological problem. Why is it that the American who wears his clothes three or four sizes too large should invariably sport a hat that is three or four sizes too small? Though the work done upon this important problem has been stupendous, and though the sheets of paper covered with collected data would, if made into bundles, fill ten and a half dust-carts to overflowing, no satisfactory solution has ever been found. My own answer to the question, which I offer in all humility, is that we are quite wrong in thinking that the American hat is too small for the head of the wearer. On the contrary it is the head of the wearer that is too large for the hat. Be it as it may, the correct headgear over there is what we may describe as a narrow brimmed truncated pork pie with a circular

depression over the crown and a band of vivid colours. That is what Mr. Parris came to by slow degrees. In his neckties, too, a change was visible, for in place of the gent's natty cravat which he used to favour, Mr. Parris towards the end of his stay in this country used to don a bootlace tied in a quaint bow with drooping ends about a foot long.

Secret Out

And then one day the secret came out, and the whole of the staff, myself included, were to be seen banging their heads against walls, turning round and kicking themselves, bursting into tears or crying, " Of course, of course." Mr. Hercy Parris, like Columbus of old, was to put forth boldly towards the West in order to discover America. Many a man would have shown signs of emotion in view of the great adventure before him. Not so Mr. Parris. His long course of moving pictures had shown him that he was venturing into a country populated entirely by cow-punchers, bank presidents, vampires, sheriffs, flappers and Ford cars; a country where people live entirely on iced water and grape fruit; a country where they either shoot you at sight or chase you for miles through the streets of the town whilst you fall into barrels of whitewash, tumble down manholes in the pavement, climb ladders whose rungs give way beneath your weight, meet runaway tramcars face to face at every turn, and finally fall over a precipice in a stolen automobile. Mr. Parris knew all these things, but did he flinch? Did he look pale? Was there a nervous hunted look in his eyes—or even in one of them?

British Courage

Certainly not. His old smile was as much in evidence as ever, whilst his eyes gleamed happily through his horn-rimmed spectacles. It is such grit as this that has made our Empire what it is. This intrepid spirit on the eve of journeys into the perils of unknown countries is that which has enabled us to splash red paint about so freely over the surface of the map of the world.

The Departure

Personally I was very keen that the departure should be of a spectacular nature. My suggestion was that Mr. Parris should issue from the portals of Bush House in full cowboy costume—sombrero, gaudy scarf, red shirt, two revolvers, leather chaps and an outsize in spurs—and then vault lightly on to the back of Bony, his favourite mount. Preceded by the massed bands of the Boy Scouts and followed by the entire staff of Radio Press, marching in fours, and

. . . Cow-punchers, vampires, Sheriffs and Fords . . .

singing " We don't want to lose you but we think you ought to go," he would proceed to the station, playfully lassoing a spectator every now and then and dragging him for a few yards behind Bony. Arrived at the station he would sweep off his hat and ride Bony into a first-class carriage. This form of entry makes it quite unnecessary to reserve a seat beforehand. At the last moment Professor Goop would step forward and hand him a bottle of his Rich Red Syrup For Pale Green Sailors. That would have been what one may call something like a send off.

Modesty

But he would have none of my great scheme. For hours I

. . . Vault lightly on the back of Bony . . .

wrestled with him, begging, praying, cajoling. It was of no use; he would not listen to me. He simply appeared on the last morning in his funny hat, his horn-rimmed " specs," his bootlace tie, his high shouldered coat, the trousers which instead of being Oxford are Toulon and Toulouse, and the knobby-toed shoes. In his hands he bore two grips, the one containing his portable set and the other his entire wardrobe. We shook him by the hand, we wept a little on the parquet floors, and then still smiling he stepped from Bush House, not on to Bony, but into a taxicab. As I write he is upon the high seas. What is worrying me most is that Professor Goop was so overcome when he said good-bye that he collapsed into a chair, forgetting that the Rich Red Syrup was in his coat tail pocket. Mr. Parris therefore had to go without it, and I trust that he is not being a pale green sailor.

WIRELESS WAYFARER.

Two-Way Communication with New Zealand on Four Successive Days

Mr. E. J. Simmonds, 2OD, of Gerrard's Cross, has succeeded in establishing two-way daylight wireless communication with New Zealand on a 20-metre wavelength on four successive days, from May 16 to May 19, in the early morning.

We understand that Mr. Simmonds used a transmitting power of 125 watts, and a vertical aerial 60 ft. high, badly screened by trees. T.250 and D.E.Q. valves were used.

The station in New Zealand with which he has been in communication is Z4AG, and is operated by Mr. Slade, of Harbour Terrace, Dunedin. Mr. Simmonds has also communicated with station A2CM in Sydney, N.S.W., in similar circumstances.

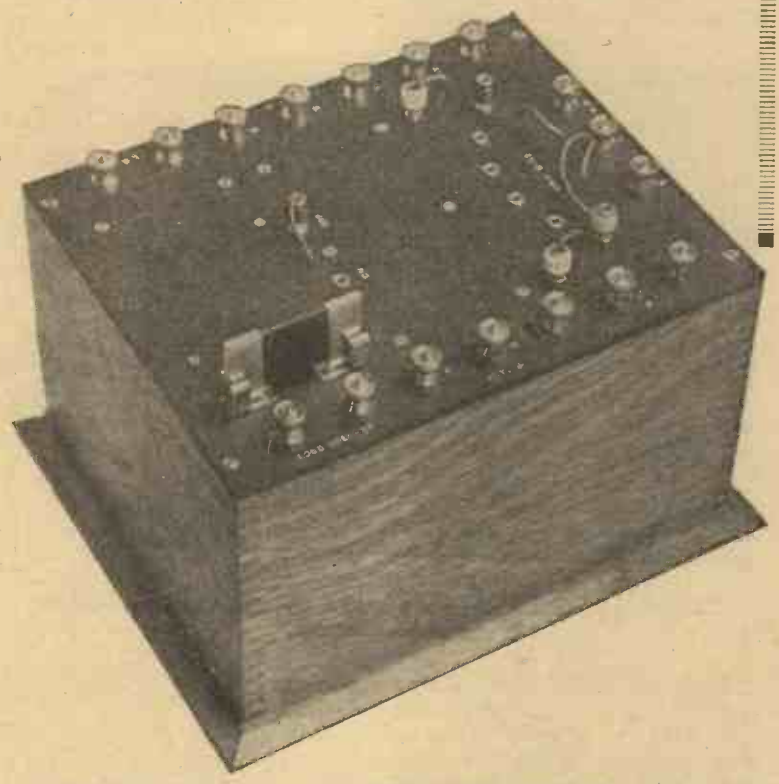
The R.S.G.B.

An informal meeting of the Radio Society of Great Britain will be held at the Institution of Electrical Engineers, Savoy Place, W.C.2, at 6 p.m. on Wednesday, the 10th June, when Mr. W. K. Alford will open a discussion on " The Application of the Supersonic Method of Reception to Ultra-short Wavelengths." In addition to being open to members of the Society, the meeting is also open to members of Affiliated Societies, who are cordially invited to attend.

A COMPACT ACCESSORIES UNIT

By D. J. S. HARTT, B.Sc.

A useful unit which will appeal to those experimenters who dislike the untidiness produced by a number of external accessories.



In constructing the unit it was decided to place the clips for the loud-speaker condenser on the top of the panel, since it is often desired to experiment with the value of this component.

IN the operation of the majority of receiving sets there are several accessories, apart from the high-tension and low-tension batteries, which, even if not absolutely necessary in all cases, are desirable refinements to have available and ready for connecting up when required.

The Desirable Accessories

These include a filter circuit for the loud-speaker, a condenser shunting unit for the high-tension battery, also some arrangement whereby a suitable value of condenser may be shunted across the loud-speaker (if provision for this is not already made in the particular set in use), and finally a tapped grid battery or similar means of applying suitable nega-

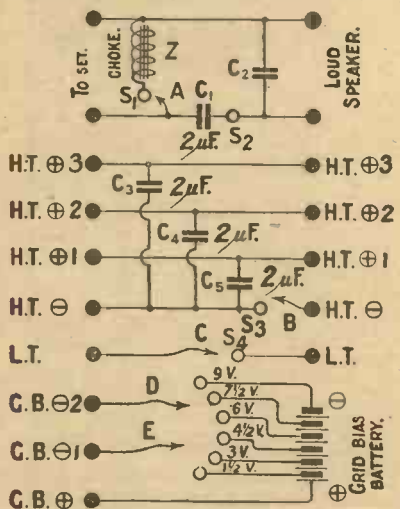


Fig. 1.—In this circuit diagram of the complete unit the Clix plugs are denoted by arrow-heads.

tive potentials to the grids of the L.F. valves when low-frequency amplification is used.

The advantages of having such accessories mounted in a compact form in one unit will readily be appreciated, and in the accompanying photographs is shown a unit embodying these features. The circuit arrangement is shown in Fig. 1, and it will be seen that a choke form of filter is used. With the flexible lead, marked A, connected to S1, the iron-core choke Z is connected across the two terminals marked "To Set." The latter two terminals are connected to the telephone or loud-speaker terminals of the receiver. Two other terminals are provided for the loud-speaker, and these are connected as indicated.

Advantages of the Filter

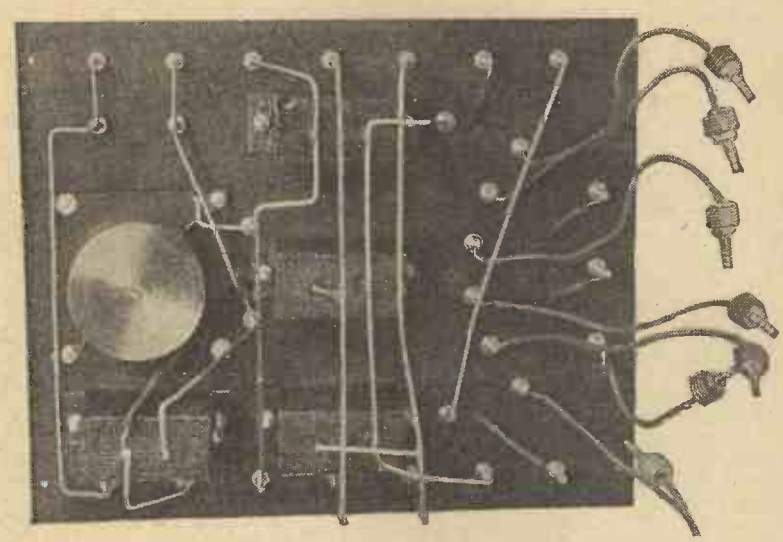
Consideration of this arrangement will show that the steady anode current of the last valve of the receiver does not pass through the windings of the loud-speaker when the filter is in use, owing to the fixed condenser C1 of 2 μF, which, however, allows the passage of fluctuating signal current, due to the varying voltages set up across the choke, to operate the loud-speaker. Such a filter is then a valuable protective device for the fine windings of a high-resistance loud-speaker, particularly in those cases when the latter would normally be placed directly in the anode circuit of the last valve of an L.F. amplifier using a power valve. The condenser C2 across the output loud-speaker terminals is for tone control, and its value may be up to .01 μF, depending on the type of loud-speaker in use; .002, .004, and .006 μF are probably the most useful values to try here.

When the Clix plug A is removed from socket S1 and inserted in socket S2, the filter is cut out of operation, so that a comparison of reception with and without the filter is readily made.

H.T. Arrangements

In the second part of the unit allowance is made for three H.T. positive tappings; across each tapping and H.T. – is connected a fixed condenser of 2 μF, these

being shown as C_3, C_4 and C_5. A Clix plug and socket marked B and S_3 respectively, are connected in the H.T. negative lead, so that the high-tension may be switched off as desired. The two



The Clix plugs visible here are to be inserted in the sockets of the grid-bias battery.

terminals marked L.T. are also connected to a Clix plug and socket, C and S_4, as shown. These may be included in the L.T. + lead from the accumulator, and the arrangement serves as an on and off L.T. switch.

Grid Bias

For the remaining part of the unit three terminals for grid-bias connections are used, flexible leads ending in Clix plugs being taken from the GB—1 and GB—2 terminals. These may be plugged into any of the series of Clix sockets which are connected to the negative contacts of the grid-bias battery cells, as shown.

The Terminals

Reference to the photographs will give an idea of the arrangement of the various terminals, Clix, etc., the significance of which is indicated in the illustration showing the layout of the panel. Note that the condenser C_2 across the loud-speaker terminals is of the clip-in type, and that the clips are mounted on the outside of the panel for convenience in changing this condenser rapidly to determine the best value.

The tapped grid-bias battery is permanently fixed inside the containing box.

Necessary Materials

The following list gives the components used in the unit photographed, but intending constructors may exercise their discretion in the choice of components if any departure is desired.

One ebonite panel, 10 x 8 x ¼ in. (Paragon).

Suitable containing box (Camco).

Four fixed condensers, 2μF. (Telegraph Condenser Co., Ltd.).

One L.F. choke. (That shown is a "Success," by Beard & Fitch, Ltd.).

One fixed condenser with clips (L. McMichael, Ltd.). The value of this should be determined by trial.

Seventeen terminals.

Ten Clix sockets (Autoveyors, Ltd.).

Five Clix plugs (Autoveyors, Ltd.).

Six Type U.W.I. dry cells (Ever-ready), or, alternatively, a tapped grid battery of 9 volts.

Ten 4 B.A. and two 6 B.A. countersunk screws.

Quantity of flex, and square wire for wiring.

Radio Press panel transfers.

Building the Unit

The construction of the unit will be found quite a straightforward operation; complete dimensions for marking out and drilling the panel are given in one of the accompanying diagrams, while a corresponding diagram of the back of the panel shows the wiring, which should present no difficulty to anyone of average capabilities in soldering.

Grid-Bias Connections

In the actual unit flex connections of suitable length and terminating in Clix plugs are soldered to the Clix sockets forming the grid-bias tapping switch, and also one to the shank of the G.B. + terminal. The

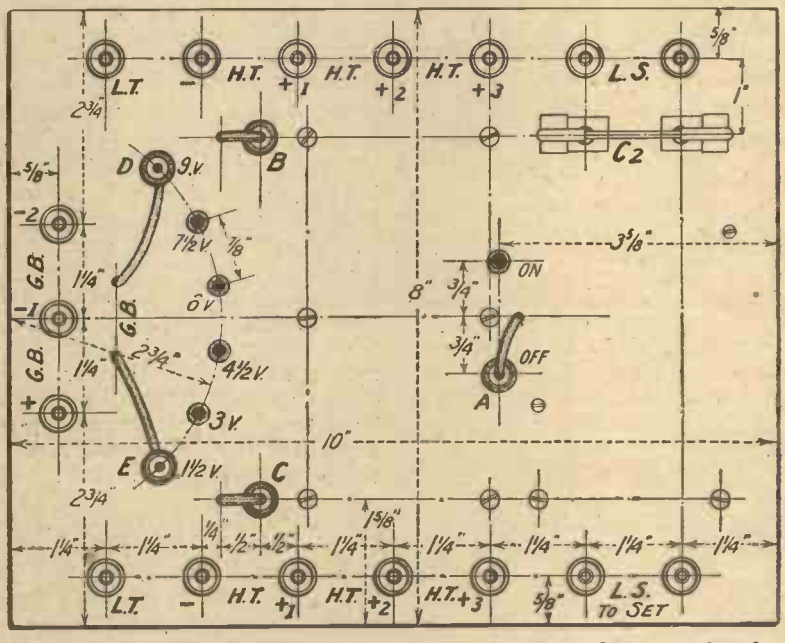


Fig. 2.—In drilling the panel, note that the grid-bias Clix are placed on part of the circumference of a circle.

grid-bias cells previously referred to are connected together, placed upright at the bottom of the box and secured firmly to the end by means of a wide strip of fibre and small wood screws.

Terminal Connections

When the unit is in use the terminals along the longer edge of the panel, on the side opposite that on which the condenser C2 is mounted, are connected to the corresponding terminals on the set, as also are the grid-bias terminals at the end of the panel. The remaining terminals are correctly connected to the H.T. and L.T. batteries and to the loud-speaker. One connection direct from the L.T. battery to the set then completes the scheme.

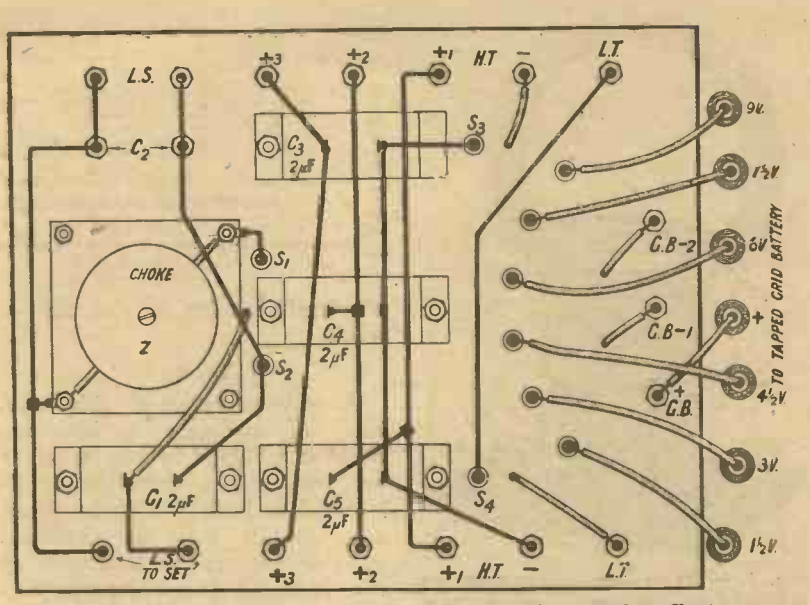


Fig. 3.—The wiring of the unit is best carried out with stiff wire.

The Standardisation of Wireless Apparatus

A brief report upon the conference which was held by the British Engineering Standards Association on May 26.

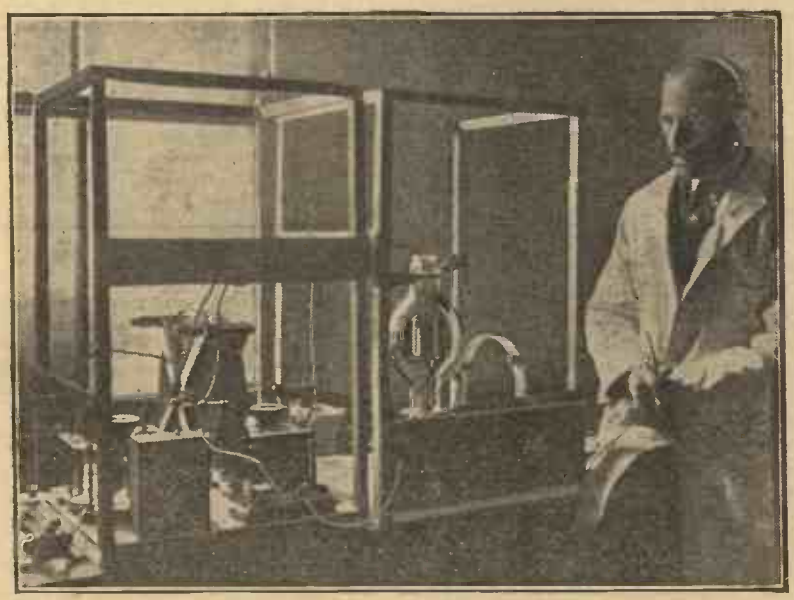
A CONFERENCE of representatives of manufacturers and users was held on May 26 at the offices of the British Engineering Standards Association, to consider the possibility of adopting some scheme of standardisation of wireless apparatus and components.

The conference was the outcome of a request made by the Radio Society of Great Britain that such work should be undertaken, and was convened by the British Engineering Standards Association to obtain the views of the producers and users as to its desirability.

After an introductory speech from the chairman, Mr. C. P. Sparks, C.B.E., a general discussion showed that all the representatives favoured the adoption of a greater degree of standardisation than at present exists. As a basis for consideration by any body which might be set up, the following list of suitable items for standardisation was given general approval :—

Valve pins, spacing and diameter; valve holders; coil plugs and holders; inductance values of coils; diameter and spacing of fixing holes in fixed condensers, transformers, rheostats, etc.; tolerances on capacity values of condensers; dimensions of grid-leaks, anode resistances, etc.; knobs and dials; battery plugs; valve nomenclature.

A resolution was passed unanimously recommending that the scheme be proceeded with.



Major Secretan, who has just made a month's trip on a transatlantic liner for the purpose of making wireless tests, is fully convinced that absolutely dependable communication can be made by the use of low power and short waves both by day and night. At a distance of 2,400 miles from England he easily picked up telephony transmitted by a British Amateur from Purley. Major Secretan is seen above with his transmitter at his home at Barnes.

Fig. 1.—The galvanometer may be mounted upon a stand made from a coil socket and a small piece of ebonite.

A Handy Galvanometer

By R. W. HALLOWS, M.A., Staff Editor.

A short note upon how an emergency galvanometer may be constructed from a plug-in coil and a pocket compass.

A VERY neat and remarkably sensitive little galvanometer can be rigged up by any amateur who uses plug-in coils at no greater expense than the cost of a small compass. Recently, when the writer was engaged in making some tests, the milliammeter was already in use in another circuit and some device was needed which would detect the presence of currents of the order of about half a milliampere. An extemporised galvanometer was rigged up in the way shown in Fig. 1.

Size of Coil

A spare No. 300 coil was placed in a single holder and a compass was laid inside it. The coil stand was turned until the needle of the compass was on the north point. Experiments were then made with the milliammeter to discover what current was required to produce a noticeable deflection of the needle. It was found that with a coil of this size a flow of 2 milliamperes caused a distinct movement, and that with one milliampere the deflection was about two degrees. With smaller coils a good deal more current was needed to cause any movement of the needle. With a No. 75, for instance, 5 milliamperes had to be passed before the instrument would record. A No. 300 coil thus seems quite a satisfactory size for the purpose, though better results will, of course, be obtained if a larger size can be used.

Testing

A galvanometer of this kind has, of course, an immense number of uses in the wireless set, and will be found an excellent aid to fault finding by those who do not care to purchase such an expensive instrument as the milliammeter. The compass dial may be removed, and in its place a card inserted, marked off into degrees or even into quite arbitrary divisions. When the set is working well the total deflection obtained with the instrument wired, as shown at G in Fig. 2, should be taken and recorded.

Should a breakdown of any kind occur, the reading obtained with the galvanometer will show at once whether it is due to a fault in any of the plate circuits. On the other hand, there may be no deflection at all, in which case there is a disconnection somewhere between the high-tension battery and the H.T. positive busbar, or between the high and low-tension batteries. Should the deflection be less than normal one of the valves is out of action. We can usually ascertain which by turning them on one at a time. Those that are in good order will show the normal reading for one valve, but when we reach the one which is at fault there will be either no reading at all or a deflection that is very much less than it ought to be. The trouble has now been tracked down, and we know either that there is something wrong with the valve or that there is a disconnection in one of its circuits.

Direction of Windings

Another use for the compass is to discover the direction of the windings of coils. It is often very important to mount two inductances so that their windings run in the same direction. Place the compass first of all in one of the coils, attaching one end of the windings to the positive and the other to the negative terminal of a single cell. Note whether the deflection given from north is eastward or westward. If it is eastward the other coil must be attached to the battery in such a way that it also gives an eastward deflection.

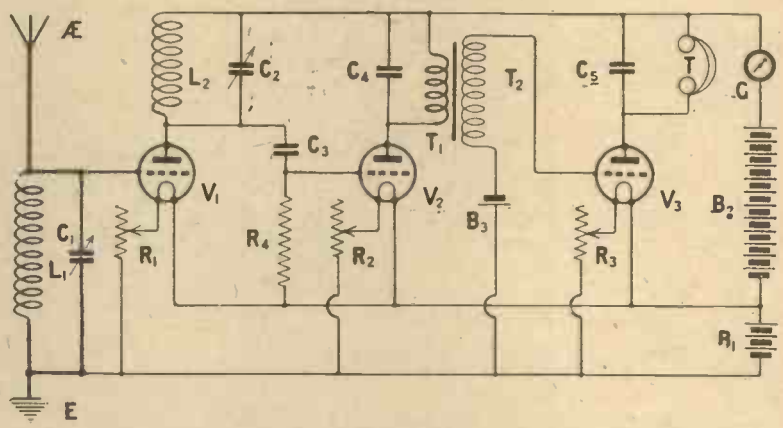


Fig. 2.—Illustrating the position in which the galvanometer should be used. If more than one H.T. positive is provided in the set, the galvanometer should be placed in the common H.T. negative lead. In some cases it may be necessary to shunt the galvanometer with a large condenser.

Special Supplement to WIRELESS WEEKLY.

The FOREIGN RADIO TIMES

Edited by Captain L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S. JUNE 3, 1925.

NOTE :—All Hours of Transmission are in British Summer Time.

WEDNESDAY, JUNE 3rd

FRANCE.

PARIS.—*Station :* Tour Eiffel.—FL.
Wavelength : 2,650 metres—5 kw.

6.15 p.m.—Concert.

Artists : M. Maurice Gouneau : M. Swan Hennessey (Composer), M. Paul Brun and the String Trio.

1. Scientific Revue. M. Maurice Gouneau.
2. An Address on Swan Hennessey. M. Andre Delacour.
3. Four Celtic Melodies. String Trio.
4. Sonata (Swan Hennessey). By the Composer.
5. Celtic Selection. String Trio.

7.10 p.m.—News Bulletin and Close Down.

8.0 p.m.—Weather Forecast.

8.30 p.m.—Concert on 2,200 metres—2.5 kw.

10.0 p.m.—Close Down.

PARIS.—*Station :* Radio-Paris.—SFR.
Wavelength : 1,750 metres—8 kw.

12.30 p.m.—Concert. Violin Soloist, Lucien Paris.

1. Granada (J. Garcia-Salabert).
2. Pensive (Caludi).
3. Hymn to the Sun (Rimsky-Korsakoff)
4. A Spring Aubade (Le Page).
5. Second Canzonetta (D'Ambrosio).
6. The Sadness of Dulcinee (Massenet).
7. Serenade of Mimi (Scassola).
8. The Lady of the Rose (I. Caryll).
9. Minuet of Spring (A. Capri).
10. Rondino (Beethoven-Kreisler).
11. Almina (P. Lincke).
12. Neapolitan (P. Fauchey).
13. Tarentella (Lederer).
14. Farandole of the Butterflies (Tellam).
15. Cavalleria Rusticana (Mascagni).

1.45 p.m.—News Bulletin.

2.15 p.m.—Close Down.

8.30 p.m.—News Bulletin.

8.45 p.m.—Concert. Fragments from "The Blossom of the Peach Tree."

10.0 p.m.—Close Down.

SWITZERLAND.

ZURICH. — *Station :* Radio-Genossenschaft.
Wavelength : 515 metres—500 watts.

5.0 p.m.—Concert by the Orchestra of Hotel Baur-au-Lac.

6.15 p.m.—Children's Hour.

8.15 p.m.—English Lesson.

8.30 p.m.—Concert.

Artists : Frl. Hedi Hilma (Ocarina), E. Nievergelt (Vocalist), Grete Troxler-Vetter (Vocalist), and the Station Orchestra.

1. (a) Return from the Festival (L. Blech), (b) A March Night (Taubert). Grete Troxler-Vetter and M. Siegrist.
2. Overture from the "Calif of Bagdad" (Boildieu). Hedi Hilma.
3. (a) Soldiers' Song, (b) Winter (Meister) (c) Dance Song (Hildach). E. Nievergelt and M. Siegrist.
4. (a) Mr. and Mrs. Sparrow (Hildach), (b) My Lover is a Weaver (Hildach). Grete Troxler-Vetter and M. Siegrist.
5. (a) La Berceuse (Godard), (b) Selection from "Rigoletto" (Verdi). Frl. Hilma.
6. Songs. E. Nievergelt and M. Siegrist.
7. Selections by the Station Orchestra.

9.50 p.m.—News Bulletin and Close Down.

ITALY.

ROME.—*Station :* Unione Radiofonica Italiana.
Wavelength : 425 metres—3 kw.

5.15 p.m.—Orchestral Selections from Albergo di Russia.

5.45 p.m.—Jazz Music.

6.15 p.m.—Close Down.

7.30 p.m.—News Bulletin.

1. Scientific Review.
2. Overture from "The Merry Wives of Windsor" (Nicolai). The Radio Orchestra.
3. (a) Berceuse (Arenski), (b) Loreley (Catalini). Emanuel d'Avila (Tenor).
4. (a) Canzonetta (Sammartini-Corti), (b) Aria (Frescobaldi). Maria Balbis (Violinist).
5. (a) The Secret Marriage, (b) The Pearl Fisher (Bizet). Lina Nobili (Soprano).
6. Conference. Com. Te Gatti.
7. (a) Andante and Barcarole from "Cleopatra" (Mancinelli), (b) Aida (Verdi). The Station Orchestra.
8. (a) Selection (Grieg), (b) Canti di Mare (Recli). Emanuel d'Avila.
9. Gavotte Varied (Pugnani-Corti). M. Balbis (Violinist).
10. (a) Baby Mine (Puccini), (b) Romance (Zanella). Lina Nobili (Soprano).
11. The Daughter of the Regiment (Donizzetti). The Station Orchestra

10.20 p.m.—News Bulletin.

10.30 p.m.—Jazz Music.

11.0 p.m.—Close Down.

AUSTRIA.

VIENNA.—*Station :* Radio-Wien.
Wavelength : 530 metres—1.5 kw.

4.10 p.m.—Concert. Programme of Slavic Music.

1. Libussa (Smetana).
2. Eugen Onegin (Tschaikowsky).
3. Two Songs (Rubinstein).
4. Selection (Smetana).
5. Life of the Czar (Glinka).
6. Russian Fantasy (Wilke).
7. Dalibor—Fantasy (Smetana).
8. Prelude (Rachmaninof).
9. Two Slavic Dances (Dvorak).

7.45 p.m.—English Lesson.

8.30 p.m.—Address on the Works of Liliencron. Dr. Hans Nuchtern.

Selections from Liliencron by W.Schmidt and Anna Kainz-Schrotter.

Songs from Brahms and Metzner by Karl Bayer.

9.45 p.m.—Orchestral Concert by the Viennese Symphony Orchestra.

1. Overture from "Rosamunde" (Schubert).
2. The Ring of the Spheres (Strauss).
3. Ave Maria (Schubert).
4. Selections from "The Bat" (Strauss).
5. Waltz (Eulenburg).
6. Minuet and Barcarole from "The Tales of Hoffmann" (Offenbach).
7. Hungarian Dances (Brahms).

11.0 p.m.—Close Down.

CZECHO-SLOVAKIA.

PRAGUE.—*Station :* Strassnice.
Wavelength : 550 metres—500 watts.

5.0 p.m.—Chamber Music by the Czech Philharmonic Orchestra.

1. Trio in G. Major.
2. Selections from the opera "Don Juan."
3. Quintet in E.
4. Flute Solo (V. Macek).

7.15 p.m.—Children's Corner.

7.45 p.m.—Close Down.

GERMANY.

HAMBURG.—*Station :* Nordische Rundfunk.
Wavelength : 395 metres—1.5 kw.

7.30 p.m.—Concert.

1. Third Symphony (Beethoven), Allegro con brio, Marcia Funebre, Scherzo and Finale.
2. Symphony for large Orchestra. (R. Strauss).
3. Selection from "The Mastersingers of Nuremburg" (Wagner).

10.30 p.m.—Dance Music.

NOTE.—This station is relayed by Bremen on 330 metres and Hanover on 296 metres.

THURSDAY, JUNE 4th

FRANCE.

PARIS.—*Station :* Tour Eiffel.—FL.
Wavelength : 2,650 metres—5 kw.

6.15 p.m.—Concert.

Artists.—Mme. Wilhelmine Coudray (Vocalist), Mlle. Pilar Cruz (Pianist), Mlle. Magdeleine de Campoenia (Violoncellist).

1. Sonata (Eccles).
   Mlles. de Campoenia and Pilar Cruz.
2. June Day from "Therese" (Massenet).
   Mme. Wilhelmine Coudray.
3. Children's Corner (Debussy).
   Mlle. Pilar Cruz.
4. It was in June (P. Gaubert).
   Mme. Wilhelmine Coudray.
5. Slave Berceuse (Neludow).
   Mlle. de Campoenia.
6. June Night (Neymark).
   Mme. Wilhelmine Coudray.
7. Violoncello Solo (Bazelaire).
   Mlle. de Campoenia.

7.10 p.m.—News Bulletin and Close Down.

8.0 p.m.—Weather Forecast.

PARIS.—*Station :* Radio-Paris.—SFR.
Wavelength : 1,750 metres—8 kw.

12.30 p.m.—Concert. Violin Soloist Lucien Paris.

1. Sabre and Lance (Hermann Starke).
2. Dreaming (Joyce-Salabert).
3. Andantino (Padre Martini).
4. Japanese Pagoda (F. Salabert).
5. Spring Song (Caludi).
6. Lullaby (De Lune).
7. Monkeys and Alligators (Volpatti Junr.)
8. Suite (Gabriel Marie).
9. Sweet Pain (Rogelio Huguet).
10. Melody (Lederer).
11. On the Borders of Sebaou (Sellenick)
12. The Shepherd's Song (E. Elgar)
13. Mazurka (Marc Markus).
14. Coons' Patrol (Adolf Lotter).
15. Selection from "Manon" (Massenet-Alder).

1.45 p.m.—News Bulletin.

2.15 p.m.—Close Down.

4.45 p.m.—Children's Concert.

6.0 p.m.—Close Down.

6.15 p.m.—Women's Talk, by Madame Yvonne Delay.

6.30 p.m.—News Bulletin.

6.45 p.m.—Concert of Russian and Roumanian Music, by Messrs. Neago and Lazarowski and their Orchestra.

8.30 p.m.—Close Down.

PARIS.—*Station :* Petit Parisien.
Wavelength : 345 metres—500 watts.

9.15 p.m.—Orchestral Concert.

1. Manfred (Schumann).
2. Ermos (R. Cellis).
3. Adagio and Presto (Berteau).
4. The Dream (Bruneau).
5. Warbling of Spring (Sinding).
6. Larghetto (Mozart).
7. The Small Elf of the Sun (F. Schmitt).
8. Mazurka (Debussy).
9. Romance in D Minor (Wieniawsky)
10. Spleen (F. Schmitt).
11. March of Valour (Schubert).

SWITZERLAND.

ZURICH. — *Station :* Radio-Genossenschaft.
Wavelength : 515 metres—500 watts.

5.0 p.m.—Orchestral Concert by Hotel Baur-au-Lac.

6.15 p.m.—Children's Hour.

8.15 p.m.—In Central Brazil. Travel Talk. H. Hintermann.

8.30 p.m.—Sophie Husi (Vocalist), Hermann Hofmann (Pianist), and the Station Orchestra.

1. (a) Song of Parninia from "The Magic Flute" (Mozart), (b) Cavatine from "The Marriage of Figaro" (Mozart). Sophie Husi and H. Hofmann.
2. Selections by the Station Orchestra.
3. (a) Romance from "Cavalleria Rusticana" (Mascagni), (b) Jewel Song from "Faust" (Gounod). Sophie Husi and Hermann Hofmann.
4. Selections by the Station Orchestra.
5. Song of Micaela from "Carmen" (Bizet). Sophie Husi and Hermann Hofmann.
6. Selections by the Orchestra.

9.50 p.m.—News Bulletin and Close Down.

ITALY.

ROME.—*Station :* Unione Radiofonica Italiana.
Wavelength : 425 metres—3 kw.

5.15 p.m.—Orchestral Selections from Albergo di Russia.

5.45 p.m.—Jazz Music.

6.15 p.m.—Close Down.

7.30 p.m.—News Bulletin.

8.30 p.m.—Scenes from the Opera "I Pagliacci" (Leoncavallo).

PERSONÆ.

Nedda (Annabella di Marzo, Soprano); Canio (Franco Caselli, Tenor); Tonio (Ugo Donarelli, Baritone); Silvio (Ugo Donarelli, Baritone); Peppo (Ezio Carinni, Tenor).

Act I. —Prologue—Tonio.
Entrance of Canio.
Scene and Song.—Canio.
Aria of Nedda.
Duet—Nedda and Tonio.
Duet—Nedda and Silvio.
Scene and Song.

Intermezzo—The Station Orchestra.
Act II.—Commedia—Minuet.
Serenade of Arlechino.
Duet—Colombia and Arlechino.
Scene and Finale—Nedda and Canio.

10.15 p.m.—News Bulletin.

10.30 p.m.—Jazz Music from Albergo di Russia.

11.0 p.m.—Close Down.

AUSTRIA.

VIENNA.—*Station :* Radio-Wien.
Wavelength : 530 metres—1.5 kw.

4.10 p.m.—Concert.

1. Comedy Overture (Artok).
2. The Maiden's Dream (Ascher).
3. Overture from "Tancred" (Rossini).
4. Andante of the Sonata (Grieg).
5. Selection (Tosti).
6. Picturesque Scenes (Massenet).

7.0 p.m.—Esperanto Lesson.

8.0 p.m.—Programme of Pianoforte Music.

Artists : Prof. Oscar Dachs and the Sedlak-Winkler Quartet.

1. Piano Quartet in G. (Brahms).
2. Selections for Piano.
   (Prof. Oscar Dachs).
3. Piano Quintet in F. (Brahms).

10.0 p.m.—Light Music and Close Down.

CZECHO-SLOVAKIA.

PRAGUE.—*Station :* Strassnice.
Wavelength : 550 metres—500 watts.

7.0 p.m.—Symphony Concert by the Station Orchestra, Conducted by M. Nademle.

1. Symphony in E. (Mozart).
2. Overture (Smetana).
3. Symphony in A. (Schubert).
4. Spring (Sinding).
5. Invitation to Dance (Weber).
6. Fantasy from "The Huguenots" (Meyerbeer).
7. Overture from "Halka" (Moniuszka).
8. Alla Turka March (Mozart).

9.0 p.m.—News Bulletin and Close Down

GERMANY.

HAMBURG.—*Station :* Nordische Rundfunk.
Wavelength : 395 metres—1.5 kw.

7.30 p.m.—Spanish Lesson.

8.0 p.m.—Musical Programme.

Artists : Elly Mucas and the Poet. A. Secker (Pianist).

10.0 p.m.—News Bulletin, Dance Music and Close Down.

FRIDAY, JUNE 5th

FRANCE.

PARIS.—*Station :* Tour Eiffel.—FL.
Wavelength : 2,650 metres—5 kw.

6.15 p.m.—Concert.

Artists : M. Paul Dermee, Mme Andree Gerard (Vocalist), M. Rene Devaux (Violinist), Mlle. Alice Andrieu (Pianist).

1. A Literary Talk. M. Paul Dermee.
2. Andante of the 3rd Concerto (Saint-Saens). M. Rene Devaux.
3. The Marksman. Mlle. Gerard.
4. Cache-Cache (Pierne). Mlle. Andrieu.
5. Song (Massenet). Mlle. Gerard.
6. Sonate (Rene). M. Devaux and Mlle. Andrieu.
7. The Forgotten Melodies (Debussy). Mlle. Gerard.

7.10 p.m.—News Bulletin and Close Down.

8.0 p.m. Weather Forecast.

8.30 p.m.—This Station Relays Ecole Superieure on 2,650 metres—5 kw.

10.0 p.m.—Close Down.

PARIS.—*Station :* Radio-Paris.—SFR
Wavelength : 1,750 metres—8 kw.

12.30 p.m.—Concert.

1. El Espada (Delabre-Smet).
2. Serbian Hearts (Jean Savasta).
3. Viennese Caprice (Kreissler).
4. Down South (Mydleton).
5. Youth (Tartanac).
6. Lament (X. Leroux).
7. The Morning (Chaminade).
8. Three Dance Airs (G. Beaume).
9. Nocturne (Monfred).
10. Berceuse (Gretchaninoff).
11. Annabelle—Foxtrot (Ray Henderson).
12. Humoresque (R. Huguet).
13. Reverie (Busser).
14. Words of Love (Meyer-Helmund Salabert).
15. Lakme—Trio (L. Delibes-Alder).

1.45 p.m.—News Bulletin.

2.15 p.m.—Close Down.

4.30 p.m.—News Bulletin.

4.45 p.m.—Close Down.

8.15 p.m.—News Bulletin.

8.45 p.m.—Concert. Selections from the Comic Opera by de Lecocq, "The Daughter of Madame Angot."

10.0 p.m.—Close Down.

SWITZERLAND.

ZURICH.—*Station :* Radio Genossenschaft.
Wavelength : 515 metres—500 watts.

5.0 p.m.—Orchestral Concert from Hotel Baur-au-Lac.

8.30 p.m.—Dance Music.

1. Pasadena—Foxtrot.
2. Chilli Bom-Bom—Foxtrot.
3. Vive la Espana—One-step.
4. Thro' the Night—Waltz.
5. Way Down Home—Foxtrot.
6. Maiden Dreams—Foxtrot.
7. Polka (Strauss).
8. I Love You—Waltz.
9. In a Caravan—One-step.
10. Foxtrot from "Mariza."
11. Foxtrot from "Bajadere."
12. Viennese Blood (Strauss).

9.50 p.m.—News Bulletin and Close Down.

ITALY.

ROME.—*Station :* Unione Radiofonica Italiana.
Wavelength : 425 metres—3 kw.

5.15 p.m.—Orchestral Selections from Albergo di Russia.

5.45 p.m.—Jazz Music.

6.15 p.m.—Close Down.

7.30 p.m.—News Bulletin.

8.30 p.m.—Concert.

1. Fashion Review.
2. Overture from "Coriolanus" (Beethoven). The Station Orchestra.
3. (a) Romance (Puccini), (b) Lucrezia Borgia (Donizzetti). Syra Banchelli (Soprano).
4. Romance for Violin (Saint Saens). E. Benvenuti (Violoncellist).
5. (a) Song (Denza), (b) Song of Love (Wagner). Fernando Bertini (Tenor)
6. Conference by Dr. Giovanni.
7. (a) Melody (Dawes), (b) Orientale (Cui), (c) Baccanale (Glazounow). The Station Orchestra.
8. Othello—Duet (Verdi). F. Bertini and Syra Banchelli.
9. (a) Andante (Gluck), (b) Scherzo (Goens). Emma Benvenuti.
10. Duet (Massenet). F. Bertini and Syra Banchelli.
11. Fantasie (Meyerbeer). The Station Orchestra.

10.15 p.m.—News Bulletin.

10.30 p.m.—Jazz Music from Albergo di Russia.

11.0 p.m.—Close Down.

AUSTRIA.

VIENNA.—*Station :* Radio-Wien.
Wavelength : 530 metres—1.5 kw.

4.10 p.m.—Concert. Programme of International Songs.

English.
1. Dreaming and Song of Autumn (Joyce).
2. Destiny and Ecstasy (Baynes).

French.
1. Prayer (Cremieux).
2. Song (Rico).
3. Amoureuse (Berger).

Italian.
1. Tesoro Mio (Becucci).
2. Lacrime d'amour (Barbirolli).
3. Mon Dernier Reve (Billi).

American.
1. The Pink Lady (Caryll).
2. Miami (Jacobi).
3. Wonderful One (Whiteman).
4. Indian Moon (Jones).

7.45 p.m.—English Lesson.

8.30 p.m.—Address—"Johann Strauss as a Composer of Operas." Prof. Fitz Lange.

Musical Programme.

Artists : Frau Grete Holm, Herr Abramovics, Herren, Tautenhayn, Zittritsch, Weissgarber and Strasser.

11.0 p.m.—Close Down.

CZECHO-SLOVAKIA.

PRAGUE.—*Station :* Strassnice.
Waveleagth : 550 metre—500 watts.

7.0 p.m.—Concert.

Artists : E. Goryanski and Miss N. Solovjov.

1. Romance (Smetana).
2. Aria from "Rigoletto" (Verdi).
3. Selection (Mozart).
4. Romance (Kasevaroc).
5. Melancholy (Reutcicny).
6. Aria from the Opera "Hubicka" (Smetana).
7. Romeo and Juliet (Brahms).
8. Aria from "Rigoletto" (Verdi).
9. Don Juan Serenade (Tschaikowsky).
10. Romance (Rachmaninov).
11. Duet (Boito).
12. Traviata (Verdi).

9.0 p.m.—News Bulletin and Close Down.

GERMANY.

HAMBURG.—*Station :* Nordische Rundfunk.
Wavelength : 395 metres—1.5 kw.

8.0 p.m.—Comedy in Three Acts, "Am Teetisch" (Karl Sloboda).

Artists : Friedel Mumme and Hugo Rudolph, Anneliese Meyer and Cark Schmidt.

10.0 p.m.—News Bulletin, Dance Music and Close Down.

SATURDAY, JUNE 6th

FRANCE.

PARIS.—*Station :* Eiffel Tower—FL.
Wavelength : 2,650 metres—5 kw.

6.15 p.m.—Concert.

Artists : Mlle. Suzanne Tessier, Rene de Buxeuil (Composer), Mlle. Yvonne Mars, Mlle. Rachel Lenoel, M. Rodor (Vocalist), Mlle. Maddy Delly, M. Henri Blanc and Mlle. Mancilly.

1. Fashion Talk. Mlle. Tessier.
2. (a) The Rose of Pedro, (b) My Caresses. Mlle. Yvonne Mars.
3. (a) My Song, (b) The Horsemen. Mlle. Lenoel.
4. (a) What Do You Do Sunday, Mary, (b) Zezette. M. Rodor.
5. (a) The Legend of Seaweed, (b) The Legend of the Moth. Mlle. Delly.
6. (a) The Kiss, (c) The Song. M. Henri Blanc (Elocutionist).
7. (a) Folly, (b) Maigris, If You Love Me. Mlle. Mancilly.
8. (a) Flower of Islam, (b) If You Will Save Thy Country. Rene Buxeuil.

7.10 p.m.—News Bulletin and Close Down.

8.0 p.m.—Weather Forecast.

PARIS.—*Station :* Radio-Paris.—SFR.
Wavelength : 1,750 metres—8 kw.

12.30 p.m.—Concert.

1. Olympic March (Craven).
2. The Steppes—Valse (F. Volpatti).
3. Before the Deluge (Saint Saens).
4. Serenade (R. Huguet).
5. Angelus (Fietter-Salabert).
6. Dolly (G. Faure).
7. Hobomoko (E. Reeves).
8. Suite (A. Guillot).
9. Romantic Prelude (R. Huguet).

10. Le Precieuse (Couperin-Kreisler).
11. Canadian Patrol (P. Fauchy).
12. Tendresse (J. Szule-Salabert).
13. Minuet (Mozart).
14. Before Spring (L. Gregh).
15. Griseldis (Massenet-Alder).

1.15 p.m.—News Bulletin.

2.15 p.m.—Close Down.

8.15 p.m.—News Bulletin.

8.45 p.m.—Gala Concert, organised by "Le Matin."

SWITZERLAND.

ZURICH. — *Station:* Radio-Genossenschaft.
Wavelength: 515 metres—500 watts.

5.0 p.m.—Concert from Hotel Baur-au-Lac.

6.15 p.m.—Concert from Handharmonika-Jugend Club.

8.30 p.m.—Concert.

Artists: Lia Kuhn (Soprano), Leopold Hohn (Bass), Hermann Hofmann (Pianist), and the Station Orchestra.

8.30 p.m.—Concert.

1. (a) In the Sunset Glow (Schubert), (b) The Young Nun (Schubert). Lia Kuhn and Hermann Hofmann.
2. (a) Secrecy (Loewe), (b) I Love You (Beethoven). Leopold Hohn and H. Hofmann.
3. (a) So Well the Sun Shines (Schumann) (b) In the Sunshine (Schumann), (c) Song (Brahms). L. Kuhn and H. Hofmann.
4. (a) I Do Not Wander (Schumann), (b) Salutation of Spring (Schumann). Leopold Hohn and M. Siegrist.
5. Duet (Lortzing). L. Kuhn, L. Hohn and H. Hofmann.

9.50 p.m.—News Bulletin and Close Down.

AUSTRIA.

VIENNA.—*Station:* Radio-Wien.
Wavelength: 530 metres—1.5 kw.

4.10 p.m.—Concert.

1. Overture from "The Noble Passion" (Gisser).
2. Praterleben (Translator).
3. Euryanthe (Weber).
4. Romance (Svendsen).
5. Lullaby (Grieg).
6. Don Juan (Mozart).
7. Indian Ballet Suite (Delibes).
8. Potpourri from "The Joy of Spring" (Strauss).
9. Love Waltz (Gilbert).
10. Selection (Lehar).

8.0 p.m.—Operette—"The Count of Luxemburg" (Bodansky). Music by Lehar.

PERSONÆ.

Rene, Count of Luxemburg (Otto Storm), Furst Basil Basilowitsch (Otto Langer), Grafin Stafa Kokozow (Mizzi Gribl), Brissard (Ernst Arnold), Angele Didier (Lia Baier), Juliette (Anny Rainer)

10.0 p.m.—Light Music and Close Down.

CZECHO-SLOVAKIA.

PRAGUE.—*Station:* Strassnice.
Wavelength: 550 metres—500 watts.

5.0 p.m.—Trio of the Czech Philharmonic Orchestra.

1. Elegie (Glinke).
2. Waltz from "Polish Blood" (Nedbal)
3. Intermezzo from "The Tales of Hoffman" (Offenbach).

7.0 p.m.—Humorous Programme. Mr. Vlasta Burian and M. Cejka.

9.0 p.m.—News Bulletin and Close Down.

GERMANY.

HAMBURG.—*Station:* Nordische Rundfunk.
Wavelength: 395 metres—1.5 kw.

7.55 p.m.—English Lesson.

8.0 p.m.—Programme of Light Music.

1. Viennese Race (Strauss). The Station Orchestra.
2. Potpourri from "The Poor Student" (Millocker). The Station Orchestra.
3. Duet from "The Gypsy Baron" (Strauss). Erna Kroll-Lange and F. Schneider.
4. Selection (Fall). The Station Orchestra.
5. Selection from "Maid of the Black Forest" (Jessel). The Station Orchestra.
6. Selection from "The Gypsy Baron" (Strauss). Kurt Rodeck.
7. Potpourri from "Polenblut" (Nedbal). The Station Orchestra.
8. Cavalier Waltz (Nedbal). Erna Kroll-Lange.
9. Potpourri from "The Faithful Peasant" (Fall). The Station Orchestra.
10. Have I Only Thine Love (Boccaccio). (Suppe). Erna Kroll-Lange.
11. Intermezzo from "Madame Sherry" (Hollander). The Station Orchestra.
12. Selection from "Countess Maritza" (Kalman). Erwin Bolt.
13. Potpourri from "The Valiant Soldier" (Strauss). The Station Orchestra.
14. Quadrille from "The Bat" (Strauss). The Station Orchestra.

10.0 p.m.—News Bulletin, Dance Music and Close Down.

SUNDAY, JUNE 7th

FRANCE.

PARIS—*Station:* Eiffel Tower—FL.
Wavelength: 2,650 metres—5 k.w.

6.15 p.m.—Concert.

Artists: Dr. Pierre Vachet, Mlle. Marcelle Waldy (Vocalist), Mlle. Yvonne Simonet (Violoncelliste), Mlle. Mauricette Andre (Pianist), and M. Bernault (Pianist).

1. Medical Talk. Dr. Vachet.
2. Melody (Scarlotti). Mlle. Andre.
3. Song of Vicent D'Indy. Mlle. Simonet and M. Bernault.
4. Ariette (Vidal). Mlle. Waldy.
5. Sonate in A (Scarlotti). Mlle. Andre.
6. Scherzo (Tournemire). Mlle. Simonet and M. Bernault.
7. The Lottery Ticket (Nicols). Mlle. Waldy.
8. Caprice (Mendelssohn). Mlle. Andre.
9. Starlight (Dupont). Mlle. Simonet and M. Bernault.
10. Rondo from "The Lottery Ticket" (Nicols). Mlle. Waldy.

7.10 p.m.—News Bulletin and Close Down.

8.0 p.m.—Weather Forecast.

8.30 p.m.—Concert on 2,200 metres and 2.5 kw.

10.0 p.m.—Close Down.

PARIS.—*Station:* Radio-Paris.—SFR.
Wavelength: 1,750 metres—8 kw.

12.45 p.m.—Concert.

Artists: M. Lucien Paris, M. Roland Lenoir, and M. Perchoir.

1. Granadino (Gareri).
2. Scarlet Kisses (Dardany).
3. Humoresque (Dvorak).
4. Overture to "Stradella" (Flotow).
5. Song.
6. Legend (Fourdrain).
7. Minuet (Paderewski).
8. Dance Macabre (Saint-Saens).
9. Elegy (G. Faure).
10. Alsatian Dances (Ch. Levade).
11. Song.
12. Werther—Trio (Massenet-Alder).

1.45 p.m.—News Bulletin and Close Down.

8.15 p.m.—News Bulletin. Esperanto Lesson by Dr. Corret.

8.30 p.m.—News Bulletin.

8.45 p.m.—Jazz Music by Mario Cazes Orchestra, from the Chateau Caucasien.

10.30 p.m.—Close Down.

ITALY.

ROME.—*Station:* Unione Radiofonica Italian.
Wavelength: 425 metres—3 kw.

5.15 p.m.—Orchestral Selections from Albergo di Russia.

6.15 p.m.—Close Down.

7.30 p.m.—News Bulletin.

8.45 p.m.—Scenes from the Opera "La Traviata" (Verdi).

PERSONÆ.

Violetta Valery (Syra Banchelli, Soprano); Annina (Luisa Castellazzi, Mezzo-Soprano); Alfredo Germont (Fernando Bertini, Tenor): Giorgio Germont (Ugo Donarelli, Baritone).
M. Alberto Paoletti (Pianist).

Act I.—Prelude—The Station Orchestra.
Brindisi—Alfredo.
Duet—Violetta and Alfredo.
Scene and Song—Violetta.

Act II. —Scene and Song—Alfredo.
Scene and Duet—Violetta and Germont.
Scene—Violetta and Alfredo.
Grand Song—Germont.
Scene—Alfredo.

Act III.—Intermezzo—The Station Orchestra.
Aria—Violetta.
Scene and Duet—Alfredo and Violetta.
Finale—Alfredo, Violetta and Germont.

10.15 p.m.—News Bulletin.

10.30 p.m.—Jazz Music from Albergo di Russia.

11.0 p.m.—Close Down.

Turn Numbers in Secondary Circuits

By G. P. KENDALL, B.Sc., Staff Editor.

In this contribution Mr. Kendall gives some further observations resulting from his experiments with coils, which go to confirm the conclusions of Mr. Sylvan Harris on the subject of condenser losses given in our issue of April 22, 1925.

IT has long been customary to accept without question the contention that it is desirable in tuned circuits to keep the parallel capacity as low as possible, and the inductance as high as possible. This is commonly spoken of as the L/C ratio, the letters L and C being the usual symbols for inductance and capacity respectively, and the belief that the ratio of L to C should be as high as possible would appear to be based upon sound theoretical reasons.

The Conventional View

In theory the higher this ratio the greater the voltages produced across the circuit by high-frequency oscillations flowing in that circuit, provided that they are of the correct frequency, and thus it appears that signal strength should also be at a maximum, when we remember that it is assumed that some voltage-operated detecting device would be connected across the circuit. We are often advised to use as large a coil and as small a condenser reading as possible, for a given wavelength, to obtain the greatest available signal strength, it being understood that we are dealing with a circuit consisting of inductance and capacity in parallel.

H.F. Resistances

Recently, however, some very notable work has been done in America by Sylvan Harris, some of whose results have been published in *Wireless Weekly*. Mr. Harris has carried out some remarkable work upon the high-frequency resistance of variable condensers of different types, and he has shown that although these resistances are not so high as has been assumed by some authorities, yet they vary according to the condenser dial reading in an important manner which is bound to modify our views as to the L/C ratio.

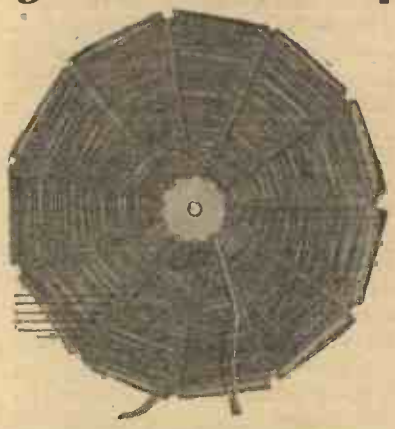
Skin Effects

He believes that the explanation is largely to be found in skin effects and their influence upon the distribution of the currents in the condenser, and he finds that although the high-frequency resistance of the instrument is fairly constant over the upper part of the scale of the condenser, there is a certain critical point which is reached as the capacity is decreased, and below which the resistance begins to rise rapidly. Upon the condensers which he has investigated, this point is located in the neighbourhood of 20 deg., and below this reading the normal resistance may be multiplied by quite a large factor.

The conclusions drawn by Mr. Sylvan Harris may be summarised to the effect that condensers should not be used at a smaller reading than 20 deg., and he has found that a lower ratio of L to C may actually give greater signal strength with condensers which display this characteristic. It might be suggested that a remedy for this difficulty would be to use a much lower capacity variable condenser, in order that one might work upon the higher part of the scale and yet preserve a high L/C ratio, but here we are confronted by the practical limitation of securing an adequate wavelength range for tuning purposes.

Some Simple Experiments

The majority of the condensers tested by this investigator seem to have been American types, but the results are so consistent for the great variety which he tried that it would seem that his results can be widely applied. With a view to ascertaining the extent to which these considerations modify the results which may be expected from variations



The arrows indicate the points to which the coil was stripped in the course of the experiments.

in the L/C ratio, using a good British condenser and a common type of coil, I have carried out some simple experiments, using as a criterion the Moullin voltmeter method of signal strength measurement.

It will probably be remembered that in this method a detector valve is connected across the circuit under investigation, a fine reading milliammeter being placed in the anode circuit of this valve. The change in milliammeter reading, which occurs when the incoming signals are applied across the grid and filament of the valve, is taken as a measure of the strength of those signals, and the whole arrangement may be regarded as an elementary form of high frequency voltmeter. The figures which result, and which may be arbitrarily called signal strength, do not actually represent the high frequency voltages across the circuit, of course, but they provide the necessary means of comparison and enable us to carry out such experiments as those under consideration in this contribution.

The experiment was carried out in a secondary circuit, magnetically coupled in the conventional manner to a separately tuned aerial circuit. It was decided to carry out the experiment in a secondary circuit in order that the greater part of the capacity should be located in the variable condenser, since it was thought that the advantage of having the

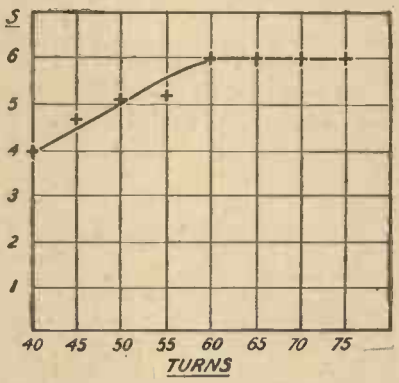
capacity more or less concentrated in the variable condenser, and removing the aerial and earth resistance from the circuit upon which measurements were made, outweighed the disadvantage presented by the difficulty of adjusting correctly the variable coupling between primary and secondary. This latter difficulty, however, was a serious one, as will be realised when it is remembered that for any given size of secondary coil there is a correct degree of coupling for maximum signal strength. Thus, when any change was made in the size of the secondary coil it was necessary to carry out a lengthy readjustment of practically every variable factor in the tuned circuit. For example, the coupling must be varied in small steps over the whole range of adjustment, and at each of these changes both primary and secondary circuits must be retuned by means of the condensers. These points should be carefully noted by anyone who may be sufficiently interested to repeat the experiments upon any particular type of condenser in which he is interested, and the warning should be given that a mere single readjustment of the primary condenser and then of the secondary condenser is by no means sufficient, since it will probably be found that, unless the coupling is exceedingly weak, any alteration to the primary condenser must be repeated after the secondary has been once more re-tuned.

Type of Condenser Used

The variable condenser used in the secondary circuit was one of a well-known and reputable British make, in which the end plates are of high grade ebonite, the thickness being reduced to the minimum permissible from the point of view of strength. The coil was of a very simple basket type, wound upon the conventional thin cardboard slotted former. The winding consisted of 75 turns of No. 24 d.c.c. wire and was equivalent to a coil a little larger than a standard No. 75.

Method of Procedure

The carrier wave of 2LO was used as the standard signal, and the procedure was as follows :—The signal strength given by the 75 turn coil was first determined, after careful adjustment of coupling to give the highest reading. This was recorded, together with the appropriate condenser reading, and then five turns were stripped off the coil, whereupon the measurements were repeated with a careful re-determination of the optimum coupling adjustment. Successive reductions were made to 65, 60, 55, 50, 45 and, lastly, 40 turns, the process



The turn numbers of the coil are plotted horizontally, while vertically the scale represents signal strength.

of readjustment of coupling for maximum signal strength and the recording of resulting signal strength and condenser reading being repeated in each case.

Results

The results are summarised in the graph which accompanies this article, and it will be seen that as the turn numbers were reduced from 75 to 60 a constant signal strength with a value of 6 was obtained, there being no diminution as the turn numbers were reduced. At 60 turns, however, a steady reduction set in, which would appear to be more or less of straight line form. The irregularity of the positions of the plotted points is, of course, readily explained upon the basis of the extreme difficulty of making certain that the correct degree of coupling had been found for each size of secondary coil, bearing in mind the fact that the whole experiment had to be carried out as rapidly as possible to reduce the chances of error from fluctuation in the received signal strength (it will be remembered that I possess a neighbour or neighbours whose hobby appears to consist in producing artificial variations in the strength of 2LO with the aid of a reaction coil).

Conclusions

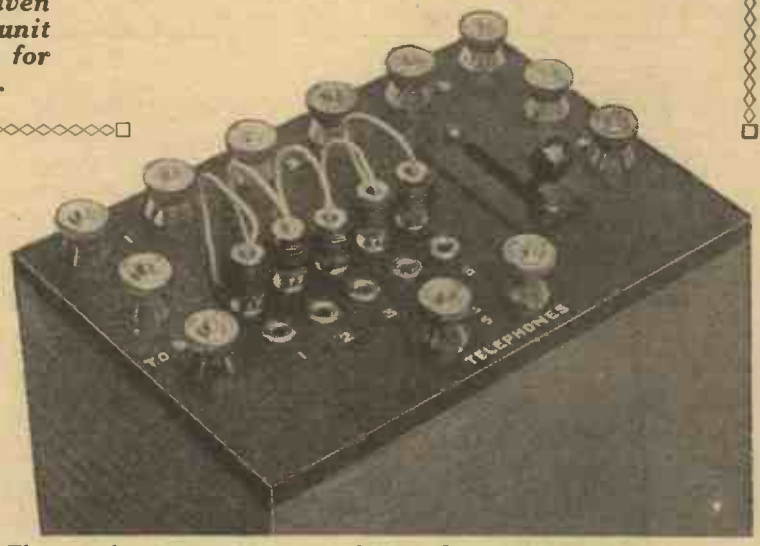
It may be inferred that for any number of turns below 60 in the case of the particular coil and condenser under consideration, the assumed relation between the ratio of inductance to capacity and signal strength holds good; that is to say that the higher the ratio of inductance to capacity the greater will be the signal strength over that particular part of the curve. The interesting point, however, lies in the fact that increasing the turn numbers above 60 does not produce any increase in signal strength, and it is significant, remembering the conclusions of Mr. Sylvan Harris, that the 60 turn coil gives a condenser reading of 32 deg. when tuned to the carried wave of 2LO. From an examination of the curve it is quite evident that some change sets in at 60 turns, which may be expressed as an increasing loss, and which completely counterbalances any improvement in signal strength which would be expected from the increased ratio of L to C with the larger turn numbers.

Several different variable condensers have been tried for this experiment, and on the limited number which I have tested it would seem that this critical point is somewhere between 20 and 30 deg. upon a 180 deg. dial, a coil of the same type being used. With none of the condensers which I tested was there an actual diminution in signal strength following upon an increase in the L/C ratio. However, it must not be forgotten that Mr. Sylvan Harris made a special point of the fact that since it is not worth while to work with small condenser readings, but rather to use a coil of medium size, therefore that coil could be of much more efficient design than is possible where a large number of turns have to be compressed within a reasonable space. Hence it is not quite a fair comparison merely to say that no diminution of signal strength takes place when the larger coil is used, since it must not be forgotten that when one uses a smaller coil it is possible to make that coil more efficient, and therefore it may be argued that with a smaller coil better signals would be obtained.

A USEFUL DISTRIBUTING BOARD

By A. S. CLARK.

Constructional details are here given for the building of a compact unit which forms a switching device for loud-speakers or telephones.



The complete unit is compact and quite pleasing in its appearance.

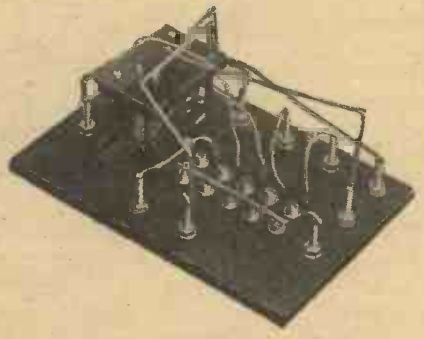
THIS unit will be found quite useful to both experimenters and broadcast listeners. It is for distributing the power from the output of the set to different rooms as desired. Since very many people have several rooms in their house wired so that telephones or a loud-speaker in any particular room may be easily connected to the set, a unit of this type will prove popular.

Switching

Provision is made for a local pair of telephones for tuning-in, and by means of a change-over switch the 'phones or loud-speakers in other rooms are easily connected. By means of the row of Clix only those rooms where it is desired to listen are connected up; thus the maximum power is always available for those who are listening. The local pair of telephones may also be taken out of circuit if it is not desired to listen on these after tuning in.

Components

The following is a list of the components used in the unit.



The wiring of the unit is extremely simple

The makes specified need not be strictly adhered to:—

Ebonite panel, 4 in. x 6 in. x ¼ in. (Paragon).

Twelve nickelled terminals (Burne-Jones and Co., Ltd.).

Five Clix plugs (Autoveyors, Ltd.).

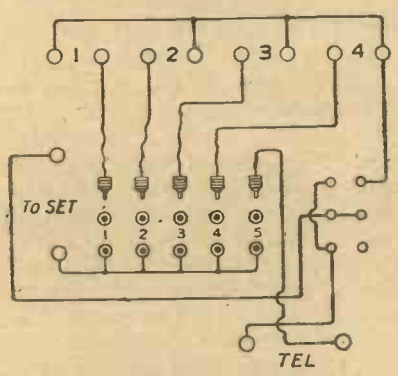


Fig. 1.—The connections of the unit are in accordance with the above.

Ten Clix sockets (Autoveyors, Ltd.).

Utility two-pole two-way switch (Wilkins and Wright, Ltd.).

Packet Radio Press panel transfers.

Containing box.

Square wire and flex.

Black insulators were used with the Clix plugs, as these, with their nickelled fittings, go very well with the panel and terminals. Having collected all the components together, mark out the panel in accordance with the drilling diagram, and drill the necessary holes. That for the arm of the "Utility" switch is best cut out with a fretsaw, although it is not difficult to make it by drilling several holes with a ¼-in. bit and filing the sides smooth.

The Transfers

Having completed the drilling, the transfers are attached, in accordance with the lettering on the drilling diagram; if desired, the different rooms may be indicated against the first four sets of terminals instead of using numbers.

Mounting the Components

Now mount the components. The switch should be fitted first, then the Clix sockets, and the terminals last. All the terminals should have a washer, and their nuts should be screwed down tightly, but it may be necessary to tighten the nuts of these, and also of the Clix sockets after soldering, as the heat is inclined to shrink the panel a little.

Wiring

Now wire up in accordance with the wiring diagram of Fig. 3. The wire which joins

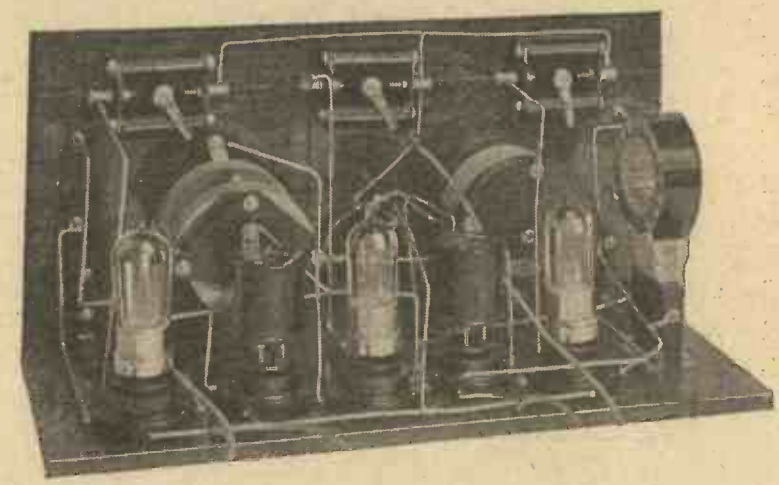
(*Continued on page 267.*)

LONG DISTANCE RECEPT

By STANLEY G.
Staff

This totally enclosed and two high-frequency stages the more distant stations Full constructional detai upon operat

THE chief attractions in the receiver illustrated are, firstly, that two high-frequency stages precede the detector valve, thus allowing long-distance stations to be received with a greater factor of certainty than is usually associated with simpler sets, and, secondly, the receiver is so designed that aerial coil, transformers, valves, etc., may all be contained within the cabinet during the operation of the receiver.



The valves, transformers and aerial coil are mounted upon the baseboard.

The tuning controls, filament re only components which a

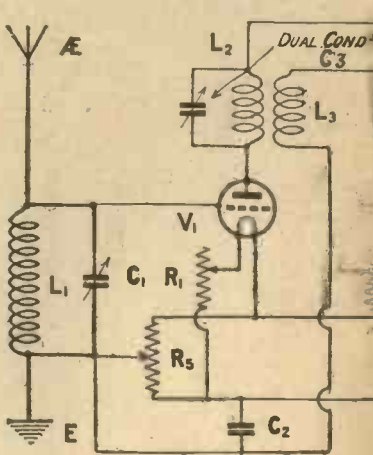
Design

Whilst on the question of design, the circuit embodied in the instrument under description is a straightforward three-valve circuit consisting of two transformer-coupled high-frequency valves, with the primary windings of the transformers tuned by a double condenser, followed by a valve detector. The tuning circuit is directly coupled to the aerial and no reaction coil is provided, oscillation being easily obtained when the aerial and the anode circuits are in tune, control of self-oscillation being given by a potentiometer.

Separate filament resistances are provided for each valve, and though the operation of the receiver becomes somewhat more critical with this arrangement when compared with the practice of using a common filament resistance for both H.F. valves, the extra adaptability obtained would seem to justify separate control for each valve, at any rate in the present receiver. The transformers used with this instrument must of course be of the matched variety, and since most high-frequency transformer manufacturers make these, no difficulty will be experienced in obtaining suitable components. The two halves of the double condenser must also be guaranteed to have the same capacity.

Arrangement

The appearance of the receiver may be gathered from an inspection of the photographs, and in that illustration where the front of the panel is shown, the two terminals on the left are for the aerial and the earth, and the



The theoretical circuit diagram given on the wiring dia

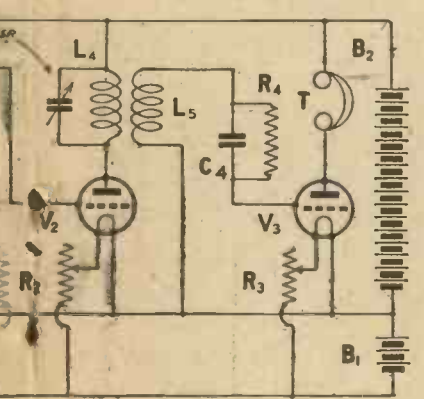
ION WITH THREE VALVES

. RATTEE, M.I.R.E.,
Editor.

handsome receiver employs s, and for this reason permits to be tuned without difficulty. ls, together with some notes ti , are given.

sistances and potentiometer are the pear on the front of the panel.

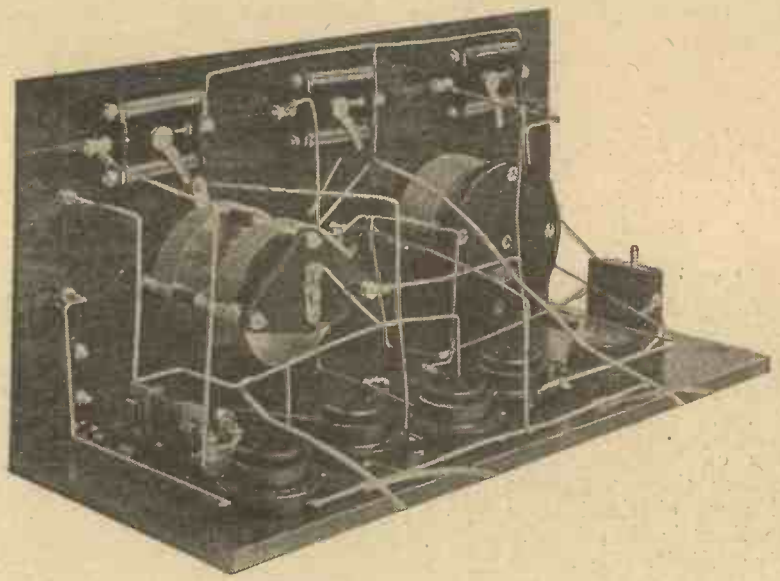
two on the right are the telephone terminals. The three filament resistances are situated



of the receiver. The letters are also gram, together with values.

along the top of the panel, and in this case are of the dual type so as to enable either bright or dull emitter valves to be used, whilst the aerial tuning condenser is situated on the left of the panel, below the rheostats. The double condenser is situated in a corresponding position on the right of the panel, and the potentiometer is located between the two tuning condensers. The valve holders for both valves and transformers are screwed to the baseboard, as are also the grid condenser and leak, the two latter being suitably insulated.

The connections for the high- and low-tension batteries, instead of being taken to the usual terminals, are made by means of flexible leads of convenient length and fitted with wander-plugs and tags respectively. When the set is fitted in its cabinet, these leads are threaded through four holes drilled in the back of the box.



The connections to the double condenser can be easily followed in this back-of-panel photograph.

Access to Wiring

The panel, as is probably already understood, is secured to the baseboard by small brass brackets, and so permits the whole of the receiver to be slid into the cabinet when complete.

Components and Materials

In the list given below will be found all the necessary materials and components required for the building of a receiver to the specifications given herein, and for the information of those readers who desire to know the makers of the components actually incorporated in the instrument photographed, the names of the firms where the articles were obtained or their trade marks are also indicated.

One ebonite panel measuring 16 in. x 8 in. x 3/16 in. (Radion mahoganite). If ordinary ebonite is preferred the reader is strongly recommended that the material purchased shall be of the

guaranteed variety, otherwise serious disappointment may attend the final results of the constructor's work.

One "All Concert" cabinet and baseboard (Burne-Jones & Co., Ltd.).

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

Two H.F. transformers (matched for 300-600 metres tuning).

Two H.F. transformers (matched for 1,100-3,000 metres tuning). (The two transformers photographed are by Burne-Jones & Co., Ltd.).

One potentiometer (L. McMichael, Ltd.).

One grid-leak and condenser unit, 2 megohms and .0003 μF respectively (L. McMichael, Ltd.).

One fixed condenser of .002 μF (Dubilier Condenser Co., Ltd.).

One double variable condenser (square law) .00025 μF each half (Bowyer-Lowe Co., Ltd.).

One variable square law condenser .0005 μF (Peto-Scott Co., Ltd.).

Four terminals. (Those photographed are of "oxy-copper" finish to match the mahoganite panel, and were obtained from the Grafton Electric Co., Ltd.).

Five valve holders for board mounting. (In the present receiver antiphonic valve holders by Burndept Wireless, Ltd., are used throughout.)

Three dual type filament resistances (Radio Instruments, Ltd.).

Quantity of rubber-covered wire for the battery connections.

Quantity of square section tinned copper wire.

Packet Radio Press panel transfers.

Two small brass brackets for securing the panel to the baseboard. (These are obtainable from any ironmonger.)

The Panel

Complete details for the drilling of the panel, in so far as dimensions are concerned, are given in the illustration of the panel layout, and it is strongly recommended that readers do not depart from this layout as considerable difficulty *may* result in obtaining the desired sensitivity of the completed set. Should the reader choose to use components other than those given in the list above, it is suggested that he assure himself that with the dimensions given there is sufficient clearance for the valves, transformers, etc. The spacing allowed is the result of some thought in this direction, and in the majority of cases there will be no difficulty in this respect; nevertheless, there may be a make of component unknown to me which necessitates some minor alteration to its intended position either upon the panel or the baseboard.

The Baseboard

After the various components have been mounted upon the panel, this latter should be secured to the baseboard by means of the two brass brackets before proceeding further, after which those components which are to be fitted to the baseboard should be secured.

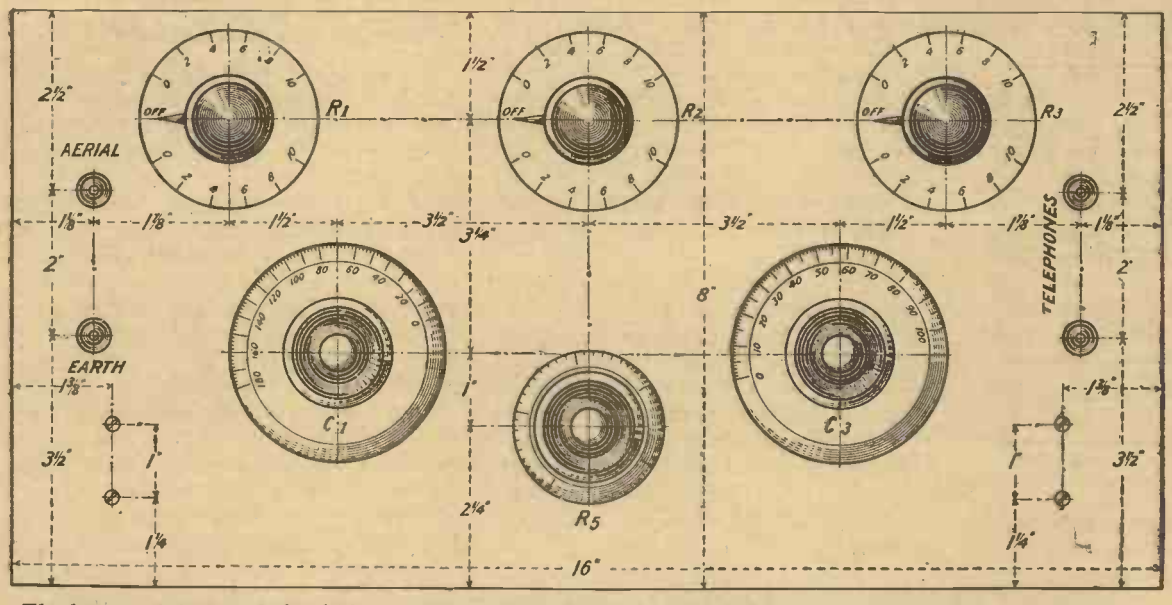
The .002 μF fixed condenser, one side of which is connected to the slider of the potentiometer and the other to the negative of the L.T. battery, though appearing in the photographs to be secured to the baseboard, is actually held in position between the two wires, this being its only means of support.

Wiring the Receiver

There will be no difficulty in wiring up inasmuch as there is quite easy access to the various points to which connections have to be made. Constructors should, as far as is within their power, copy in every detail the arrangement of the wiring shown in the practical wiring diagram, the reason being that any drastic departure from the original may quite conceivably bring about capacity effects large enough to upset the balance of the tuning circuits of the high-frequency transformers.

Testing the Receiver

With the wiring complete and the low-tension battery connected, insert the three valves in their sockets and test the filament circuits, after which connect the H.T. battery. Plug-in the two 300-600 metres trans-



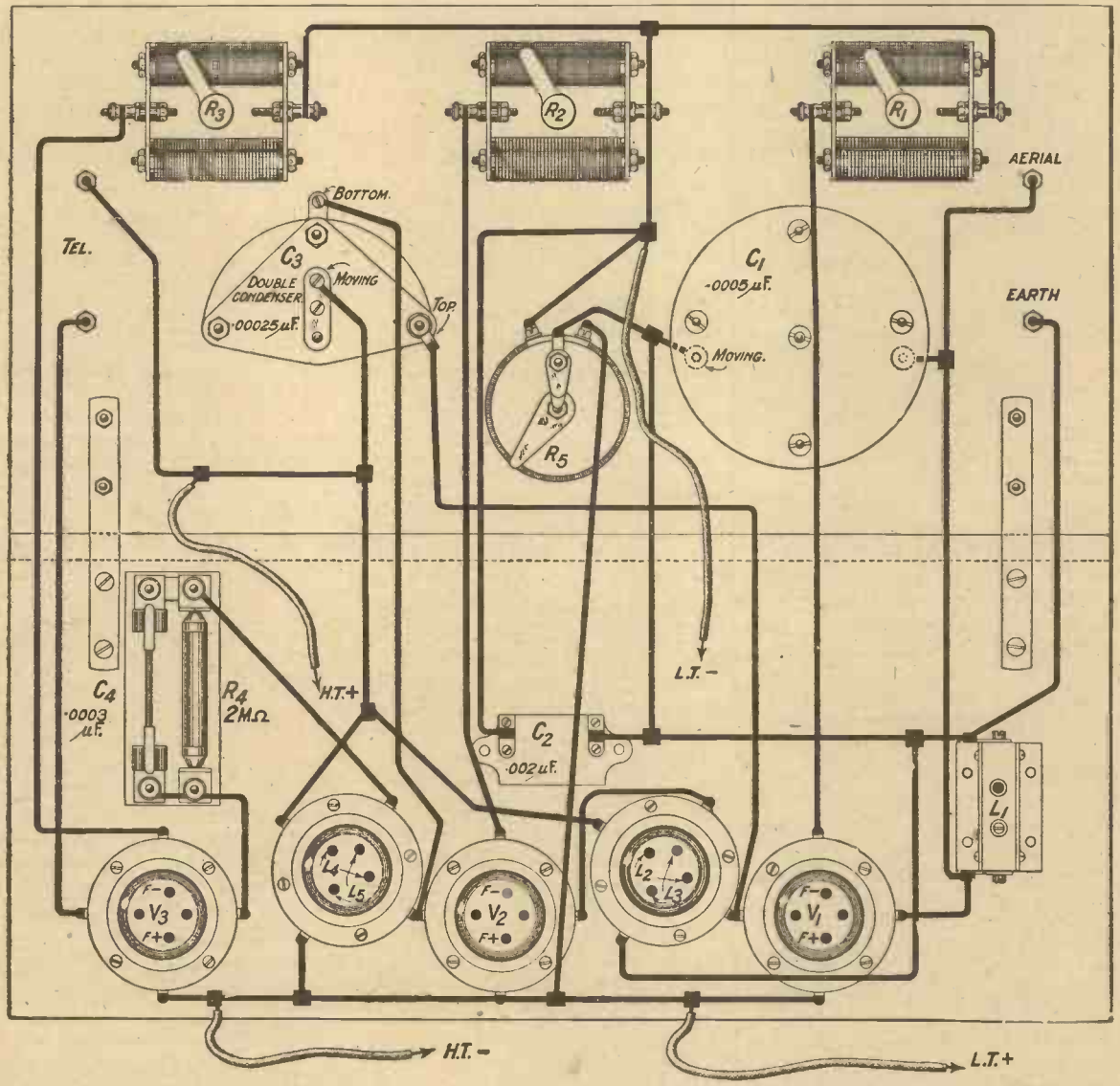
The layout of the panel should be carried out in accordance with the dimensions given above. A blueprint of this drawing may be obtained upon quoting number 120a.

formers and a No. 50 or 75 coil, and without either aerial or earth proceed to operate the set in the following manner. Before lighting the valves turn the potentiometer to full positive, and with the valves suitably bright, tune, if possible, to the local station. So long as the distance is not more than 12 miles, this should not be difficult, or if the distance is greater tune the set until any signal, including telegraphy, is heard. With the signal picked up in this manner, adjust the two condensers and the two H.F. valve filament resistances for the best results, when the potentiometer should be turned towards its negative end. This movement will cause the signals to increase in strength, and will, if continued, cause the set to oscillate.

With the set used in this manner in a suburb of London, actually at Sydenham, where the new 2LO station is not very good, with a No. 50 coil in the socket previously mentioned, and without aerial or earth, 2LO is received at comfortable telephone strength. As an indication of whether the receiver is sensitive or otherwise, London readers who build this set may take it that, unless they can receive 2LO in a similar manner, there is something not quite as it should be with either the wiring or the layout; the presence of soldering flux on the panel or between valve legs may also be suspected.

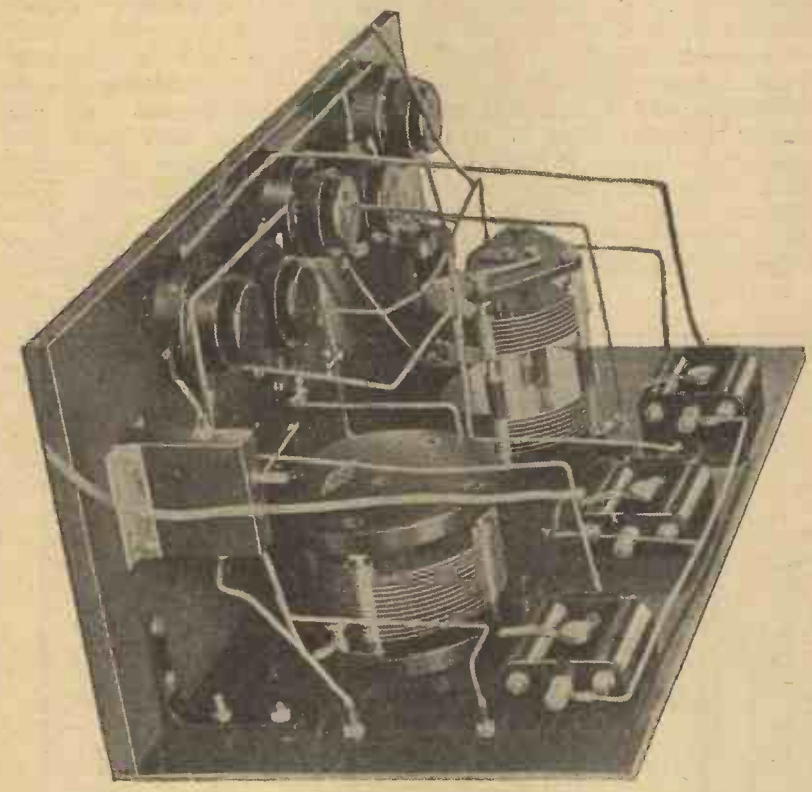
Operating the Set

For the reception of the B.B.C. stations, exclusive of Chelmsford, the two 300-600 metres H.F. transformers are used throughout, whilst for the aerial a No. 25, 35 or 50, according to individual aerial conditions, should be used. When tuning, the aerial condenser should be set at zero and the other condenser slowly turned from its zero position until the set is just near the oscillation point, with the potentiometer so adjusted that the set does not actually break into oscillation when the two sets of circuits come into tune with each other, after which the two condensers are moved simultaneously, the aerial condenser



For purposes of clearness the panel and baseboard are shown flat. The flexible battery leads terminate in wander plugs and spade tags. Full size blueprints of this wiring diagram bear the number 120b.

being moved slightly faster than that tuning the high-frequency transformers. During this operation the potentiometer should still be kept to the same adjustment. When the desired signals have been picked up, by turning the potentiometer a little towards the negative end the signal strength will be increased,



Though special valve holders are used throughout, those holders used for the transformers may be of the ordinary board mounting type if preferred.

but if the set starts to oscillate, the potentiometer should be turned towards the positive end until the oscillation is stopped. If it is desired to receive a distant station and interference is experienced, careful adjustment of the filament resistances of the high-frequency valves will, in many cases, bring about an increase in selectivity. It may be understood, therefore, that the adjustments of the first two rheostats are extremely critical. The adjustment of filament current in the case of the detector valve, however, is not at all critical.

For the reception of the longer wave stations the same remarks apply concerning the operation of the set, though in the case of Chelmsford, Radio Paris, the Eiffel Tower, or any other station with a wavelength of over 600 metres, the two transformers must be changed for others covering the wavelength used by the desired station. In the case of the three stations named above, the transformers used will cover from 1,100-3,000 metres, and for the reception of Chelmsford and Radio Paris a No. 150 will be required for the aerial coil, or a No. 250 for the Eiffel Tower.

Valves

With regard to valves for use with the receiver, since suitable filament resistances are fitted, either the bright or dull-emitter type may be used.

The two high-frequency valves should preferably be of the same make and type, and should require the same filament voltage and consume the same filament current. In so far as the detector valve is concerned, this may be any good general purposes valve, but preferably of the same filament voltage as the H.F. valves.

Results Obtained

With the receiver connected to an indoor aerial in Sydenham, using a No. 35 coil, several German stations were received at 10 p.m., giving lessons in English, though who these stations were I am as yet unable to find out. On the same evening the Birmingham station was received with clearness to the exclusion of London, as was also Radio Belgique, though the successful tuning out of the London station was not by any means an easy feat—a somewhat natural condition, when it is borne in mind that London can be received at good strength without aerial or earth.

On the following evening good reception of the Newcastle station was obtained, in addition to weak reception of the Aberdeen station, the aerial in the case of both these stations being the indoor arrangement.

Chelmsford and Radio Paris, together with a number of shorter wave French and German stations, were received at comfortable telephone strength, the tuning of the receiver being sharp and the potentiometer adjustments critical.

Though the receiver will give really loud signals from a number of stations it will not give signals of sufficient volume to work a loud-speaker satisfactorily, even though the station being received is the local one.

In addition the receiver has been tested by another member of the staff on a good outdoor aerial about eight or nine miles S.W. of 2LO. In the course of a short but thorough test a number of British and Continental stations were tuned in easily at varying strengths. In particular, Aberdeen, Birmingham and Glasgow were of good strength in the 'phones, but powerful Morse interference on occasions rather marred the reception from Birmingham. Belfast was also of fairly good telephone strength. Ecole Superieure was received well, but the Madrid station was not so strong. Two German stations, which the operator did not wait to identify, also came in well. Time did not permit of the identification of two or three other stations which were tuned in during the course of the test.

The receiver was, on the whole, simple to control, but some little care in the adjustments was required to eliminate the powerful local station on nearby wavelengths.

A Useful Distributing Board

(*Concluded from page 261*)

one row of the Clix sockets together should receive special attention. Before fitting any wires, all points to which contact is to be made should be tinned, and this tinning may prevent the wire just mentioned from falling

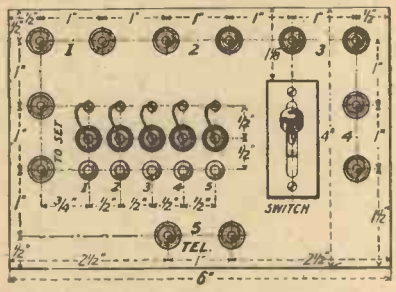


Fig. 2.—All panel dimensions should be taken from this diagram.

across every socket, so this should be looked to. If necessary, extra solder should be put at the side of the wire and each Clix socket to ensure good contact. The inner row of Clix sockets do not have to be connected anywhere, they are used to hold the Clix plugs when not inserted in the sockets in the outer row.

The best way of attaching the flexible wires to the terminal shanks is to first bare the flex for about ½ in., and then clean carefully every strand of wire. This does not necessitate scraping each strand separately, but may easily be done by the gentle application of the corner of a triangular file. Now twist the strands together, apply a little flux, when the solder will flow easily while tinning the ends.

How to Use the Unit

The unit is now complete, and may be put into use. The two left-hand terminals marked "To set" are connected to the telephone or loud-speaker terminals of the set. The two front terminals labelled "Telephones" are used when tuning in, and are always in circuit whichever side the switch may be, unless the No. 5 Clix is removed. The four sets of terminals may now be connected to the wires leading to the different rooms, and according to how they are required the Clix 1, 2, 3, and 4 may be plugged into the outer row of sockets. If it is not desired to listen in all the rooms, the particular Clix of the terminals which

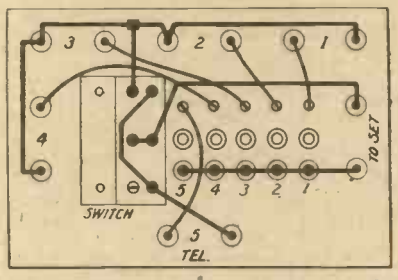


Fig. 3.—The wiring of the unit may be followed from this illustration.

supply those rooms should be placed in the inner socket.

This unit may also be used as a switch for putting a loud-speaker in or out of circuit, or for a telephone distributing board.

THE EXPERIMENTAL BENCH

By JOHN W. BARBER.

Some useful hints and tips upon how best to furnish the bench with fittings for experimental work.

THE man who is in the habit of trying out every circuit that comes his way is often in a quandary, as it is not pleasing to have to dismantle the whole, or even a part, of one's gear in order to carry out an experiment, and those of us who wish to carry out any useful work with our stations do not want them to be always in a state of confusion. What, then, is the solution? The simplest, and possibly the most satisfactory, is to keep the station ready equipped with gear ready for instant use, and to rig up a separate table, if possible, as an experimental bench. If it is not convenient to do this, a part of the operating table may be allocated to the experimental side.

The following remarks concern particularly the use of a separate bench, but the ideas may readily be adapted to other arrangements.

Battery Supply

Firstly, we must provide means of obtaining battery supply, and this is best accomplished by means of terminal strips fastened along the side of the table, the batteries being supported on a shelf, or, in the case of accumulators, on the floor. The construction of suitable terminal strips is seen in Fig. 1. It is suggested that round or countersunk head screws be used, and suitable nuts, such as those found on the top of dry cells, screwed on, thus ensuring that no terminal shanks touch the wood of the bench. The leads to these terminals may be

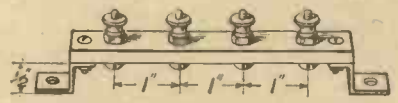


Fig. 1.—A suggested arrangement for use as a terminal strip.

equipped with spade tags, to facilitate connections, and the wires from the terminals to the batteries themselves may pass through holes in the table. If rubber-covered flex is used, no further insulation will be neces-

sary, otherwise small ebonite bushes may be used.

The Aerial

The most useful arrangement in this case consists in an extension to the main aerial, the lead from the test apparatus being joined by means of a suitable clip, such as the Burndept, to the extension. In my own case, to permit experiments being carried out in any part of the room, I have arranged a well-insulated

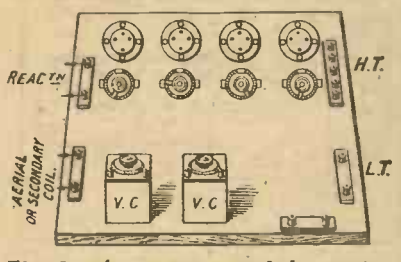


Fig. 2.—Arrangement of the testing board for experiments in reception.

wire right across the room, with a down lead to the window pane, wherein comes the aerial lead. The inside of a Silvertown insulator has been equipped with a Gibson socket, and the lead from the extension has a Gibson plug upon it, thus making it a simple matter to join up. In cases where this is not practicable, however, a smaller extension aerial may be equipped upon the test-bench itself, by arranging a vertical support at each end and running the aerial lead between them. In reception only, a pair of wooden supports may be used, the wire being held on insulated hooks, but for transmission purposes something more effective should be employed, such as porcelain or glass. The earth wire may be fastened to the legs of the table as in Fig. 3, and the dynamo starter switch, for transmission purposes, may also be secured in a similar convenient position, while the positive and negative of the high-tension transmission supply will find a convenient position on the edge of the table, with about three inches between the terminals.

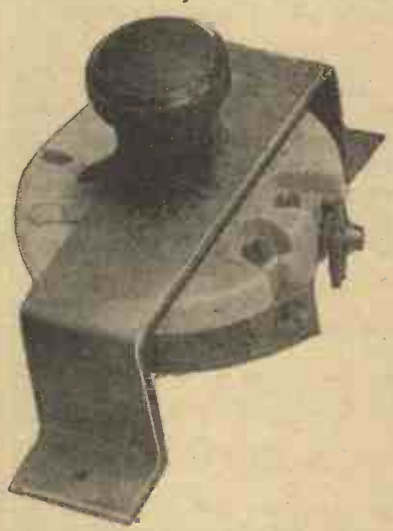
Connecting Wires

A bunch of wires for joining up the various components on the bench will be required, and these may conveniently be of rubber-covered flex, in eight-inch, one-foot, eighteen-inch, and two-feet lengths, the ends being finished off with spade tags.

Arrangement of Apparatus

For reception the arrangement of the various parts will depend largely upon the individual needs of the experimenter, and also upon the work undertaken. The valve sockets should preferably be of a type provided with terminals on a substantial ebonite base, in order to facilitate direct connection to any element of the valve. Fig. 2 shows a suggested layout for the apparatus, but modifications to suit each case will present themselves to the experimenter, and no details need be gone into here.

When such a test board is used in conjunction with some standard form of tuner, such as that described by myself in the April, 1925, issue of *Modern Wireless*, a very useful combination will result, and the variable condensers shown on the board will only be needed for tuned anode or similar positions.



A filament resistance of this type is easily fitted for experimental work.

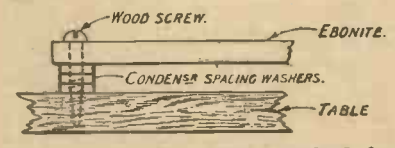


Fig. 4.—An alternative method for mounting the ebonite strip for the terminals.

In order to obviate the necessity for changing over the batteries from the test set to the regular apparatus, change-over switches may be employed. These may be placed in such positions that the leads from them to the regular set may not be in the way of testing leads. This remark applies more especially to accumulators, as it may lead to some complication if several tappings on the high-tension battery have to be changed over. Such a change-over is quite possible, however, and if desired may be carried out by means of a switch of the "Utility" type, which may be obtained as 2-, 4- or 6-way.

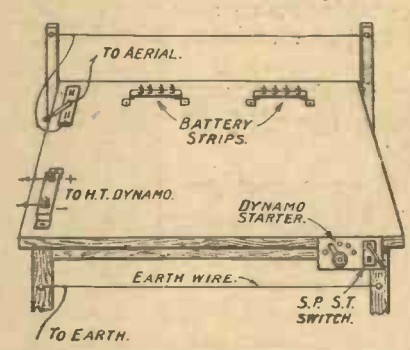


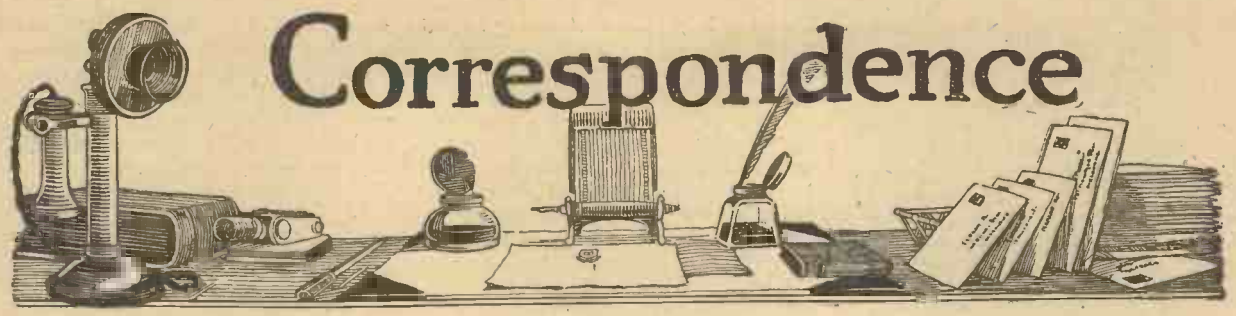
Fig. 3.—A useful method of arranging the aerial and earth connections.

H.T. Battery

The leads from the H.T. battery (including the negative) are taken to the middle row of contacts on the switch, one of the outer rows being joined to the terminal strip, while the other set of contacts is joined to the permanent set.

For transmission purposes, a series of meters should be available on or near the test bench, and should be provided with stout terminals in order that connections may be made and broken easily. For the aerial circuit, a hot-wire meter will give sufficient indication of aerial current to enable comparative tests to be made, although for accurate measurements a thermo-ammeter should be employed. Such hot-wire meters are obtainable at reasonable prices from shops handling Government disposals stores. A milliammeter should be provided for inclusion in the plate leads, and a high-resistance, high-reading voltmeter across the feed will be useful.

It is clearly not practicable, in an article of the present type, to give detailed instructions for such work, but the lines indicated will give a good general idea of the procedure to be followed, and the individual transmitting or receiving amateur will readily adapt the suggestions to his own circumstances.



Correspondence

THE TRANSATLANTIC V IN BELGIUM

SIR,—I think it may interest you to know the results I have obtained with the "Transatlantic V" Receiver (Mr. Percy W. Harris, *Modern Wireless* for June, 1924). This set is wired with the same components used by Mr. Percy W. Harris. I can receive the following European stations at loud-speaker strength: 2BD, 6BM, 2BE, 5XX, 5WA, 2DE, 5SC, 2LO, 2ZY, 5NO, Barcelona, Bremen, Breslau, Frankfurt, Hamburg, Hanover, Haeren, Hilversum, Königsberg, Komarow, Leipzig, Madrid, Munich, Munster, Ecole Superieure, PTT, Petit Parisien, Radio-Paris, Ryvang, Rome, Stuttgart, Voxhaus, Radio-Wien, Zurich, Eiffel Tower.

The American stations are WGY, KDKA, WBZ, and several others from which I could not hear the call sign.

I enclose two photos of my receiver. On the right side is the wave-trap used to cut out my local station, which is a stone's throw from my house. On the left hand

Mr. Beuviolt's "Transatlantic V" receiver is of particularly attractive appearance.

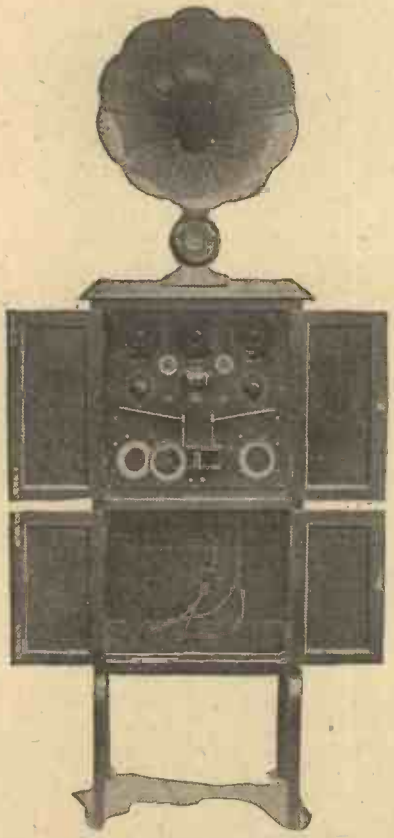
is a resistance-capacity amplifier used for distant stations.

The volume from 5XX, Eiffel Tower and Radio-Paris fills the whole house in daylight.

May I congratulate Mr. Percy W. Harris upon this wonderful circuit? —Yours faithfully,

Brussels. V. BEUVIOLT.

P.S.—In the beginning I was using commercial coils. I am now using duolateral home-made coils with stranded wire, 40 turns of



The handsome ST100 receiver constructed by Mr. Rumble.

enamel insulated wire d.c. covered. This is giving me a greater signal strength. I am also working with Mr. G. P. Kendall's coils described in *Wireless Weekly*, Vol. 5, No. 14, using the same wire.

With these coils I am able to receive Bournemouth, 2LO and Newcastle at good loud-speaker strength in daylight on five valves.

AN IMPROVED TWO-VALVE RECEIVER

SIR,—I am writing to inform you that I have constructed the "Improved Two-Valve Receiver" described in the January issue of *Modern Wireless*, by Mr. Stanley G. Rattee, and to congratulate you upon publishing this excellent set. The results obtained are splendid, the local stations coming in at good strength, also several Continental stations in addition. Belfast appears to be the best long-distance British station; Chelmsford, too, is very good. The operating of the set is simplicity itself.—Yours faithfully,

H. J. SMITH.

Manchester.

SIR,—I feel bound to write to thank you for publishing the description of "The Improved Two-Valve Receiver," by Mr. Stanley G. Rattee, in the January issue of *Modern Wireless*. I made up the set roughly, and straightway tuned-in 2LO at good loud-speaker strength, and all the other main stations of the B.B.C. at good 'phone strength. I also had several foreigners quite clearly. Using a piece of flex about 20 ft. long, hung around the picture rail, I had London at uncomfortably loud 'phone strength, and also three foreigners rather faintly.

My outside aerial is about 70 ft.

The H.T. batteries and accumulators for Mr. Beuviolt's receiver are contained in the lower part of the cabinet.

long and about 30 ft. high, and my earth is a lead from a water-pipe. I am about 20 miles west of London.

Wishing you every success for your excellent journal.—Yours faithfully,

J. A. HACKER.

Slough, Bucks.

ENVELOPE No. 1

SIR,—Having constructed the ST100 Receiver (Envelope No. 1, by Mr. John Scott-Taggart), I have enclosed some photographs of my instrument, which I thought you might like to publish. I think the circuit is splendid, and the results the same.

Wishing you and your papers every success.—Yours faithfully,

H. T. RUMBLE.

Ilford.

THE HOME THREE-VALVE RECEIVER

SIR,—I am writing to you to tell you of my results in connection with the "Home Three-Valve Receiver" described in *Modern Wireless*, December, 1924, by Mr. E. Redpath.

I have constructed this set with some slight modifications. They are as follows: Separate H.T. on the detector valve, and the last stage of L.F. is resistance coupled instead of transformer. I am using Lissenagon coils 35 primary, 50 secondary and 25 reaction for London. My house is situated 15 miles due south of 2LO.

The set presents a very neat appearance. The cabinet was home-made and French polished.

Results for more distant stations are slightly more difficult to get, the difficulty being to avoid oscillating and yet receive the desired station.

The volume of London on one valve is extraordinary.

Hoping this may prove of some interest to you.—Yours faithfully,

H. J. UNDERHILL.

Warlingham.

SINGLE-VALVE RECEIVER FOR KDKA

SIR,—It will no doubt interest you to know the results I have had with the "Single-Valve Receiver for KDKA," described by Mr. Stanley G. Rattee in the March issue of *Modern Wireless*. I made it up exactly as described, with the exception of the condenser, which in my case is a "J.B."

KDKA comes in at good 'phone strength practically any night after 11.15 p.m., although varying, of course, with the weather conditions prevailing.

Besides KDKA, I have received many French and English amateur C.W. stations.

The tuning is very sharp, although the set is not difficult to handle.—Yours faithfully,

J. V. FOSTER.

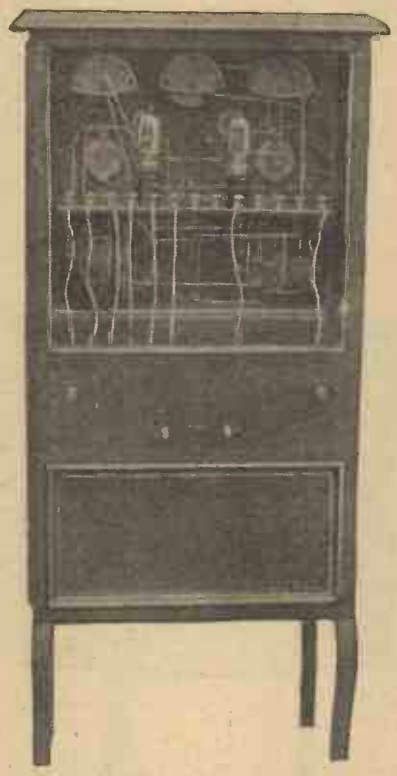
Ipswich.

ENVELOPE No. 3

SIR,—I am now writing you to inform you that I have built the "Simplicity 3," by Mr. G. P. Kendall, and I am very proud of the results obtained by its use. The signals are very loud, wherever they come from, London, Bournemouth, Belfast and Glasgow being the stations which I have tuned-in as yet. The nearest station to which I live is Newcastle, 80 miles away. I am situated 35 miles west of Carlisle, and, as the crow flies, 300 miles from London.

The coils that I have are of the duolateral staggered lattice type, as described by Mr. Kendall in his book, "Tuning Coils and How to Wind Them."

When Big Ben is broadcast, the loudness of the signal is simply



The back-of-panel arrangement of Mr. Rumble's ST100

marvellous. We could not hear it any better if it were on the house-top.

Wishing you every success with the "Simplicity 3," as there may be some 3-valve sets as good, but none better.—Yours faithfully,

Bullgill. PETER WILSON.

SIR,—I have constructed the "Simplicity Three-Valve Receiver" (Envelope No. 3, by Mr. G. P. Kendall), and I thought you might like to know of the results I am obtaining. I am using two B.5 valves and one B.6. I have received the following stations on the loud-speaker: Manchester, Liverpool, Birmingham, Leeds - Bradford, Glasgow and Chelmsford, whilst on the headphones all B.B.C. main and relay stations have been received. America has been received once only. Also Rome, Madrid and nearly all the French and German stations.

Wishing your papers every success.—Yours faithfully,

JOHN MARTIN.

Manchester.

SIR,—Having quite recently finished the "Simplicity 3" receiver, by Mr. G. P. Kendall, the following particulars might be of some interest to you:—

Aerial height, 30 ft.; length, 90 ft. Stations received: London, Glasgow, Belfast, Bournemouth, Aberdeen, Manchester. All the above are very loud and distinct, and free from interference. Wishing you every success with the "Simplicity 3."—Yours faithfully,

P. W.

Cumberland.

ST100 IN ANTWERP

SIR,—I have much pleasure in penning these few lines to you. I have just completed building the ST100 two-valve receiver (Envelope No. 1, by Mr. John Scott-Taggart), and must give credit where it is due.

Last night I got Chelmsford, Hamburg, Brussels and Paris with good results on a loud-speaker, and am quite satisfied if I never get another set, as this particular set, the ST100, is certainly what it is represented to be, and I am perfectly satisfied.—Yours faithfully,

S. WOLFE.

Antwerp.

THE ALL-CONCERT RECEIVER

SIR,—It gives me great pleasure to write to you and give you a brief account of the wonderful results my husband and I have achieved with that extraordinarily efficient circuit Mr. Percy W. Harris introduced to us some time ago through the medium of *Modern Wireless*, September, 1923, viz., the All-Concert Circuit.

You will be interested to know that my husband is a blinded ex-soldier, and is now carrying on a poultry farm after being trained in that occupation by St. Dunstan's.

We live in a very isolated neighbourhood, and consequently the pleasure we derive in getting in touch with the outside world by means of our little wireless set is inestimable.

But what I mostly want to tell you is that on Sunday night, April 26, at about 11.45, we heard distinctly a lady and gentleman singing "Hard-hearted Hannah," followed by a band playing several fox-trots, the names of which, though familiar, I could not give you.

The atmospheric conditions were bad at the time, consequently we were unable to get the call sign of

the station in question, though the announcer appeared to speak with a distinct nasal twang.

We are hoping that it was America which we picked up. I forgot to say it came through very strong on the loud-speaker, and but for atmospherics we could have heard every word.—Yours faithfully,

NELLIE M. NEWLAND.

Hever, Kent.

[We shall be pleased to hear from any reader who may have heard and identified the transmission referred to.—ED.]

THE "SEVEN-CIRCUIT" CRYSTAL SET

SIR,—A few remarks concerning the "Seven-Circuit Crystal Receiver" described by Percy W. Harris in *The Wireless Constructor* for December, 1924, may interest you. I made this up in Brighton by way of experiment. Chelmsford came in at good strength, speech being readily intelligible. London and Bournemouth were just audible. Since results were so good, I brought the set up to my "diggings" in London, and here, a mile or so from 2LO, excellent signals result, using the bed mattress as an aerial and the gas radiator pipe for an "earth." Really loud signals are obtained with 15 ft. of Electron wire slung out of the window. I think many of your readers compelled to reside in "diggings" within a few miles of 2LO would make the set up if they only knew that a very rudimentary earth and aerial would give quite good signals. As a matter of experiment, 10 ft. of wire across the room gave slightly better results than the mattress used as an aerial, a distinct improvement resulting from the outside length of wire. An R.I. detector is used in the set.

It is certainly an excellent receiver, and the results obtained could hardly be excelled by any other type of crystal receiver. For the design, etc., of the circuit Mr. Harris deserves my thanks.—Yours faithfully,

H. W. KOHLER.

London, W.C.1.

A READER'S EXPERIENCES

SIR,—With reference to the "Auto-coupled Three-valve Neutrodyne Receiver," described by John W. Barber in the April 22 issue of *Wireless Weekly*, I should like to give you my experiences of this system.

When the first neutrodyne receiver was described by Mr. John Underdown in *Wireless Weekly*, Vol. 4, No. 14, I altered my set from potentiometer control to neutrodyne with two H.F. stages. It was immensely superior both in musical reception from 2LO and 5XX, but also more selective and more far-reaching as regards distant stations. But it was not until I remounted valve sockets (scrapping the so-called anti-capacity holders I was using) direct on to the panel, with air spacings between each, that I obtained the full value of neutrodyne control.

By a simple arrangement of Clix plugs and sockets, one or both of the H.F. stages can be completely eliminated, similarly with the L.F. stages. Thus the set can be used absolutely efficiently in any combination of valves if it is desired.

The aerial tuning to the set is also arranged with Clix plugs from a three-coil holder, so that primary or primary and secondary coils may be used, with or without reaction from the plate of the detector valve.

There is nothing original about the set, as all my knowledge has been derived and pieced together from reading the publications of your house.

Now as to results. The aerial is badly situated as regards screening; hence the necessity for perfection in the receiver.

(1) Aerial: In my case I find that a low resistance strip aerial gives better signals than any wire.

(2) Aerial tuning: Primary and split secondary are rather easier than primary and simple secondary.

I do not find that aperiodic tuning is as good as the above.

Outside the London range the set is very selective. London, however, swamps Cardiff and Bournemouth, whilst Chelmsford over-rides Radio Paris. This is not to be wondered at, as we are only 16 miles from Chelmsford as the crow flies.

On the loud-speaker I have obtained Aberdeen in the north and Rome and Madrid in the south without any distortion, speech being intelligible. The following stations have been logged on many occasions, and their position on the home-made buzzer wavemeter recorded: Brussels, Hanover, Gothenberg, Nottingham, Barcelona, Edinburgh, Bremen, Petit Parisien, Cardiff, London, Manchester, Bournemouth, Madrid, Breslau, Newcastle, Glasgow, Rome, Stuttgart, Ecole Superieure, Birmingham, Aberdeen, Berlin, Konigsberg, Zurich, and recently Lyons.

In spite of atmospherics, if the neutrodyne controls are properly set, the tendency to break into spontaneous oscillation is small, and when it does happen, the slightest touch of the second neutrodyne condenser puts things right.

(3) Reception of music: Perfect reproduction of music from the local station is as important as selectivity and ability to receive distant stations.

The best arrangement I have found for the best reproduction from London is with 2 H.F., detector and one L.F. stage, in accordance with the details I have given above. Given a good loud-speaker, with a suitable fixed condenser across it, the most critical musical listener is satisfied with the result (provided that the transmitting station is not experimenting with the modulation).

In conclusion, I must congratulate the staff of Radio Press on the most interesting and instructive articles which they give us week by week and month by month.—Yours faithfully,

A. Butler Harris,
M.A., M.B. (Oxon.)

Loughton.

THE ALL-CONCERT RECEIVER IN AMERICA

Sir,—Since writing my letter to you acquainting you of the results I had with the "All-Concert" Receiver (described by Mr. Percy W. Harris in "Twelve Tested Wireless Sets), and which was published in *Wireless Weekly* of May 28, 1924, I have been to the United States and Canada and have only just returned to England, and I feel I must write you again of the results of the "All-Concert" on that side of the ocean.

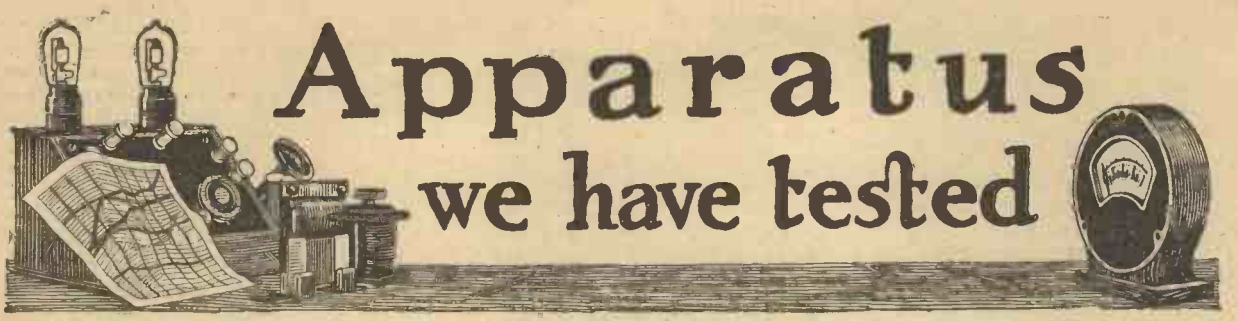
I constructed a set while in Detroit, Michigan, and while the local stations, either WCX or WWJ, were broadcasting, could easily tune in New York and Eastern stations, including the popular KDKA, WBZ and WTAM, Cleveland. When locals were closed down I could easily tune in stations in the Southern States, including WFAA, Dallas, Texas, and CYB, Mexico City, was frequently received. KPO, San Francisco, was the only Western station received.

Again, in Montreal an "All-Concert" was constructed employing V24 valves for both high and low-frequency and a QX for detector. A test was made, and the "All-Concert" was equal to the five-valve neutrodynes which are very popular in that city for distance, but the volume was not quite so strong.

Still wishing your publications greater success,—Yours faithfully,

W. H. Symes.

South Devon.



Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

"Gripsit" Wiring Washers

Yet another device for abolishing that bugbear of many amateur constructors, the soldering iron, whilst still enabling really sound and lasting connections to be obtained between the wires of a set, and the contacts of fittings on the panel is the "Gripsit" washer, marketted by Messrs. Kirby Banks Screw Co., Ltd. This consists of a small triangular brass washer, with the points of the triangle turned up a short way. If the washer is placed over a terminal stem with the points down, a single wire can be gripped most effectively under the claws so produced, whilst for holding two or three wires, two washers placed face to face clasp these firmly between the six claws available. For more than three wires a second pair of washers can be superimposed on the first. The wires cannot slip out sideways in the manner so frequently noticed when making connections hastily without washers.

On trial, these washers operated just as indicated; they can be recommended for home construction, particularly as we understand that the price is very moderate.

The "Precise" Multiformer

We have had submitted for test the "Precise" Super Multiformer obtainable from C. G. Vokes & Co. This instrument is for use in super-heterodyne receivers, and takes the place of the filter or input transformer and three inter-frequency transformers. The whole unit is contained in a metal screening case, and terminals are arranged very conveniently, with the result that grid and anode leads can be made exceedingly short. The input primary should be tuned by a .0005 μF fixed condenser, which also acts as a by-pass condenser. The multiformer was thoroughly tested in a super-heterodyne receiver employing the Tropadyne oscillator circuit. A frame aerial 2 ft. square was employed.

On 2LO, of course, the receiver was badly overloaded. Other stations were received at good loud-speaker strength, using two stages of L.F. amplification, and no difficulty was experienced in going the round of the B.B.C. stations on the loud-speaker, except in the case of Manchester, where there were traces of interference from 2LO. Foreign transmissions were also easily picked up at varying strengths on the loud-speaker, as were also relays. The amplification obtained was very good, though quality and

silence of background leave something to be desired. Occasionally a tendency to whistle developed, but this could be cured by connecting the metal case of the multiformer to L.T.–.

Though not perhaps the best of the various makes of intermediate frequency transformers with regard to quality or silence in working, this instrument nevertheless gives excellent range and volume. Long-wave interference, if experienced, must be endured, since it is not possible to tune it out with this unit, which is designed to give maximum amplification at a certain frequency, apparently equivalent to a wavelength of about 7,000 metres. For the inexperienced this may, however, be an advantage, for it will not be necessary to balance up each stage of inter-frequency, and results can be obtained immediately without any trouble.

Variable Condensers

Messrs. Hall & Brenard, Ltd., have submitted samples of their variable condensers, with ebonite end-plates, and of the snail-cam shape. Both the samples were rated nominally as of .0005 μF capacity; the one had a three-plate fine-adjustment unit mounted co-axially with the main portion, and controlled by a concentric knob. The usual one-hole-fixing device was provided, suitable for panels up to $\frac{1}{4}$ in. thick; connections were provided for by soldering tags, spring washers being relied upon to ensure good contact and smooth action. It was noticed that the fine-adjustment plate had a tendency to move round when the main bank of plates was moved. Positive stops limit the motion of the plates both ways.

On measurement, the instrument with fine-adjustment device showed a minimum capacity of just under 7 $\mu\mu$F, and a fine-adjustment range of about 31 $\mu\mu$F; the maximum of this condenser was .000405 μF. The other showed a minimum of only 4 $\mu\mu$F and a maximum of .000375 μF. There was a noticeable discrepancy between the nominal and actual measured capacity. Both condensers gave ready oscillation when tested in an actual receiving circuit on the broadcast waves.

"Junit" Self-Soldering Wire

Yet another device for making smooth the path of the home constructor in a direction which often presents formidable difficulties to the uninitiated, is provided by the "Junit" self-soldering wire, put on the market by Messrs. Brown Bros., Ltd., for bare wire connections behind the panel. This appears to be ordinary square bus-bar wire, in two gauges and brightly tinned, but on application of a little flux and a hot tinned soldering iron it is found that the wire has already a sufficient coating of low-melting solder to make excellent, sound joints without further addition of solder. On practical trial, in wiring up a complex tapped-inductance set, this feature proved of the greatest practical value, and an extremely neat job could be made of it.

Wates Bros.' "K" Fixed Condenser

A small tubular type of fixed condenser, of nominal capacity .0002 μF, has been sent for our examination by Messrs. Wates Bros., Ltd. This measured only $1\frac{3}{4}$ in. by $\frac{1}{2}$ in. diameter, and was enclosed in a tubular transparent case, with brass ends and terminal screws; brass clips are provided for mounting it on the panel, rather after the fashion of some fixed grid-leaks. The actual capacity, on measurement, came out at about .00023 μF, *i.e.*, near enough to the nominal value for ordinary radio purposes. Tested as main tuning capacity in an oscillating circuit, it was found to require appreciably more reaction than a standard air-dielectric condenser, indicating a fairly high-power factor. The D.C. insulation resistance was quite satisfactory.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

M.A. (FINSBURY) has constructed an ST100 receiver and finds that when connected up in the normal manner, namely with a No. 50 coil in the aerial socket, and the aerial connected to the constant aerial tuning terminal, no signals are received. If however the shorting strap between the moving vanes of the aerial condenser and the lower end of the aerial coil is left open weak signals are heard providing the catswhisker does not make contact with the crystal. The anode coil is a No. 50 and has been found to work satisfactorily in other sets, as has the crystal detector. Two general purpose valves are used with a 60-volt high tension battery and no grid bias.

Reviewing the symptoms given in our correspondent's letter, it seems almost certain that the aerial condenser is short-circuited. A simple means of locating whether the trouble is definitely in this component is to disconnect the two leads from the fixed and moving vanes and to carry out the "click" test with a pair of telephones and a small dry battery, such as is used in a pocket flash lamp. Connect one side of the flash lamp battery to one tag of the telephones, the free side of the battery to one condenser terminal, and tap the other condenser terminal with the free telephone tag. This test should be carried out whilst slowly rotating the moving vanes. If present, a short circuit will announce itself by loud clicks in the telephones. It would appear from our correspondent's letter that it is not an ordinary intermittent short, such as would be obtained if the vanes were bent out of shape and touching in a few positions, but rather that the short circuit is more definite in nature. The condenser should be held up to the light and carefully examined to see that no lumps of solder are responsible. Vanes which appear to be touching should be bent with a pocket knife so as to clear properly. If a condenser is available which is known to be working effectively, a much more simple test is to connect this in circuit in place of the one that is suspected of shorting. If this is found to work satisfactorily, the trouble is undoubtedly located in the aerial condenser, which should be changed.

The trouble of signals disappear-

ing completely when the cat-whisker is brought into contact with the crystal is not an unusual one. Actually all that is usually wrong is that the first valve of the set is being used in such a way as to cause it to rectify instead of to amplify at high and low frequency simultaneously. The remedies which are almost always effective are to apply another 30 to 40 volts to the plate of this valve and to apply a suitable grid-bias voltage with some care. When carrying out this operation it is necessary that a sensitive spot on the crystal be found, and after this that readjustment be made of both the tuning and reaction controls. When the crystal is brought into operation it is always found to diminish the amount of reaction by increasing the damping across the anode circuit, and this must be compensated for by bringing up the reaction coil a little nearer to the aerial coil, before it is possible to say whether the crystal is working properly.

T.H.D. (LIVERPOOL) has a crystal set with an outdoor aerial but finds it difficult to get a good earth connection. At present he is using a connection to a gas pipe. He has run twin flex leads through the house in order that the programme may be available in another room when it is not desired to be in the same room as the set. The twin flex lead is 30 feet in length and when in use it is found that signals are considerably stronger than when telephones are used at the actual set terminals. He also finds that the earth connection can be dispensed with in this case.

The reason why our correspondent receives stronger signals when the telephones are used at a considerable distance from the set and also when the normal earth connection to the gas pipe is lacking, is to be found in the fact that the twin flex leads are acting as a fairly efficient counterpoise arrangement. In cases where difficulty is experienced in getting a good earth connection, a counterpoise may often be used with advantage. A gas pipe seldom makes a really good earth connection, and is certainly not to be advised, as not only is this a dangerous practice, but often the joins in this type of piping are made gas-proof with materials which have a very high resistance. A counterpoise, however, is free from these drawbacks, and hence tuning is sharpened and signal strength improved in many cases. Often a length of insulated wire taken from the earth terminal of the set and through the rooms of the house on the floor, under the carpet or around the skirting, is found to make an excellent substitute for the more conventional earth connection. The fact that this is not taken directly under the aerial will not prevent it working with a fair degree of efficiency.

P.G. (NEWPORT) has electric light in his house and asks us how it is possible to determine whether this is direct or alternating current and also how to find the polarity of the mains providing his supply turns out to be D.C.

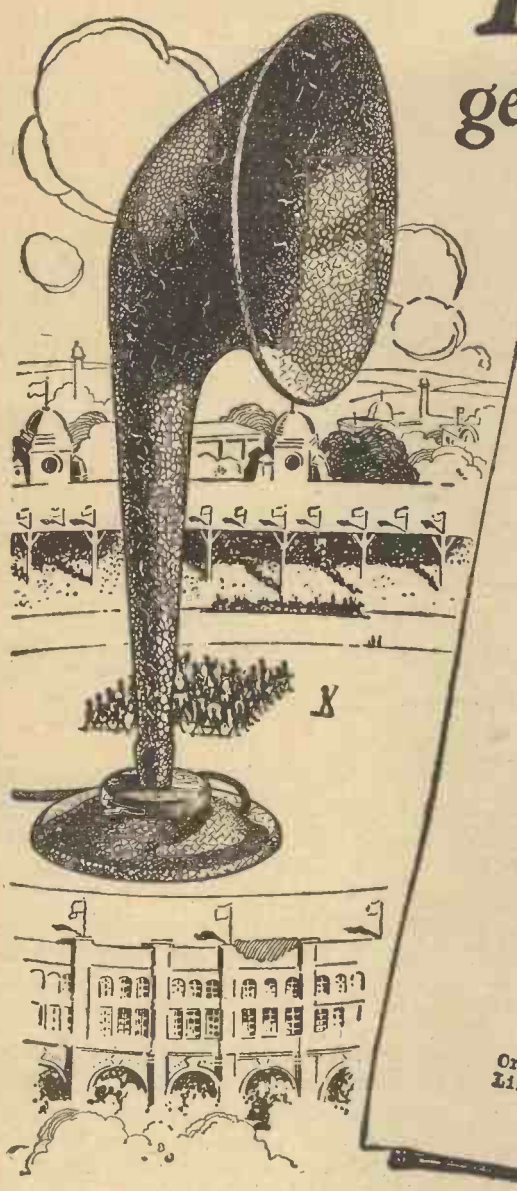
Whether the supply is alternating or direct is usually easily determined by examining the supply meter. If the supply is alternating the frequency or periodicity of the supply is usually marked on it. If, however, an examination of the meter does not reveal the type of supply, application should be made to the local electricity authorities.

If direct current, the polarity of the mains may readily be established by taking two leads from the supply, connecting a lamp in one lead and dipping the two ends into a glass of water to which a small quantity of salt has been added. Care should be taken that the two wires do not touch; the wire from which most bubbles rise is the negative lead.

The Table-Talker

TRADE MARK

gets an unsolicited compliment!



COPY.

Dear Sir, DEAL.
May 9th, 1925.

A fortnight ago I purchased a Brandes Table-Talker, and should like to express my great satisfaction at its clearness of reproduction.

This morning's ceremony at the opening of the Exhibition at Wembley and the speech by His Majesty the King gave me a further opportunity of testing the value of your Table-Talker, and the test it stood should satisfy the most exacting conditions.

I have a 3 Valve Set and for the test obtained 300 feet of ordinary telephone wire (double laid). By the use of this length of wire I was able to instal the Table-Talker on the railway station platform and from 11 a.m., until 12.45 p.m., the result was "great". Its voice was heard all over the station -- even though trains were passing to and fro. A large number of people -- railway staff, outside public and passengers congregated to listen, and their comments were most gratifying. Several enquired about the Table-Talker -- expressing surprise at the loudness, clearness and absence of distortion.

After this test I am more than ever satisfied, and it occurred to me you would like this appreciation of your Product, more than a mere "Table-Talker" -- a complete "Loud Speaker"; splendid value for money.

(Signed). Yours faithfully,

W.W.H.

Original letter can be seen at Offices of Brandes Limited.

This interesting experiment, carried out on the occasion of the broadcasting of the Opening Ceremony at the British Empire Exhibition, successfully conveys some idea of the general excellence of this efficient loud speaker. The Brandes *Table-Talker* has a specially constructed horn which eliminates metallic harshness, and is matched to the unit so that the air resistance produced will exactly balance the mechanical power of the diaphragm. Perfectly even tone is supplemented by rich, generous volume.

Price 42/-

Obtainable from any good Dealer.

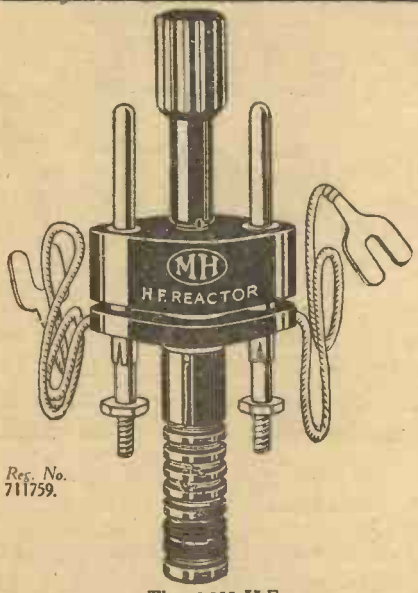
Brandes

The name to know in Radio

"Matched Tone" Headphones

20/-

Official money-back guarantee. *Brandes Limited, 296, Regent Street, W.1.* *WORKS: Slough, Bucks.*



Reg. No. 711759.

The *MH* H.F.

REACTOR

Price* 15/- *each.

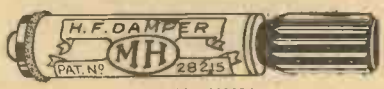
The REACTOR is a patented device for applying reaction to the H.F. Transformer instead of to the aerial coil, thereby largely preventing re-radiation and gives increased selectivity. A closer control with sharper tuning is more easily obtained by this method.

Builders of sets have always found (MH) Components good and sound.

You can add High Frequency Amplification to your receiver with the certainty of success.

The (MH) H.F. components here illustrated give you maximum efficiency with the greatest ease of control.

Beside the Pride of Achievement there is the Pride of Possession when (MH) components are incorporated in a set.

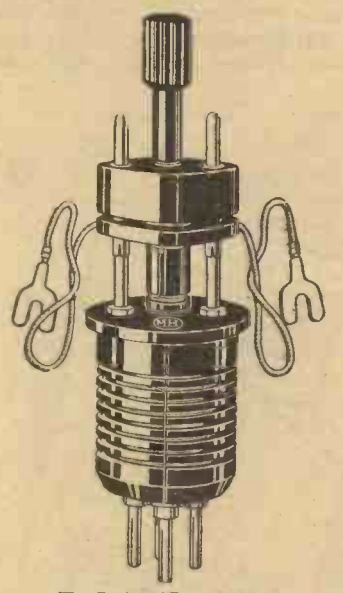


Pat. No. 228834.

The *MH* H.F.

DAMPER

Price (as illustrated) **2/-.**



The REACTOR in position.

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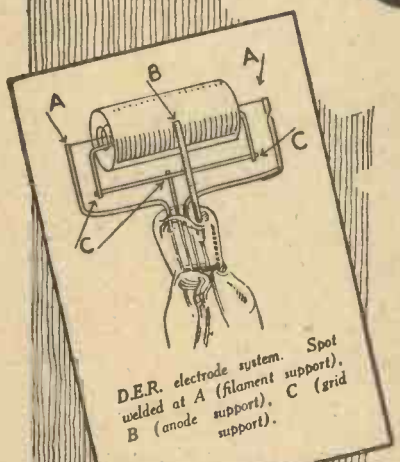
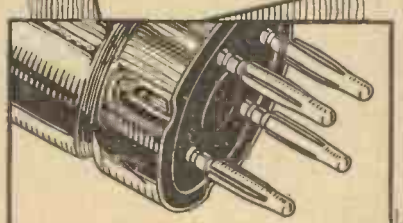
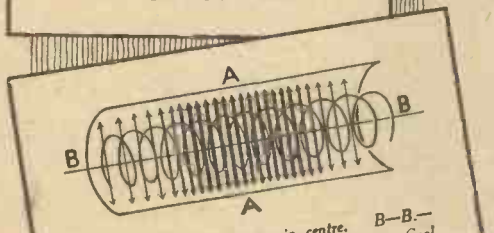


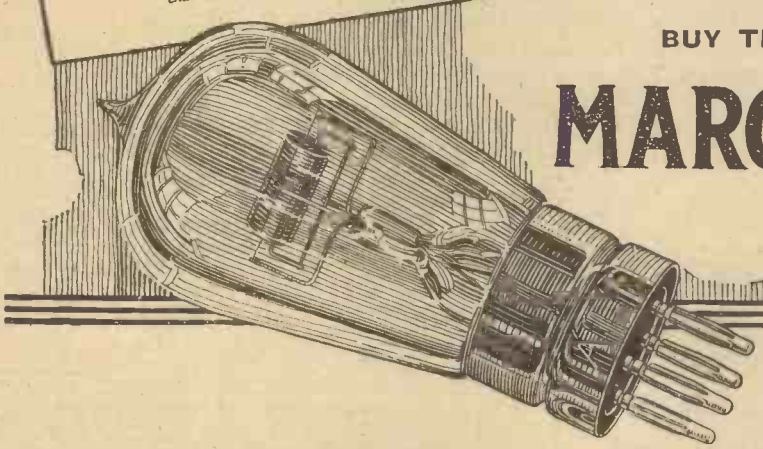
D.E.R. electrode system. Spot welded at A (filament support), B (anode support), C (grid support).



Cap of high insulation, subjected to exhaustive tests before use. Leaf-spring pins to give "all-round" contact in valve holder, instead of split pins, which give only part contact.



A—A.—Greatest emission in centre. B—B.—Cool ends of filament, non-emitting. Non-escape of electrons through ends.



The electrode system which is efficient for one type of valve is not necessarily suitable for other types. To be efficient a valve must be designed with definite reference to the conditions under which it will be used.

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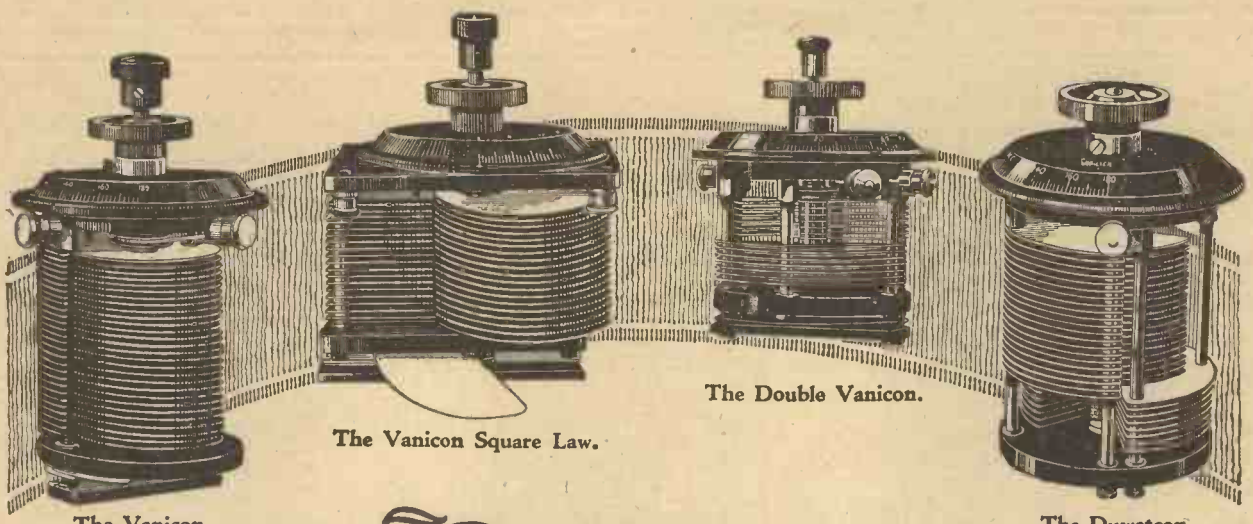

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Wireless Weekly Small Advertisements.

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A portable set will give you music wherever you are. Get ready now. June "Modern Wireless" contains an interesting article on "Portable Sets and Their Uses," by Percy W. Harris, M.I.R.E.

You are shown just how you can get the most out of a portable set under all conditions.

"A Two-Valve Portable Set" illustrated above, is described by A. S. Clark. Full constructional details are given showing explicitly how the enthusiast can build this compact and useful receiver.

John Scott-Taggart, F.Inst.P., A.M.I.E.E., the Editor, continues his very interesting article on "A Nine-Valve Supersonic Heterodyne Receiver."

Those interested in multi-valve set construction will find the article on "How to Make a Four-Valve Tri-coil Receiver," by C. P. Allinson, of special interest, describing fully, as it does, the building of a novel and efficient four-valve receiver.

The June issue of "Modern Wireless" also contains, as usual, numerous hints and tips of great value to all radio enthusiasts.

Selection from Contents:

PORTABLE SETS AND THEIR USES.
By Percy W. Harris, M.I.R.E.

HOW TO MAKE A FOUR-VALVE TRICOIL RECEIVER.
By C. P. Allinson.

A TWO-VALVE PORTABLE SET.
By A. S. Clark.

A SINGLE VALVE SET WITH REINARTZ COUPLING.
By Stanley G. Rattee, M.I.R.E.

A ONE-VALVE RESISTANCE AMPLIFIER.
By J. Underdown.

A SPADE-TUNED CRYSTAL SET.
By E. J. Marriott.

A NINE-VALVE SUPERSONIC HETERODYNE RECEIVER (Contd).
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We have examined the records of the above publication for the period ended 14th April 1925 and we certify that the average net sales for the six issues of that period (after deducting all free, returned and voucher copies) amounted to 253,180 copies per issue.

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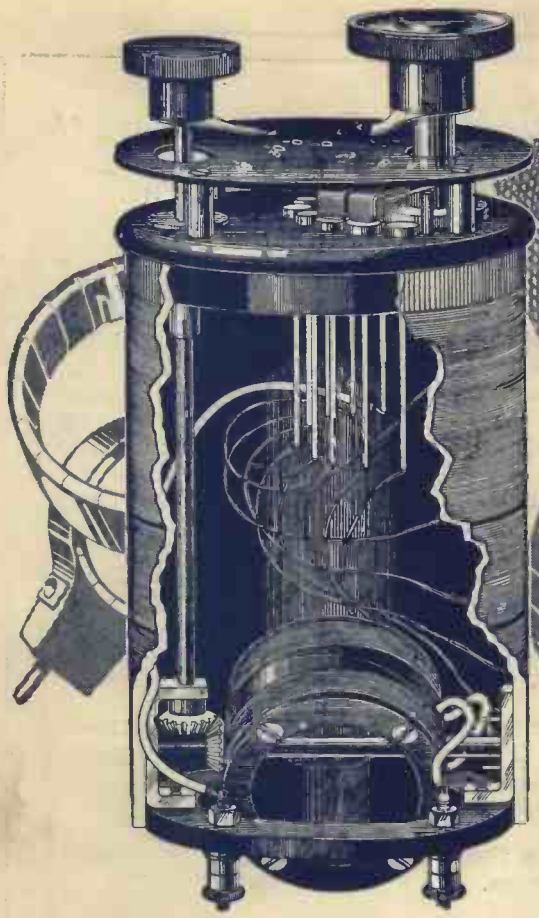

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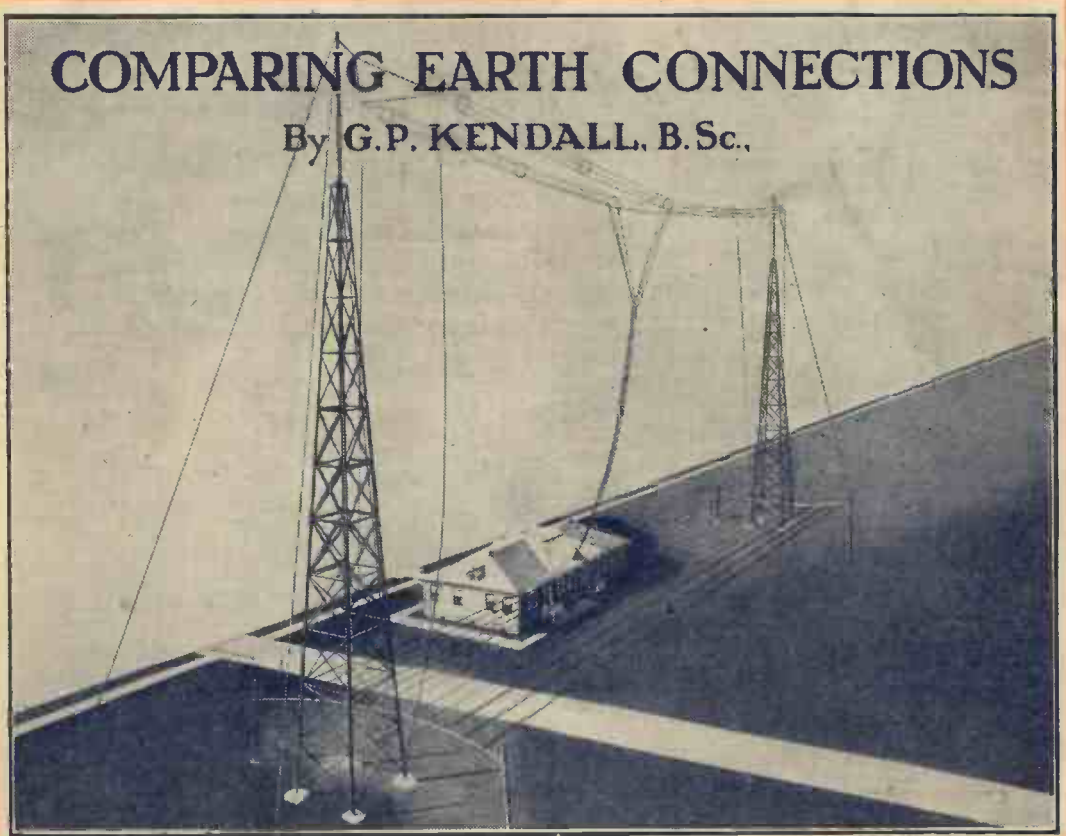
Wireless Weekly, 6d. Net. Wednesday June 10th, 1925

Wireless Weekly

Vol. 6. No. 10.

COMPARING EARTH CONNECTIONS

By G.P. KENDALL, B.Sc.,



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A New Trade Journal

THOSE who have followed the development of Radio Press, Limited, the proprietors of this journal and of both *Modern Wireless* and *The Wireless Constructor*, will have realised that, owing to the unique facilities and the close touch that exists between the company and the public on the one hand, and the trade on the other, it was only a matter of choosing an opportune moment for the company to produce and publish a trade journal.

This opportune moment has arrived, and a notice appears elsewhere in this journal to the effect that we are producing a monthly trade periodical which is being called *The Wireless Dealer*.

The sphere of influence of the Radio Press is now such that there is hardly a street in the country which does not come within it. The joint circulation of our three papers is approximately 400,000 copies, and in addition to this huge total we carry on a very large business in the publication of books, envelopes and other non-periodical publications. In the sale of these latter we are, of course, in constant touch with most of the retailers in this country, who are also indirectly influenced by Radio Press, Ltd., as most of their clients are purchasers of Radio Press magazines and books, and consequently buy components and the like from their counters.

The discussion of Radio Press business activities in a leading article may appear to some to be out of place, but we ourselves have so consistently taken our readers into our confidence that any matter which ultimately affects them is disclosed at the first opportunity.

We ourselves have, perhaps, been particularly successful in studying the needs of the wireless public. Were it not so, the circulations of our papers would not be as high as they are. We have just announced that the average net sales of *The Wireless Constructor* for the last six months are 253,180 copies per month. This represents the largest wireless net sales in the world (the highest ever achieved in America is that of the *Radio News*, 210,000), and is a total greater than that of all the non-Radio Press technical and semi-technical periodicals put together.

We are, consequently, in a unique position to bring public and trade together in an impartial manner. That we have helped the trade in this country to an unusual extent is admitted by every manufacturer, since most of our publications relate to the construction of wireless receivers.

We are fully aware that in producing a new trade paper we are entering a field already partially filled, but we feel convinced that we shall achieve the same success in this sphere as in the case of those periodicals which go to the general public. In brief, wireless publishing in every form is essentially a business for wireless people.

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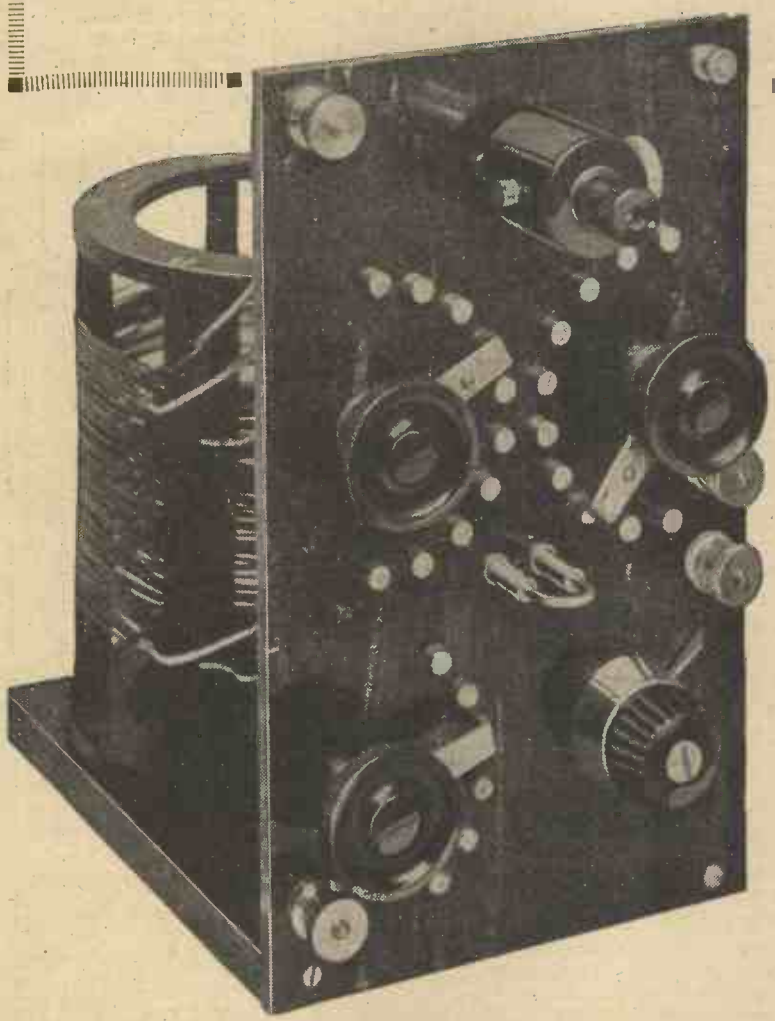
Crystal Reception and Low-Loss

By A. D. COWPER, M.Sc.,
Staff Editor.



The instrument which Mr. Cowper used in the course of his experiments employed a special low-loss coil tapped at various turns.

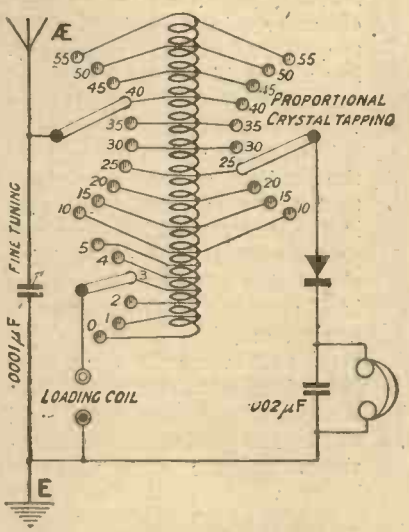
THE somewhat elaborate crystal receiver illustrated on this page represents an attempt to incorporate in a practical instrument nearly all the factors that careful experiment and measurement have shown to be essential to obtain the *maximum possible* signal-strength, on the crystal, from a given aerial and transmission. There is still a slight dead-end effect, due to the necessity of providing tapped coils in order to cope with varying aerials and aerial-capacity, and to give a wide tuning-range. Actual measurement shows, however, that the effect of this comparatively small number of dead turns, when air-spaced (i.e., with minimum distributed capacity and dielectric losses), is very small; and that the expedient usually suggested of short-circuiting one or all of these turns produces quite measurable losses. (Compare Prof. Fortescue's address on "Resistance in Wireless Circuits" to the Radio Society of Great Britain, Feb. 25, 1925.)

Advantages of Thick Wire

Experiment has shown that there is no very appreciable gain in signal-strength by the use, *on a low-loss former*, of very large gauge wire for a crystal tuning inductance, when the crystal-phone circuit is tapped across the *whole* of the inductance, and therefore exerts to the full its very considerable damping effect. (*Wireless Weekly*, Vol. 6, No. 4, April 29, p. 120.) It is otherwise when more usual types of compact inductances are used, as then the spacing effect with d.c.c. insulation on clumsy thick wire which cannot be wound as neatly and compactly as thinner gauges results in a coil of appreciably smaller H.F. resistance, and gives, in general, better signals. And with "proportional crystal-tapping" (as adopted here) it becomes again worth while, up to No. 18 gauge.

Coupled Circuits

The alleged step-up by the use of coupled circuits and auto-transformer coupling has similarly proved, in my experience, to be quite illusory in the case of crystal receivers. Measurements on the latter are given later, which show a definite loss in signal-strength when a large number of extra turns are included in the crystal circuit in the vain hope of getting a step-up in voltage. Very many tests carried out by the writer with loose-coupled crystal circuits have uniformly shown that



This theoretical circuit diagram shows the various turns on the coil at which Mr. Cowper made tappings.

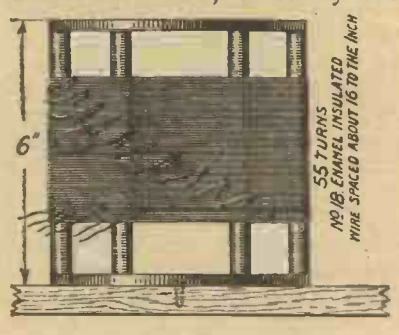
In this contribution Mr. Cowper elucidates the more important factors governing the maximum signal strength which it is possible to obtain on a crystal set from a given station, and upon a given aerial. Stress is laid upon the importance of utilising the correct amount of inductance across the crystal-phone circuit.

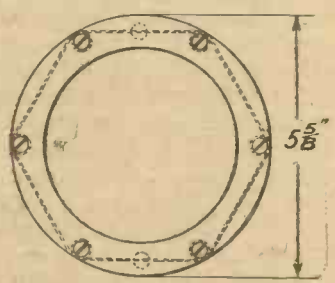
with P.M.G. aerials and the shorter broadcast wavelengths there is no measurable increase in signal-strength by the use of coupled circuits.

Possible Advantages

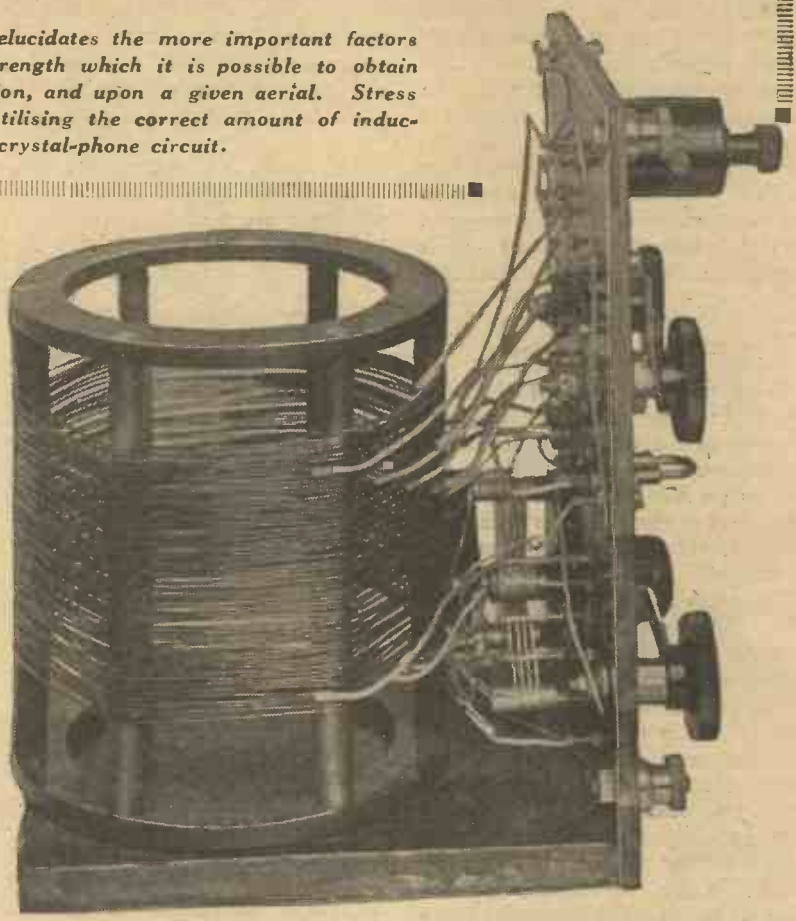
With some combinations of aerial-capacity and signal-frequency, and in some cases where the aerial damping can be reduced by decreasing the coupling to the aerial of a crystal-loaded circuit, it may be that one can observe a slight increase, but the writer has never been able to reproduce these particular conditions on short waves. When an extra voltage is sought by increasing the number of turns in the crystal-circuit *below* the earth-connection point, auto-transformer fashion, the loss may be still greater since these turns are effectively shorted by the casual capacities of the observer's body to earth—a high-loss and inconstant condenser if there ever was one.

Given a tuning inductance of minimum H.F. resistance for its inductance value, tuned by the very minimum of wasteful extra tuning-capacity across it, then the principal factor controlling signal-strength is the damping effect of the crystal itself (as an energy-operated and energy-absorbing device), and the need to balance this most efficiently against the inevitable resistance losses in the aerial. The ether in the neighbourhood of the aerial cannot be looked upon as an indefinitely large source of signal-energy waiting to be tapped, but elementary physical principles demand that the consumption of energy in the crystal must be balanced against the losses in the aerial and A.T.I. for maximum *effect* (not maximum *efficiency*). Therefore, to obtain maximum signals from our aerial we must balance the crystal-circuit, with its damping losses, against the aerial tuning circuit, instead of putting the former right across the particular part of the aerial circuit which happens to be included in our tuning-coil.





Details of the low-loss coil and skeleton former. The diameter given is that of the end rings, the effective diameter of the coil will, of course, be slightly smaller.



This view of the set shows clearly the appearance of the completed coil. The positions of some of the tappings and the air spacing may also be seen.

Need for a Crystal Tapping

A proportional tapping-device is therefore demanded, whereby the energy-absorbing crystal-phone circuit can be put across any desired proportion of the tuning-inductance. What proportion should be included is the subject of simple experiment. Elaborate calculations can be made, on certain assumptions, which may be true for a brief period for one setting of the crystal and for one particular condition of the aerial; but a change of crystals or 'phones will completely upset the conditions. Accordingly a variable tapping device must be incorporated for adjusting the crystal load to the conditions of the moment.

Critical Adjustment Unnecessary

Fortunately, with direct coupling to the aerial, the position of this tapping-point does not prove to be extremely critical, so that although at first the writer attempted to make provision for

tapping single turns, experiment showed that a tapping-point every five turns gave sensibly as good results, with considerable gain in simplicity. It must be clearly understood that an appreciable improvement in signal-strength through the use of this variable crystal-tapping is only to be expected with a really low-loss tuning inductance, and with aerial and earth equipment of fair efficiency.

The Actual Receiver

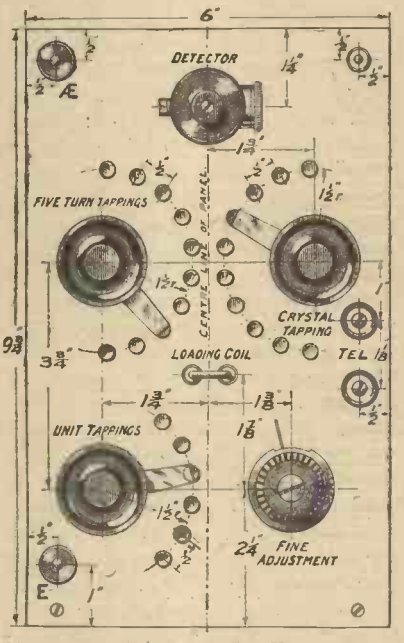
The practical design which is given in these notes as an illustration of the way in which these requirements can be met, incorporates a low-loss inductance of a type which shows the optimum inductance-resistance ratio on the broadcast frequencies (*Wireless Weekly*, Vol. 6, No. 4, p. 121) of No. 18 enamel-insulated wire wound on a large diameter skeleton former, in this instrument on one supplied by Messrs. Precision Screw Co., Ltd. The tubular members of the frame have a coarse screw thread cut on them, which greatly facilitates the spacing of the wire at the correct intervals (about 16 to the inch). Fifty-five turns in all are wound on, with this approximate spacing, the former being made 6 in. long so as to have the end-rings away from the magnetic field. Tappings are made every turn for five turns at the lower (earth) end; then every five turns up to the 50th. A six-point switch selects the earthing-point and thus provides fine tuning; most crystal-set users will be surprised to notice that in addition a fine-tuning condenser is needed, of .0001 μF capacity, standard type, and that furthermore this condenser is fitted with a $3\frac{1}{2}:1$ geared control, for still finer adjustment. This is actually desirable, so fine becomes the tuning with the proportional crystal-tapping device in use.

The Detector

Two ten-way tapping switches are provided for coarse tuning, and for the crystal-tap respectively. An automatic crystal-detector is suggested, so that in operation the attention can be concentrated on fine tuning, etc., rather than on the mere action of setting a crystal by hand: the finding of a good spot is a lottery in any case, and might as well be performed mechanically. It appears seldom to be realised that the very action of setting the whisker may spoil that particular

The majority of the tappings are confined to the panel side of the coil.

spot for further use, and that the life of any one surface of the ordinary "——ite" galena crystal in constant use is often to be measured in days, if real efficiency be desired.



The panel layout, with all necessary dimensions.

A 'phone blocking-condenser is shown, of .002 μF capacity; careful measurement in circuits of this type shows a small increase in efficiency due to this. When using a microammeter or Weston galvanometer, etc., for actually measuring the signals, as must be done in any work of scientific significance, it is well to shunt this with a 2 μF Mansbridge condenser.

Mode of Mounting

Serious losses are incurred if the large tuning inductance is boxed up in a small cabinet of such a bad dielectric as damp wood. The instrument is actually assembled behind a vertical panel, in American fashion, with base-board attached, so that it can, if desired, be slipped into a cabinet; this should be arranged so as to leave plenty of space around the tuning-coil for the reason indicated. The coil-former is screwed to the base-board; all other parts are mounted on the panel itself.

The Coil Tappings

The 16 tappings to the coil are made by scraping off a little of the enamel insulation, after slightly raising the particular wire, and (after tinning the wire) soldering on a short length of square tinned bus-wire; this is subsequently joined to a similar piece soldered to the back-stud of the corresponding stud on the panel, the wires being bent so as to facilitate this and to reduce mutual capacities. The electric soldering device of Messrs. Quality Radio proved extremely useful in making these tapping connections, some of which were not very accessible with the ordinary soldering bit. The taps are made in two diagonal rows around one-third of the circumference of the coil.

Provision for Chelmsford

An additional small terminal was fitted, in the top right corner of the panel, and connected to the crystal-tapping switch, for use in certain experimental work with valves, after withdrawing the crystal detector. The wiring diagram and views give full constructional details. A loading coil plug is provided, as usual, for receiving the high-powered station. As but a small tuning-range is provided by the variable condenser, the tapping-switches are used to adjust the whole inductance, with a No. 150 or 200 coil (according to aerial characteristics) inserted in place of the shorting plug, for this purpose.

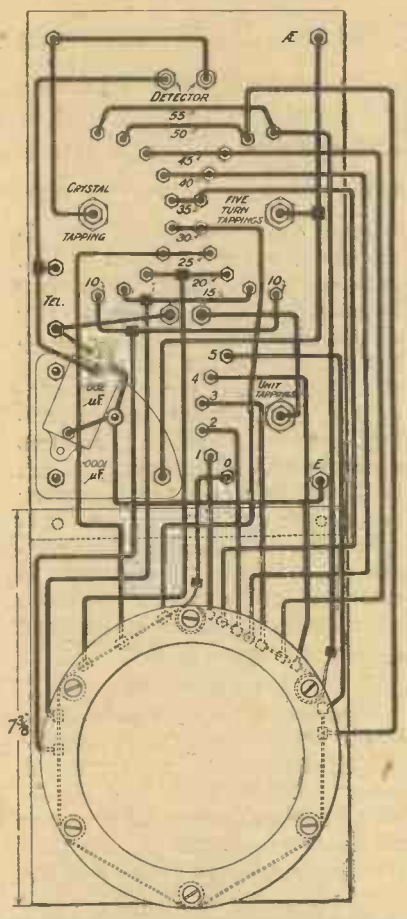
Other ranges can be obtained by the use of corresponding plug-in coils. The variable crystal-tapping appears to have but little favourable effect on the longer waves.

Low Resistance Aerial Required

It must be emphasised again that the full effect of low-loss inductances and proportional crystal-tapping will only be observed in conjunction with an aerial-earth system of low resistance. Repeated measurements on three P.M.G. aerials of fair design and with a good direct water-pipe earth, or counterpoise respectively, showed an increase of signal-strength, over a pretty efficient thick-wire variometer tuner in a conventional circuit, of up to nearly 100 per cent., when the optimum tapping-point had been found. Thus on a single 80 feet aerial, about 20 feet high and fairly isolated, about 13 miles from 2LO, with 4,000 ohm 'phones in series with the micro-ammeter, the signal-strength (at a time when full power was apparently not in use) was 24 microamperes with the crystal and aerial-earth both across 27 turns; 18 microamperes with the crystal across the whole inductance (auto-transformer fashion), and 31 to 33 microamperes with the crystal across 12 turns only: all with critical tuning. With three-wire counterpoise and the crystal across 7 turns, 27 microamperes were recorded. With a .0007 μF series condenser and counterpoise, the best, with 10 crystal turns, was 20 microamperes; with good water-pipe earth and .0007 μF series condenser, 27-28 microamperes with 15 turns, and with about .0005 μF series condenser 26 microamperes with 15 turns respectively, as against (now) 30 microamperes with direct connection: exhibiting the loss with a series tuning condenser.

Effect with Larger Aerial

The effect of the proportional tapping was more marked with a large high (40 feet) three-wire sausage aerial, 70 feet long, at the same point; with counterpoise, and with both crystal and aerial-counterpoise across 25 turns, the rectified current was 77 microamperes; with crystal across the whole 55 turns, only 49 microamperes; and across 10 turns, 120 microamperes. With direct earth, the figures were 106, 77, and 112 microamperes respectively (the last with 13 turns in use out of 18).



The wiring diagram must be followed with great care to prevent possibility of error.

A further useful view of the receiver.

Further Figures

On another occasion, when 2LO was at full power, the big aerial with counterpoise gave 182 microamperes with 4,000 ohm 'phones in use, 330 microamperes with a choke-capacity-coupled loud-speaker, and ½ milliampere directly on an ordinary Pye 0-5 milliameter with a 2 microfarad blocking condenser across it, at 13 miles.

Long Distance Reception

Some patient observation on the same high aerial on other wavelengths emphasised what has often been pointed out in connection with claims for long-distance crystal reception: that they generally involve some special conditions. A stony silence rewarded one for the most time, when listening on this high aerial and efficient receiver, with sensitive crystal and with a wave-meter to assist in tuning, except for an occasional rustle of atmospherics or a squeak of Morse from GNF, etc. Then once late at night, on a "good" night, Aberdeen came in during the late transmission after the other B.B.C. stations had ceased, clearly audible for some time; whilst Madrid is a fairly safe catch any *favourable* night.

Operating

The method of tuning is fairly obvious: with the crystal set across the whole inductance, first the coarse adjustment (by 5 turns) is made with the top left-hand switch, then fine adjustment by the unit (lower left-hand) switch; the optimum crystal-tapping is then sought with the top right-hand switch, following up with the fine-tuning condenser, and, if necessary, correcting on the unit switch so as to have as little of the tuning-condenser in use as possible. A buzzer to set the crystal is invaluable; really accurate tuning is best done on a microammeter in series with the 'phones.

A Transmitter for Forty Metres

By WILLIAM H. SCHICK (U2MU).

In view of the interest taken in short wave transmission, the following contribution will be found of considerable practical value, since the necessary coil and condenser values are given.

MANY months ago some new short wave bands were allotted to American amateurs, and most experimenters in the United States have taken advantage of the 75-metre band and are doing remarkable long distance transmission, considering the power they use.

However, very few have taken advantage of the 40- and 20-metre bands, and the result is that the interference is becoming unbearable on 75 metres. There seems to be an impression among the amateurs that it is a hard problem to get a transmitter working on 40 or 20 metres, but this is not the case. With a little care and forethought, it is possible to cover these bands as easily as it is to work the 75-metre band.

Herewith is a description of my 40-metre transmitter, which will also work on 20 metres. The oscillatory circuit is the old standby, the loose-coupled Hartley circuit.

The Oscillator Inductance

The oscillator inductance consists of seven turns of edgewise wound copper strip 4½ in. in diameter, air spaced ⅝-in. between turns. This inductance is held firmly by means of two slotted dry wood strips, one on top and one on the bottom of the coil. The oscillator tuning condenser is a .00025 μF receiving condenser which has two separate sets of stationary plates insulated from one another and two sets of rotor plates. It is commonly known as a dual condenser. This condenser is mounted on a small porcelain cone insulator which is fastened to the top wood strip.

The Condenser

However, it is connected in the circuit in a manner not usually practised by most amateurs. A series connection is used. By that I mean that one set of stator plates is connected to the grid side of the oscillator coil and the other set goes to the plate side of the inductance. The rotary plates are not connected in the circuit at all, but turning the rotor plates in and out changes the capacity nevertheless. The .00025 μF condenser, when connected in this manner, has a maximum capacity of .000125 μF, and it will stand very high voltages without breaking down. For the grid-leak I use a standard 5,000-ohm grid resistance. Both grid and plate condensers are of fixed capacity of .002 μF high voltage type.

Radio Choke

The radio frequency choke which I use in the plate circuit is much smaller than the average choke in that it has only 15 turns of No. 24 d.c.c. wire on a 4-in. cardboard tube, but this choke has been helpful in getting the oscillator to work on the extremely short waves. Across each side of the centre filament tap there is a 1 μF condenser.

Connections

All connections are made in the usual manner according to the circuit diagram, but it is important to keep all leads short and make them rigid, for if they swing back and forth the signals will be wobbly.

Tuning

Before you start to tune the oscillator, it is very important

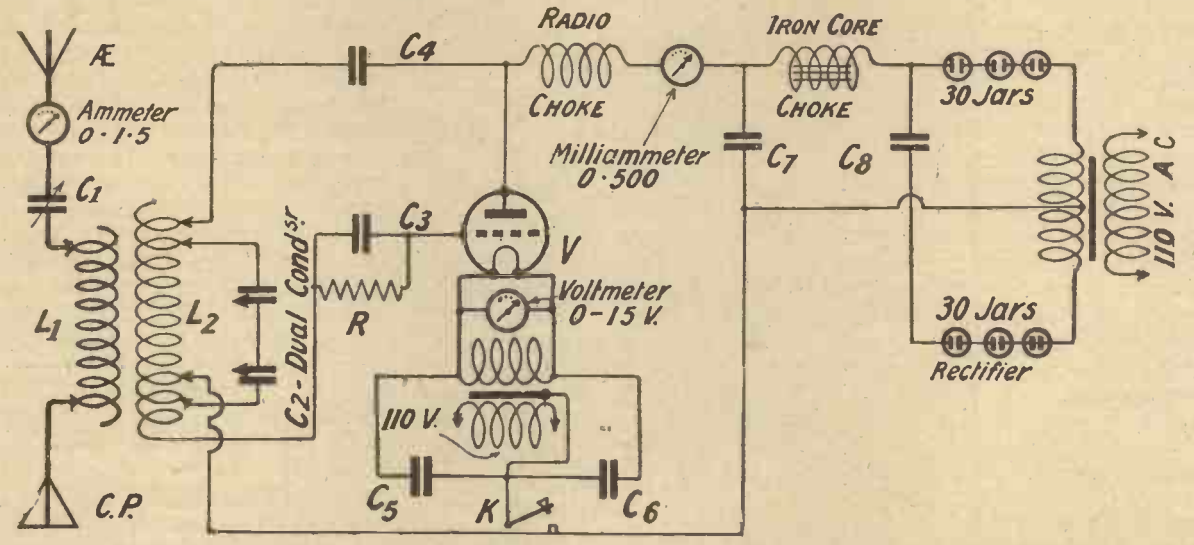


Fig. 1.—The loose-coupled Hartley arrangement as used by the author for short wave transmission work. The condenser C_2 is a double condenser similar to those commonly used in this country in receiving circuits.

to have a wavemeter handy that will cover the 40-metre band.

Connect a heavy lead from one set of stator plates of the balanced condenser to one end of the inductance and make another connection from the other set of stator plates to the other end of the inductance. The plate lead is connected directly to one end of the coil and the grid lead to the other end. All variable leads are shown in the diagram with arrows, and these leads should all have clips so that variations can be made easily. A good method of making these clips is to use the jaws of some old switches fitted with an ebonite-capped terminal as shown in Fig. 3.

Adjustments

The negative high-tension lead is clipped on about two turns above the grid lead. This connection is critical, but you will find the best adjustment about two to three turns above the grid lead. Now turn the rotor plates to full capacity, and if everything is working properly, your wavelength will be approximately 40 metres. The valve should not heat up at all if the circuit is oscillating properly, but if it does heat badly, try adjusting the negative high-tension lead.

When you are sure the oscillator is tuned to 40 metres, you are ready to couple the aerial to the oscillator. The aerial coil consists of 7 turns of edgewise wound copper strip 6½ in. in diameter and is mounted on wood strips the same as the oscillator coil. The spacing between these turns can be ½ in.

The Aerial Condenser

Now mount a .0005 μF condenser on the top of the aerial coil frame in the same manner as the oscillator condenser. Connect one side of this condenser (C1) to the ammeter, the other side going to one end of the coupling coil. The counterpoise lead is connected directly to the other end of this coil. The aerial side of the coupling coil is placed nearest the plate end of the oscillator coil. There should be from 2 to 4 in. coupling between the two coils for the signals may have a tendency to be unsteady if the coils are closer than this.

Operating

Start the oscillator going by pressing the key in the usual manner and start turning the aerial series condenser from zero up, and as the aerial comes in resonance with the oscillator you will notice that the anode current of the valve will begin to increase until the condenser comes to a point where it will fall again. This shows that you have passed resonance. Begin over again but

Fig. 2.—The type of aerial insulator used by the author.

do not pass this point, and by watching the milliammeter and aerial ammeter, you can soon tell when you have the best adjustment. Press the key a number of times and see if the meter reads the same, for sometimes when the set is not tuned properly, the aerial current will vary each time the key is pressed and your signals will not be steady.

You are now ready for work, but before going further I will mention a few words about aerials for short waves. For 40-

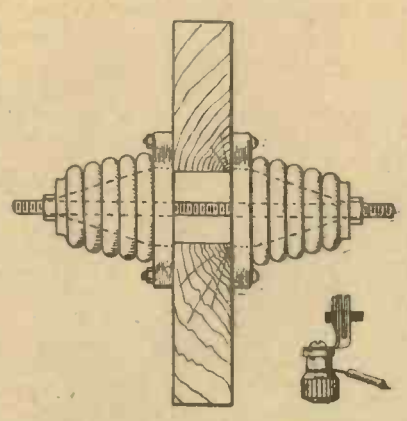


Fig. 3.—An easily constructed leading-in tube suggested by the author. The clip referred to may be seen in the bottom right-hand corner.

metre work do not use a large aerial because it is difficult to tune to resonance.

Aerial Hints

Do not use an aerial with a fundamental over 60 or 70 metres. I have found from experience that a single wire aerial and a single wire counterpoise or even a small cage counterpoise works best. It seems that a single wire aerial is not affected by surrounding objects as much as the twin-wire type. Try a single wire about 40 to 50 feet long; that is, from the free end to the apparatus and a single wire counterpoise the same length and about 5 feet above the earth. If you cannot tune to resonance, cut down the length until you can. No rules can be given for the proper size, as the fundamental of the aerial will vary in different localities due to surrounding objects.

Insulators

For insulators, use glass towel racks which can be purchased quite cheaply in almost any hardware store. The method of connecting them is shown in Fig. 2.

The aerial and counterpoise lead-in wires are brought to small porcelain cone insulators, of the same type as is used to mount the condensers, and are fastened to a board on the window sill.

Daylight Transmissions

The 40-metre band is a very good one for daylight transmission, and this may interest us now that the days are getting longer. Stations 700 miles away can be worked consistently at noon. It was the general impression among many amateurs that 40-metre transmission was useless after darkness, but this has been proved untrue for this station. However, about one hour after sunset in Brooklyn it is impossible to hear stations in New England, while stations 800 to 1,200 miles west are easily readable. My best distance west was U6TS at Santa Monica, Calif., which was, I believe, the first time two amateurs on either side of the country were in communication on 40 metres. This is now being done every day. Every United States district has been worked on 40 metres with this set, and in almost every instance it was daylight at the other end. U6TS was worked three hours after sunset in Brooklyn which meant sunset in California, but after working for about one hour and a half his signals faded away and I understand that mine did the same. I have heard 40-metre signals from

stations 1,200 miles away as late as 6 hours after sunset here, which shows that 40-metre transmission is not entirely killed by darkness. It may be that we will be able to work great distances, say, 5,000 to 10,000 miles, when the sun is about halfway between the two stations.

Aerial Location

My aerial is located on the roof of a three-story brick building 40 feet high, the poles being 18 feet high. The aerial consists of a single wire No. 14 enamelled, 50 feet long with a lead-in taken from the centre and brought down 35 feet to a window on the second floor. The counterpoise is a single 2-in. cage of four wires only 18 feet long and the lead-in of the same type brought up to the window. The whole counterpoise and part of the lead-in of the aerial is surrounded on all sides by the building. The counterpoise happens to be in a small courtyard 20 by 20 feet.

Aerial Current

The roof is covered with tin and there is a metal skylight about 10 feet high running parallel with the flat top about 4 feet away. So you can readily see what can be done on the short waves with a poor aerial. The aerial current on 40 metres is only 1/10 of an ampere with an input of 95 watts. With this circuit and aerial but operating on 77 metres, using a separate set of inductances consisting of 12 turns each and 6 in. in diameter with the same type condensers as described for 40-metre work, I have been in communication with 60 West Coast stations, England, France, Holland and Italy, and have been heard in almost every European country. Brazil has also been worked on 77 metres.

Interchangeable Inductances

If you wish to work both the 75-metre and 40-metre band, it would be a good idea to mount both sets of inductances on small baseboards, so that they can be interchanged quickly, the only connections being made are the grid, plate, negative high-tension, C1 aerial and counterpoise. I use clips on these five connections so that it is possible for me to change from 75 to 40 metres within less than a minute.

By tuning the oscillator down lower and making a smaller aerial, you can work the 20-metre band. This is a daylight band only. At this station I have worked stations 1,200 miles away at noon on 20.5 metres, which certainly is good long-distance work when compared with that done on the old 150-metre wavelength.

THE FOREIGN RADIO TIMES.

Readers will notice that we are no longer continuing the publication of our Foreign Programme Supplement. This step has been taken because the British Broadcasting Company are proposing to publish foreign programmes themselves, and we feel that no useful purpose would be served by duplicating the information. Having acted as pioneers in this matter, we leave the continuation to others and propose to devote the space hitherto taken by the programmes to technical articles.

MR. HARRIS' TOUR.

Arriving in New York. The first photograph of Mr. Harris after the "Berengaria" reached port. The original description of this portrait supplied by the American Photographic Agency alluded to him as "known over the world as the best radio announcer!"

Comparing . . . . . . Earth Connections

By G. P. KENDALL, B.Sc., Staff Editor.

An article intended for the less experienced experimenter, showing how simple methods of testing can be applied to the comparison of alternative earth connections.

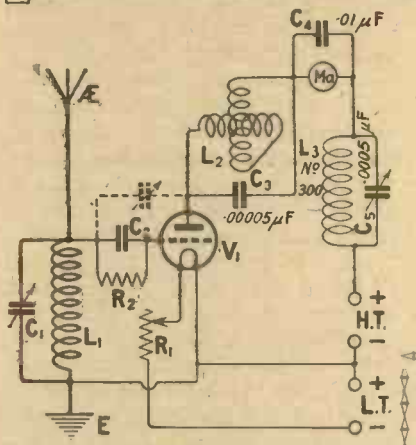


Fig. 1.—A simple circuit for comparing the "reaction demands" of different earths.

BEFORE commencing upon the subject-matter of these notes, it should perhaps be explained that they are intended rather for the comparative beginner than for the advanced experimenter. The experimental methods which we shall be considering will all be quite simple, involving the use of very little apparatus, such appliances as are required being most probably already in the possession of anyone who is embarking upon even the simplest wireless experimental work. To the more advanced reader, the methods which we shall be considering may perhaps prove interesting as a basis for more elaborate work.

Good and Bad Earths

Now, the reader who has reached the stage when I hope these notes will be of use to him will no doubt be aware that the quality of his earth connection is a matter of great importance to the results he will obtain with a given receiving set, and he will no doubt have received many injunctions to acquire the best earth possible under his particular conditions. In most situations it is possible to install quite a variety of different earth connections, such as buried plates, buried wires, rods or pipes driven vertically into the ground, leads to waterpipes and so on, but some difficulty arises when we come to try and discriminate between the various possible arrangements as to which will give the best results.

Certain general rules can be adopted for our guidance, such as those which require that the earth lead itself shall be relatively short and of fairly thick wire, whilst the earth connection shall present a large surface of conductive material to damp soil, and that this earth connection itself shall be somewhere, if possible, beneath the aerial.

Comparing Earths

We are still, however, left with such questions to decide as whether a buried biscuit-tin connection will be better than a lead to a waterpipe, or whether buried wires will give better results than either of these arrangements, and the actual installing of the earth and testing of the resulting connection is the only way of settling such questions decisively, and since very little expense is involved in such experiments, and their results are often decidedly interesting in themselves, it is proposed to give a few simple methods by which one can come to definite conclusions regarding any given earth connection.

Resistance

The main characteristic of an earth connection in which we are interested is the resistance which it opposes to the flow of high-frequency oscillations into the surrounding soil; the high-frequency resistance of an earth connection is by no means to be confused with its ordinary direct current resistance, which may be of a totally different order, and therefore it is no very easy matter to measure or even to estimate this particular property of an earth, and we are driven to adopt somewhat indirect methods if our apparatus is to remain simple.

The resistance of the earth connection is one of the properties of a receiving system which has a marked effect on sharpness of tuning, and if we can devise some method of estimating the selectivity which is obtained with different earth connections we shall have provided ourselves with a rough and ready means of comparing their merits.

Measurements

Quite a convenient method may be found in the plotting of resonance curves with the aid of the Moullin voltmeter method of signal-strength estimation. Considerations of space prevent my explaining this method of estimation in detail, and I must refer readers to recent issues (*Wireless Weekly*, Vol. 5, Nos. 12 and 13) in which the necessary information has been given, and content myself with a brief outline of the procedure to be adopted in actually plotting such a curve. Assuming that the experimenter is in possession of two alternative

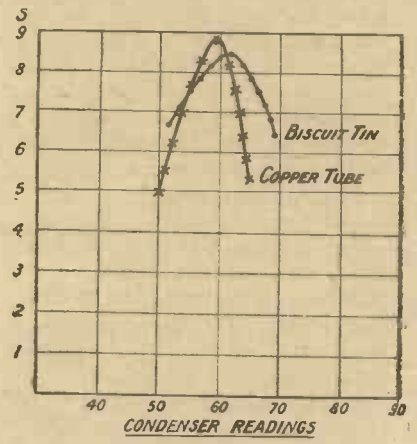


Fig. 2.—The resonance curves given by the two earth connections used by the author in his first series of tests.

earth connections which he desires to compare by this method, the procedure will be as follows: Connect the Moullin voltmeter circuit across a circuit which is capable of being tuned to the

wavelength of the local transmission, and attach to this the aerial lead and a lead from one of the earth connections. With the tuning condenser in the parallel position, the local transmission is now tuned in, and the exact reading of the condenser noted, which produces the greatest signal strength as recorded by the milliammeter in the plate circuit of the Moullin valve. The signal strength and condenser reading are recorded, then the circuit is de-tuned one degree first to one side and then to the other of the true resonance point, and the signal strength again recorded.

Resonance Curves

Progressive de-tuning a single degree at a time, recording each condenser reading and equivalent signal strength, are then continued until figures are obtained on each side of the true resonance point, showing that signal strength has fallen to, perhaps, a half or one-third of the maximum value. A resonance curve can then be plotted, upon which the condenser dial reading is marked horizontally and the equivalent signal strength vertically, as indicated in Fig. 2.

The other earth connection is then substituted for the original one, and the test is repeated, a second curve being plotted upon the same piece of paper. The condenser readings for maximum signals should be approximately the same as before, and one can usually see at a glance which of the two curves has the sharper peak, and this, of course, corresponds to the better of the two earth connections.

Rough Tests

An approximate method which enables one to obtain the desired information quickly and without any actual plotting of curves, is to record first the condenser reading and the maximum signal strength obtained in the full resonance position, and then to de-tune until signal strength is reduced by one-half, noting the number of degrees of de-tuning necessary to produce its reduction. The same process is then carried out with the other earth connection, and the number of degrees necessary for the one-half reduction again noted. The earth connection which requires the smaller number of degrees de-tuning for a one-half reduction of signal strength is then concluded to be the better of the two under consideration.

Results

I have used this method with success in discriminating between two available earth connections, one of which consisted of a copper tube nearly one inch in diameter and 5 feet long, driven vertically into the ground, a lead consisting of No. 14 enamelled wire 8 feet in length connecting this to the earth terminal of the receiver. The other earth connection was a large buried biscuit-tin at a depth of about 2 feet, the earth lead being identical with the one just mentioned. Of these two, the copper tube gave a markedly sharper resonance curve than the biscuit-tin. A third earth was compared with these which consisted of a lead about 20 feet in length to a water pipe, but the curve which it gave was so much flatter that this connection was not seriously considered in comparison with the others.

Another Method

An alternative method of estimating the high-frequency resistance of an earth connection may be found in the fact that when a single valve reaction circuit is used, less reaction is necessary to produce self-oscillation if the earth is of low resistance than when it is of high resistance. Thus if everything else in the circuit is maintained constant, and changes of earth connection are made, and if means of estimating the amount of reaction can be devised, it is possible to obtain quite interesting comparative figures for different earth connections. In general, of course, the decisions arrived at in this way will confirm those to which the experimenter is led by the resonance curve method, but it is interesting to determine in many cases just how far the two methods corroborate each other, and a particular attraction of the " reaction demand " method is that no expensive apparatus is needed, the fine-reading milliammeter necessary for the Moullin voltmeter arrangement being no longer required. Quite a cheap milliammeter is desirable to carry out the experiment conveniently, but at a pinch can be dispensed with and replaced by a pair of 'phones.

Apparatus

What we require to compare earth connections by noting the change in the amount of reaction necessary to produce oscillation is essentially a means of noting and recording reaction adjustments. A graduated reaction adjustment is very easily obtained by means of the circuit recently mentioned by Mr. Cowper in con-

Miss Helen Colt, founder and hon. organising secretary of the Garden League for Devastated France, recently gave a talk from 2LO, and was introduced by the French Ambassador, M. de Fleuriau. They are seen above before the microphone in the London studio.

sidering the high-frequency resistance of coils, in which he obtained the necessary control of reaction by placing in series with the valve anode circuit a large plug-in coil, which is shunted by a variable condenser. Between this arrangement and the anode of the valve there is some device for producing reaction, Mr. Cowper recommending a large variometer shunted by a small condenser, forming a circuit tuned to the wavelength being received, so that the whole arrangement would normally oscillate under certain conditions, provided that there was no checking device in the nature of the shunted choke coil in the anode circuit to which we have already referred.

Method Employed

With such an arrangement, when the variable condenser across the No. 300 coil is set at its maximum value, the circuit will oscillate, provided that the damping of the grid circuit of the valve is really low, and when this condenser is reduced towards its minimum value self-oscillation will cease. Mr. Cowper has found that with this arrangement the alteration of condenser reading which is necessary to produce self-oscillation when circuits of different high-frequency resistances are connected to the grid and filament of the valve bears a direct relation to the high-frequency resistance in question. Thus, the reading of the condenser which shunts the large choke coil can be taken as a measure of the high-frequency resistance of, say, the earth connection which is used with the circuit, and we have here a very ready means of comparing different earths. It is considerably quicker to use than the resonance curve arrangement, and is thus very convenient when quite a considerable number of earths are to be compared.

Reaction Control

A limitation of this particular circuit arrangement is to be found in the fact that unless the damping of the grid circuit of the valve is really low self-oscillation will not result unless a valve of special type is used, and even then difficulty may be experienced. It is therefore best not to rely upon the natural reaction produced through the inter-electrode-capacity of the valve, but to incorporate some more positive arrangement for producing quite strong reaction effects, such as the reaction condenser shown dotted in Fig. 1.

The Reaction Condenser

This condenser should be of .0003 μF capacity under average conditions, and it will probably be found that it will produce self-oscillation at quite a low dial reading. The variometer should be a large one, so that the capacity of the fixed condenser in parallel with it may be kept low. My own variometer was a particularly large one, and the parallel condenser was therefore of .00005 μF (one of the small air-dielectric type made by Messrs. Ormond).

If you use a smaller instrument the fixed condenser will require to be larger, and values up to .0003 μF may be needed. In such cases the setting of the condenser shown dotted will usually have to be increased to produce self-oscillation, and if the experimenter does not possess a variometer of really adequate size, it will probably be better to adopt some other method of producing reaction.

For example, the variometer can be replaced by an ordinary plug-in coil, say a No. 50 or 75, with a variable condenser of .0003 μF capacity, instead of the small fixed one as shown in the diagram, and it will be found that if this coil is lightly coupled to the aerial coil, and the tuning of the anode circuit varied, a position will be found at which the set breaks into oscillation, over quite a narrow band of tuning. This indicates that aerial and anode circuits are in tune, and coupling should be arranged so that self-oscillation takes place over only a few degrees of the anode condenser scale, when the condenser across the large choke coil is set to a reading of perhaps 90 deg.

Although a tuning condenser is shown in the aerial circuit in Fig. 1 this is not actually essential, and the tests can be carried out fairly satisfactorily without one. Simply use a No. 35 or 50 coil in the aerial circuit, and tune the anode circuit to the fixed wavelength thereby produced,

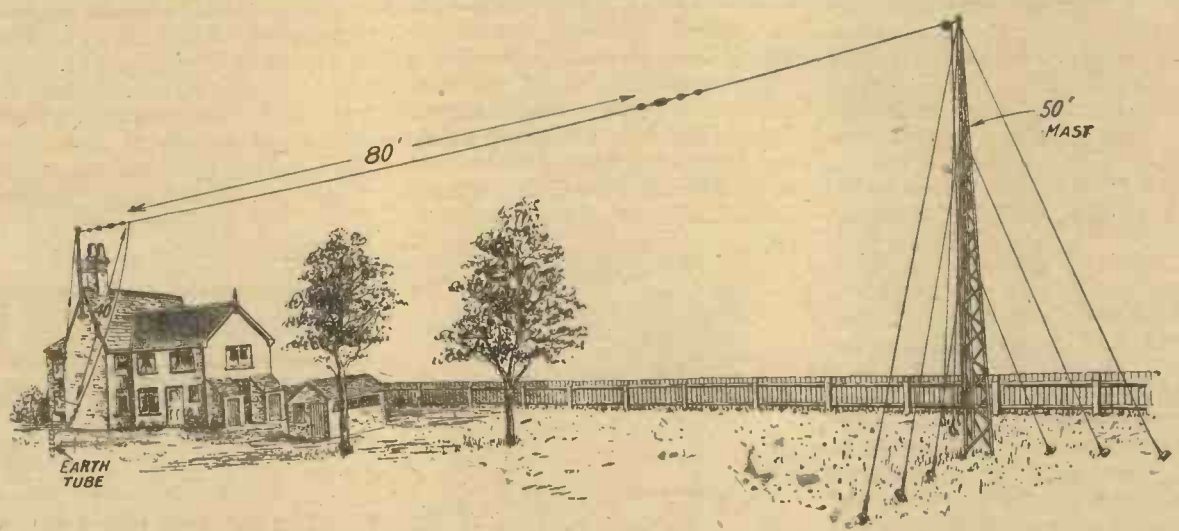


Fig. 3.—Mr. Kendall's usual arrangement of aerial and earth. The biscuit tin which he mentions was buried close beside the earth tube shown here.

and carry out all your tests upon this same wavelength. You may find that a slight alteration in anode tuning is necessary when changing the earth connection, but the alteration will be so slight that it will not seriously affect the accuracy of the results, if the anode condenser is carefully re-adjusted each time the earth is changed.

Depth of Earth Tube

I have used this method to settle the question of the depth to which it is necessary to drive a vertical earth tube in my particular locality, with decidedly interesting results, the tube being the one already referred to, which is made of copper a little under one inch diameter, and about 5 feet long. To one end of this a length of No. 14 gauge enamelled wire was soldered, the resulting earth lead being about 8 feet in length. The tube was gradually driven into the ground, observations being made by the circuit just described as this was being done. For the first 12 inches the earth resistance was evidently extremely high, and could not be compared with the others which we have just considered, since the circuit would not oscillate with the same arrangement of coils, high tension, etc. (It should be explained that the first 12 inches represented the penetration of the loose soil layer, which was in a somewhat dry state.) Below this, the tube began to enter moist clay, and a very few inches here reduced the earth resistance to quite a reasonable value, and when the tube had been driven to a total depth of 18 inches, which of course included only 6 inches of the clay, the reading obtained was exactly the same as that given by the biscuit tin already mentioned. A further 6 inches reduced the necessary amount of reaction very slightly, that is to say, the reading on the condenser across the large choke coil necessary just to permit self-oscillation was reduced to about 5 degrees. Driving the tube to a great depth up to the maximum of 5 feet produced no measurable improvement.

Soil

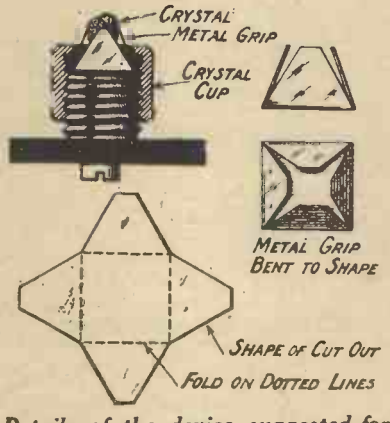
It is interesting to note that a penetration of the tube of only 6 inches into the moist clay gave results as good as those obtained with the large biscuit tin at a total depth of 2 feet, but this seems explicable on the basis of the fact that the clay into which the tube was driven was undisturbed, whereas the biscuit tin was surrounded by soil which had been disturbed and then repacked.

Tests for Oscillation

A practical point which requires a few words of explanation concerns a means of deciding whether the circuit which is being used for the test is accurately on the verge of self-oscillation or actually just oscillating. One or other of these conditions should be adopted as standard, and alterations made to the condenser C_5 controlling reaction so that the circuit is in the desired state. Probably the best arrangement is to increase the reading of the condenser until the set is just on the point of breaking into self-oscillation. The ordinary test of clicks when the aerial terminal is touched may be used, but a more positive indication is obtained by replacing the telephones with a milliammeter, as shown in the diagram. It will be found that when the set commences to oscillate the milliammeter needle will give a sudden flick to a new reading, usually a lower one than before. This is a very definite and easily recognised indication, and is preferable for accurate work; the milliammeter may be quite a cheap one.

A Device for Holding Small Crystals

MOST wireless constructors have in their possession a number of small pieces of broken crystals which cannot conveniently be fixed into existing cups excepting with the use of Wood's metal. This process, however, is not always desirable where it is intended to change the crystal from time to time. The device shown in the diagram adapts itself to the "Easyfix" type of crystal cup, or to those provided with one or more securing screws. All that is necessary is to cut out a piece of thin brass to the shape shown in the lower portion of the diagram. This is bent into shape, as indicated, by folding over along the dotted lines. The square base thus formed should be of such dimensions as to fit into the bore of the crystal cup. The metal grip is finally inserted into the cup and the crystal placed between the jaws of the grip. On screwing down the cap of the crystal cup, the crystal, however small, will be found to be held firmly in position. H. B.



Details of the device suggested for effectively gripping small pieces of crystal in the type of crystal cup illustrated.

Reception of NRRL

The signals of the cruiser *Seattle*, now in the Pacific with the American fleet, have been picked up by an American amateur in France. The call letters NRRL, which have been assigned to the short-wave station on board the cruiser had already been heard by an English amateur, Mr. J. H. Ridley.

Using a special short wave receiver with two valves, Lloyd Jaquet, U2OZ copied the signals from the cruiser for practically an hour early in the morning of May 2 in Paris.

* * *

The proposed monopoly of wireless which was part of a Bill recently presented to the Portuguese Parliament, was defeated for the time being by means of the active campaign waged against it by certain members of Parliament, and the Association of Agents of the Posts, Telegraphs, and Telephones Department.

Jottings by the way

Busy

WHEN I dropped round to see Poddleby the other night I found him very busily engaged in doing everything all at once. His coat was hanging on the back of a chair, whilst his collar was hanging on the back of his neck. Screwdrivers, pliers, soldering irons and other tools were sticking out of all his pockets, and he was assaulting the cabinet of his wireless set with a thing that looked like a jemmy. With my usual perspicacity I diagnosed almost at once that something was

. . . *Assaulting the cabinet of his wireless set* . . .

wrong. Seating myself in his best armchair I asked him to let me help him, though I was at the moment engaged in helping myself, since (a) his back was turned, (b) my cigarette case was empty, and (c) his cigarette box was full. A flood of words came from Poddleby. Do not misunderstand me. I do not mean that he was indulging in what is called language. Poddleby is naturally a rapid talker, and when he is labouring under the stress of strong emotion he gets up an extra turn of speed.

The Jemmy

I was, it appears, quite right in my original analysis of the situation. Poddleby said that his set had refused to work. I asked him why he was using a jemmy, for I myself seldom use such a weapon, unless I am in the last stage of exasperation. He assured me that it was not a jemmy, but a patent screwdriver of a particularly alluring kind. "Look here," he said. He pushed the thing in like a telescope and turned a little knob. It remained reduced to half its length. He passed it over to me, courteously presenting the hilt. I grabbed the thing and touched the little knob. The blade end flew out like an enraged Jack-in-the-box, catching Poddleby fair and square in the midriff or the brisket, or some other vulnerable spot, for he promptly doubled up and stopped talking. Meantime I was holding the thing at arm's length for fear that it should have some scurvy trick in store for me. "Really, Poddleby," I said, "I don't like your joke screwdriver at all. I have seen these things advertised in the catalogues that you get about Christmas time. I suppose that the next thing is that you will ask me to try and put in a screw with it and I shall get my face covered with soot. Or perhaps it will squirt water at me, or go off with a bang." Poddleby by this time had recovered a little. He assured me that the thing was no joke at all, but one of the greatest possible helps to wireless construction.

Poddleby Demonstrates

He insisted upon showing me precisely how it worked. Allowing it to remain extended to its full length, he touched a little catch near the handle. "Now," he said, "just watch me extract a screw without turning my hand. I simply put the screwdriver bit into the nick of the screw, push down hard, and out she comes." He placed the blade of the screwdriver in the nick of the screw. So far all was well. Turning round and beaming on me he pushed down hard. The thing flew from the head of the screw, scored a deep dent in the panel, and smashed a valve. "Poddleby," I said, when I had finished laughing, "I knew all the time that you were trying to fool me. This is one of the best joke screwdrivers that I have ever seen. Do tell me where you got it, and I will buy one at once and give it to General Blood Thunderby for a birthday present. I can just see his face when the thing shoots out and removes the lobe of one ear, or does one of

. . . *"I'll give one to General Blood Thunderby"* . . .

those priceless little skids and lays out his new set. I am quite sure that in the catalogue it says, 'Watch his face when you give it him. Raises shouts of laughter. You must have one of these.'"

I Take a Hand

Poddleby adopted a distinctly injured tone. He assured me, almost with tears in his eyes, that it was not a comic affair at all. He had merely locked the catch in the wrong position, so that when he pushed down, the thing tried to screw up instead of unscrewing, and couldn't. Hence the slip and the smash. He now pushed the catch in the opposite direction and started all over again. I looked on expectantly, waiting for the thing to squirt him with scent or say "papa," but this time there was no untoward happening. The screw was simply oozed out, and Poddleby's face became covered

with radiating smiles. He touched the catch again and pushed once more. The screw oozed in. I begged him to explain it thoroughly and to let me try. He did both. Seeking fresh worlds to conquer I attacked a screw in one of the panels of the door which separates Poddleby's den from Mrs. Poddleby's drawing-room. I gave one hearty push and the screw simply flew at me. There was a crash on the far side of the door. "Heavens, man!" cried Poddleby, "That's the screw that held the clock bracket in the next room. . . ."

Secret Broadcasting

The clock, I fear, will have to make a prolonged sojourn in the workshop of our local horologist, but we put the bracket up again without further accidents, with the aid of the screwdriver. Then I asked Poddleby once more if I could help him to locate the trouble in his receiving set. The symptoms I gathered were quite straightforward. He had switched on, and though there was no doubt that 2LO was working, not a sound of any sort came through. He had tried everything without the slightest result. The explanation I told him was perfectly simple. 2LO was quite possibly experimenting with some new secret wireless transmission. Of course, you have heard about secret wireless? Personally, I believe that quite a lot of experi-

. . . *Give a well-bred shrug of the shoulders* . . .

mental work has already been done in recent weeks at both 2LO and 5XX with this silent system. The usual break-down is not really a break-down at all. You think that a transformer has burnt out, or that there has been a holocaust of giant valves. You are entirely wrong. Secret broadcasting is in progress. In future, when a friend comes round and his set refuses to work, as it of course will, he will simply give a well-bred shrug of the shoulders and say, "I am so sorry, but silent broadcasting is in progress and I am powerless."

System

Poddleby, I regret to say, did not receive my suggestion at all well. He merely grunted and turned his back, doubtless not realising that I carried a second cigarette case, which was also empty. I begged him to be calm, explaining that when something goes wrong with the set it is system, and again system, that locates the fault. You should

. . . *Poddleby reached for the dangling leads* . . .

begin, I explained, with the high-tension battery. We began with the high-tension battery. You should go on with the accumulator. We went on with the accumulator. You should look next at the filaments of the valves. We looked at the filaments of the valves. One, of course, had no filament, owing to the screwdriver joke. We replaced that and went on looking. Next, the condensers should be examined. We examined the condensers. The inductances call next for attention. We gave the inductances attention. The wiring should be tested. We tested the wiring. Gridleaks, known to be in good order, should be substituted for those in use. We substituted the gridleaks, known to be in order, for those in use. The 'phones should next fall under suspicion. The 'phones fell under suspicion and were exonerated. We examined with the utmost care the potentiometer, the rheostats, the low-frequency transformers, the grid battery and everything else we could think of.

Solved

Then on looking round the set I noticed two terminals that seemed to be, as it were, lonely, since nothing was attached to them. I hardly liked to mention them, owing to the peppery way in which Poddleby had received my previous helpful remarks. I therefore let him go on all by himself for quite a long time before I ventured to do so. Then I gently took his hands in mine and laid the forefinger of one upon the first terminal and the forefinger of the other on the second without uttering so much as a word. With a little resigned sigh Poddleby reached for the dangling aerial lead, which he attached to the first terminal, and for the dangling earth lead, which he attached to the second. "Mr. Elihu Slumper will now give you his talk on 'How To Make Your Own Bootlaces,'" blared forth the loudspeaker. I left hurriedly, not caring to listen to the remarks either of Poddleby or of Mr. Slumper.

WIRELESS WAYFARER

Fixing the microphone in position for broadcasting the nightingale's song, from Oxted, Surrey.

The Effect of Wave Damping in Radio Direction-Finding

By R. L. SMITH-ROSE, Ph.D., M.Sc., A.M.I.E.E.

Dr. Smith-Rose has already conducted many valuable experiments in direction-finding, and in the following article we are happy to give to "Wireless Weekly" readers some of the results and conclusions he has arrived at, accruing from recent experiments to determine the reliability of continuous wave transmissions for D.F. purposes.

AT a meeting of the Wireless Section of the Institution of Electrical Engineers, held on Wednesday, June 3, with Admiral Sir Henry B. Jackson, G.C.B., K.C.V.O., F.R.S., D.Sc., M.I.E.E., in the chair, a paper was read by R. L. Smith-Rose, Ph.D., M.Sc., A.M.I.E.E., on "The Effect of Wave Damping in Radio Direction-Finding."

In his paper Dr. Smith-Rose included a summary of previous work carried out by other investigators in connection with this subject, and went on to deal with certain experimental work conducted with spark, C.W., and interrupted C.W. transmissions from the National Physical Laboratory at Teddington, with the object of obtaining definite conclusions as to the suitability and reliability of I.C.W. and C.W. transmissions for direction-finding purposes. The main substance of the paper is given below :—

In a paper* published in 1922 the author described experiments which showed how errors might arise in the use of direction-finders on continuous wave transmissions when the field from the local oscillator used for heterodyne purposes was allowed to interlink the receiving loop. The difficulties of adequately screening a valve oscillator were emphasised and the details of the design of a suitable screened oscillator were given. Oscillators of this type were employed at a number of direction-finding stations situated in Great Britain, engaged under the auspices of the Radio Research Board in the daily observation of the apparent bearings of many European transmitting stations. A large mass of data was collected during the years 1921-24, and the results of its analysis are being published in a series of official reports.†

Transmissions on long waves (2 to 9 km).—During the first year of working the observations were confined to damped-wave transmission, whereas during the second year about 80 per cent. of the total observations were made on undamped waves. The maximum variations recorded at each observing station were of the same order during the two years, and ranged from 50 deg. to 90 deg., the undamped-wave observations during the second year showing no marked difference from the damped-wave observations of the same or the previous year.

Among the relatively large mass of observations analysed in these reports, the only two transmitting stations which gave conditions approximating to the ideals mentioned above were Clifden and Karlsborg, and in Table 1 is given a summary of the whole year's observations obtained on these stations. The difference in wavelength in the case of the Karlsborg transmissions is known not to be responsible for any marked difference in the effects observed. It is seen from the table that, although in some cases, both by day and by night, the extreme errors appear to be slightly greater on undamped waves, the reverse is also true in other instances; and, particularly at night, the proportion of the errors is less on undamped than on damped waves. The actual differences tabulated are probably not significant, and the deduction is therefore made that, provided the necessary precautions are taken with the direction-finding receiving apparatus as previously described, no differ-

* R. L. SMITH-ROSE: "On the Electromagnetic Screening of a Triode Oscillator," *Proceedings of the Physical Society*, 1922, vol. 34, p. 127.

† R. L. SMITH-ROSE: "Variations of Bearings of Radio Transmitting Stations," Radio Research Board, Special Report No. 2, 1924.

THE BARCELONA STATION

The masts and aerial of the station at Barcelona, concerts from which are heard by many listeners in this country.

ence in the ordinary night variations is experienced with the use of either damped or undamped waves of lengths within the range of 2 to 6 km. It may also be pointed out that in the case of the transmissions from Karlsborg to Aberdeen and Newcastle more than three-quarters of the path of transmission was over sea, whereas from the Clifden transmitting station the major portion of the path was over land.

Transmission on shorter waves (750 *to* 1,800 *m*)—Between November, 1923, and March, 1924, a series of experiments was conducted, in which probably the closest possible approach to the ideal conditions mentioned in Section (2) was realised. For this purpose the transmitting station of the National Physical Laboratory, Teddington, was utilised, special signals being sent in turn on damped waves, interrupted continuous waves and continuous waves. The three types of transmission followed each other at regular intervals of two or three minutes, the whole cycle of transmissions being repeated every ten minutes. Two direction-finding stations were employed, at Orford and Slough respectively, and the experiments took the form of a series of simultaneous observations at the two stations over continuous periods of 24 hours at a time.

At the Slough station, distant only 11.5 miles from Teddington, no difference whatever could be detected in the bearings observed on either type of transmission by day or night. The maximum error in bearing observed throughout the whole series of tests was less than 2 deg., the great majority of the readings being correct to within 1 deg.

At Orford, distant 93 miles from Teddington, the observed bearings showed the usual effects associated with daylight and darkness. A summary of the results obtained in these tests is given in Table 2, in which no distinction is made between the day and night portions of the 24 hours.

By making an arbitrary division of the day and night periods at one hour after sunrise and one hour before sunset, the day observations are found to give a maximum error in bearing of less than 3 deg., and all the larger errors recorded above occurred during the night. It will be seen from the table that there is no obvious difference in the order of the variations experienced with either of the types of wave employed. In the last column is recorded the proportion of cases in which the signal minimum was so broad that no observation of bearing could be made. This proportion is seen to be quite an appreciable fraction of the total observations, particularly when it is remembered that the figure is considerably " diluted " by the daylight readings. While the exact percentage of readings giving such flat signal minima was found to be very variable in the different tests, it will be noted that there is a tendency for the continuous wave transmission to give a maximum proportion and for the interrupted continuous waves to give a minimum proportion of such readings.

The above tests from Teddington to Orford were carried out at a distance over land for which previous experience has shown direction-finding to be practically useless, on account of the variable errors and the ill-defined signal minima obtained. A considera-

TABLE 1.

Summary of Observations made on Transmitting Stations using both Damped and Undamped Waves.

Transmitting station.	Type of transmission and wave-length (km)*	Observing station.	Day observations.			Night observations.		
			Number.	Extreme Variation.	Percentage more than 2° from mean.	Number.	Extreme Variation.	Percentage more than 5° from mean.
				deg.	per cent.		deg.	per cent.
Clifden ..	Spark (5.8)	Aberdeen	19	3.0	0.0	35	6.8	0.0
Clifden ..	C.W. (5.8)	Aberdeen	189	5.0	2.1	573	4.1	0.0
Clifden ..	Spark (5.8)	Bristol	19	0.7	0.0	32	6.2	0.0
Clifden ..	C.W. (5.8)	Bristol	166	5.6	1.0	212	3.9	0.0
Clifden ..	Spark (5.8)	Newcastle	85	1.5	0.0	66	12.5	9.1
Clifden ..	C.W. (5.8)	Newcastle	316	2.3	0.0	594	26.0	3.4
Clifden ..	Spark (5.8)	Teddington	34	1.5	0.0	62	15.7	14.5
Clifden ..	C.W. (5.8)	Teddington	153	5.7	4.6	389	38.5	9.8
Karlsborg ..	Spark (2.5)	Aberdeen	—	—	—	259	32.3	59.5
Karlsborg ..	C.W. (3.9)	Aberdeen	436	4.8	0.9	242	34.3	9.9
Karlsborg ..	Spark (2.5)	Bangor	32	2.8	0.0	257	34.4	28.4
Karlsborg ..	C.W. (3.9)	Bangor	540	10.8	7.6	291	51.1	19.2
Karlsborg ..	Spark (2.5)	Birmingham	136	5.8	11.7	438	47.5	25.8
Karlsborg ..	C.W. (3.9)	Birmingham	104	9.3	11.6	38	7.5	0.0
Karlsborg ..	Spark (2.5)	Bristol	27	5.2	3.7	324	41.0	21.6
Karlsborg ..	C.W. (3.9)	Bristol	84	2.5	0.0	23	11.9	8.7
Karlsborg ..	Spark (2.5)	Newcastle	171	6.6	20.5	485	57.5	42.5
Karlsborg ..	C.W. (3.9)	Newcastle	503	10.5	11.3	237	55.0	16.9

* C.W. = continuous wave.

tion of all the results in Table 2, giving due weight to them in accordance with the number of complete 24-hour tests worked, tends to the deduction that the above differences in the results obtained are not very significant; the general conclusion being that all the usual types of night effect in direction-finding are equally likely to occur both with damped waves and with undamped waves, whether interrupted or not. The actual figures indicate that the type of effect known generally as broad or flat minimum is more common with undamped than with damped waves, but on account of the warning it gives to the operator this effect is not harmful in the application of direction-finding to navigation problems.

Conclusions

From careful, systematic observations carried out on various wavelengths from 750 to 6,000 m. it is concluded that the liability of wireless direction-finders to the type of errors known as "night effect" is equally great with damped and undamped waves. The special experiments were carried out with transmissions made directly over land, when it is common experience that these night-effects occur for ranges exceeding about 30 miles. Since, however, it has already been shown* that when the path of transmission is entirely over sea and free from land and coastline effects, direction-finding with damped waves is accurate enough for most navigation purposes at distances up to 80-100 miles, it is inferred that equal reliability would be obtained with undamped waves. This is in direct confirmation of some experiments† carried out by the United States Lighthouse Service with radio beacons provided with modulated continuous-wave transmitters for the use of direction-finders on board ship. Comparative tests carried out with the ordinary spark beacon transmitter showed that at various distances up to 132 miles over sea the accuracies were practically identical in each case, both by day and by night. The faith of the authorities in their results is exemplified by the fact that they are already introducing the modulated continuous-wave transmitters into their beacon stations.

TABLE 2.

Summary of Direction-Finding Observations made at Orford on Various Transmissions from Teddington. (Distance = 93 miles; true bearing = 240.6°.)

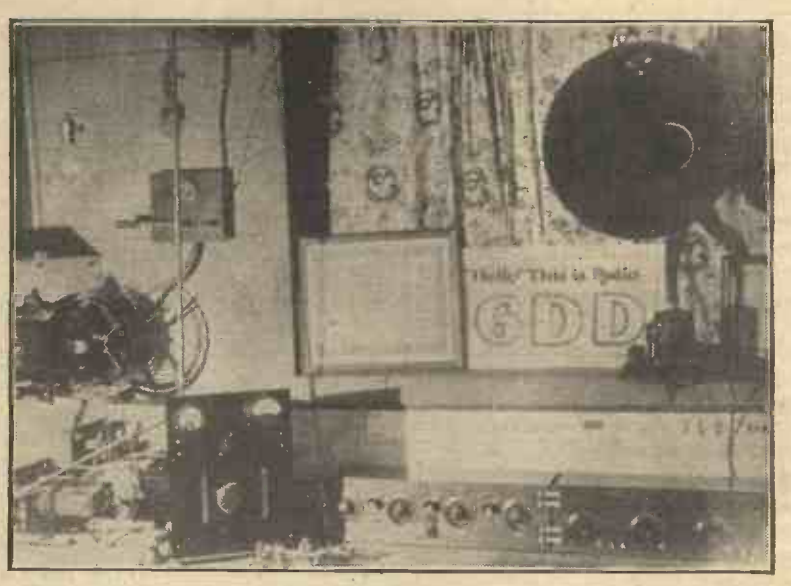
Type of transmission and wavelength (m)*	Number of 24-hour periods worked.	Extreme number of observations.	Observed bearings. Total variation.	Percentage more than 2° from mean.	Percentage more than 5° from mean.	Percentage of flat minima recorded.
			deg.			
Spark (750)	3	418	20.0	1.8	0.8	11.5
I.C.W. (750)		299	17.0	1.4	1.0	7.0
C.W. (750)		388	20.0	5.0	2.5	25.7
Spark (1,000)	1	135	0.7	—	—	17.0
I.C.W. (1,000)		110	2.2	—	—	5.5
C.W. (1,000)		138	3.0	—	—	45.6†
Spark (1,800)	2	212	6.0	2.0	—	7.6
C.W. (1,800)		167	10.0	3.8	2.9	7.2

* C.W. = continuous waves; I.C.W. = interrupted continuous waves.
† In a subsequent test on this type of transmission the flat minima recorded were less than 15 per cent.

Discussion

In opening the discussion which followed the reading of the paper, Commander Slee expressed his appreciation, and stated that as far as the navigation of ships is concerned, the use of I.C.W. at moderate distances is perfectly satisfactory, and the amount of interference when working on a wavelength of 1,000 metres with the power necessary would be small. Dr. S. H. Long considered that both I.C.W. and C.W. gave reliability up to distances of 100 miles, and described briefly a system in which a compensating device is employed at the receiving end to sharpen up the minimum. Mr. R. Keen thought that the evidence as to the relative merits of C.W. and I.C.W. transmissions in contrast with spark transmission was still quite conflicting. Major B. Binyon joined with the others in appreciation of Dr. Smith-Rose's paper, and said he favoured the use of I.C.W. for D.F. work on beacon stations and between ships, but the change from spark to modern systems must necessarily come gradually for financial reasons.

In reply to the various points raised, Dr. Smith-Rose agreed with Commander Slee's remarks in emphasising that D.F. work for navigational purposes was necessary only for distances of 50 to 100 miles, when night errors are not serious over sea. In contrast to Commander Slee's observations he had not noticed any abnormal effects as regards errors at sunset. It was generally agreed that the use of I.C.W. for reliable short distance D.F. work was perfectly satisfactory.



The apparatus at the American amateur station 6DD, belonging to Mr. Phil Keast, of Grass Valley, California.

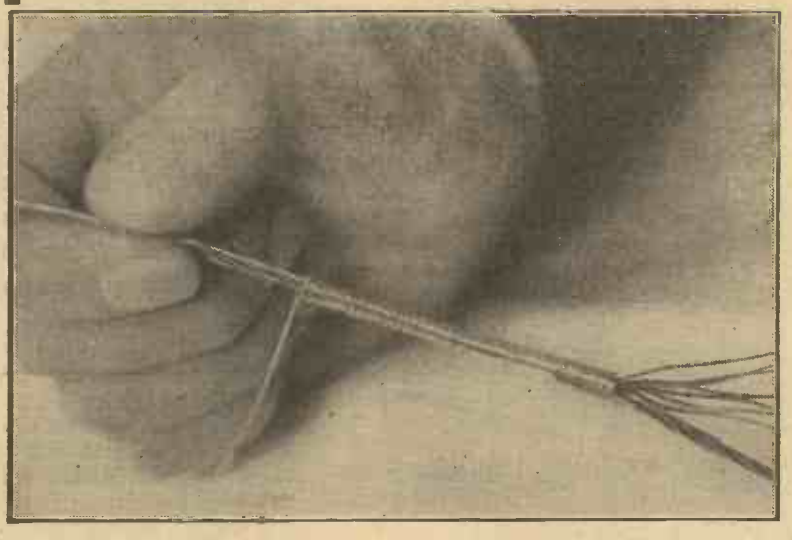
* R. L. SMITH-ROSE, "Some Radio Direction-Finding Observations on Ship and Shore Transmitting Stations," *Journal I.E.E.*, 1924, vol. 62, p. 701.

† G. R. PUTNAM: "Radio Fog Signals for the Protection of Navigation: Recent Progress," *Proceedings of the National Academy of Sciences*, 1924, vol. 10, p. 211.

Some Notes on Aerial Joins

By A. JOHNSON-RANDALL.
Staff Editor.

Some useful hints on a much-neglected subject.



This photograph shows two pieces of aerial wire in the process of being joined together.

IT would appear that the average listener is somewhat hazy as to the best method to employ when making joins in his aerial system. The problem is apparently too great for some amateurs, particularly in those cases when a join has to be made in the horizontal portion of the aerial in tension. To be efficient the join must fulfil two conditions :—

(1) It must be mechanically sound.

(2) The electrical resistance must be a minimum.

The General Method

It has been stated by some writers in the past that wires in tension should not be soldered owing to the detrimental effect of the heat necessary to ensure a good joint. For this reason the novice is usually advised to clean carefully the two ends to be joined, after separating the strands if stranded wire is used, and then to bind the ends tightly together, protecting the completed join from oxidation by a layer or two of insulating tape. While it is perfectly true that the strength of the wire is impaired by the application of heat, I have personally found that in practice oxidation does take place after a few months have elapsed owing to the fact that insulating tape does not retain its protecting properties when exposed to the elements for any appreciable period. If, as is so often the case, the aerial system is not overhauled at regular intervals, its resistance becomes considerable, and the general efficiency of the receiver as a whole falls off much to the mystification of the owner. How, then, may we overcome this? Probably the best method of all, especially in cases where the strain on the wire may be considerable, is that frequently used commercially. The two wires to be joined are taken round heart-shaped thimbles and seized with No. 20 soft copper wire, the seizing being soldered.

An Elaborate Join

The two ends of the wire are left free for a distance of about 4 in., and the thimbles are connected together by means of a galvanised iron shackle. The two loose ends of the wire are now bound tightly together, and soldered, after which the soldered joint is given a thick coat of enamel or paint to protect the joint from corrosion. It will be obvious that by this method all strain is taken from the joint itself. My own opinion, however, is that the strain on the ordinary P.M.G. type of aerial possessed by the average amateur and under normal conditions, is not sufficient to warrant these rather elaborate precautions. It has been estimated that the maximum tension in the horizontal portion of an ordinary single wire broadcast listener's aerial in this country is not likely to exceed 50 lbs., and as the most commonly used aerial wire is 7/22 hard-drawn copper a very substantial factor of safety is ensured. Bearing this in mind it would seem that the slight loss in strength of the wire due to the application of heat to the joint when soldering would be more than compensated for by the large factor of safety possessed by the adequate gauge of wire used. I have found this to be borne out in practice, and I feel sure that the amateur will find the following method to be the best to adopt. Clean the two ends of the wire to be joined, and after first separating the strands for a few inches from either end, twist the two wires half a turn and then bind the strands tightly together. Make sure that the join is strong mechanically by pulling on one wire after securing the other to a rigid support. Then lay on a single layer of thin soft copper seizing wire and run solder into the join, using a plentiful supply of soldering paste or, preferably, resin. Wash off any excess of flux, and cover the join with a protecting agent such as tar or enamel. Properly made a join carried out in this manner will remain good indefinitely.

A Satisfactory Method

Another method which is very satisfactory, but perhaps a little more difficult, is to proceed as follows. First untwist the strands and straighten each one by pulling with a pair of pliers. Place the two ends together so that the separated strands overlap beyond the untwisted portion of the wires, and turn out one strand near the centre of the intended join at right angles. Bind

(*Concluded on page* 301.)

A TWO-VALVE

By D. J. S.

In this contribution the incorporating an efficient conjunction with a select This instrument makes distant stations without i nearb

Note how the controls of the complete receiver are all placed in accessible positions for convenient manipulation.

MANY excellent designs for two-valve receivers, all of which have their special points, have from time to time been published, but no apology is offered in presenting yet another, in which are incorporated several new features to enable the set to be used successfully for the reception of the more distant stations without any interference, even from a powerful local station.

Careful Tuning Required

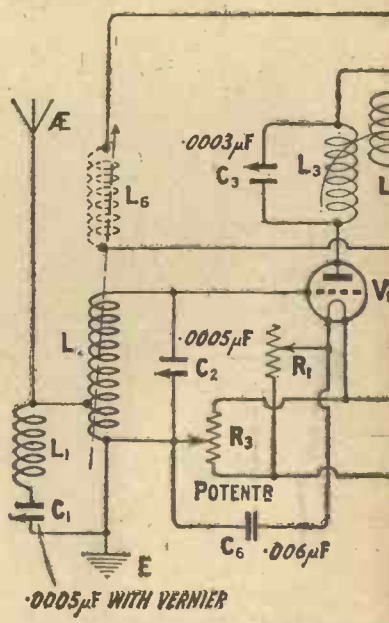
This receiver will perhaps be of more interest to the xperimenter and to those who have patience enough to spend a little time in careful adjustment of the various controls to obtain the best results than to those who are content to obtain an average sort of result in the shortest possible time and with the minimum amount of tuning adjustments.

Loud results are not to be expected from the more distant stations, but more particularly clear and moderately loud telephone reception, even when the set is operated during the transmission from a main broadcasting station situated within, say, ten miles of the receiving aerial, for such a transmission can be completely eliminated with the aid of the wavetrap which is embodied in the set.

The Circuit

Reference to the circuit diagram will show that a stage of transformer - coupled high - frequency amplification, followed by a detector valve, is employed. This high-frequency stage is of interest in that the new McMichael H.F. reactor is used. This consists of an adaptor which can be fitted to an H.F. transformer of the same make to enable a coil wound in slots on an ebonite rod to be inserted into or withdrawn from the hole in the barrel of the transformer. The whole device slides up and down upon two rods provided with the instrument. These two rods are simply fixed into the two tapped holes at the top of the transformer, after the two screws have been withdrawn. Two flexible leads from the instrument, terminating in spade tags, serve to make the connections to the coil.

This coil is connected in the anode circuit of the detector valve, and gives a reaction effect when coupled to the windings of the H.F. trans-

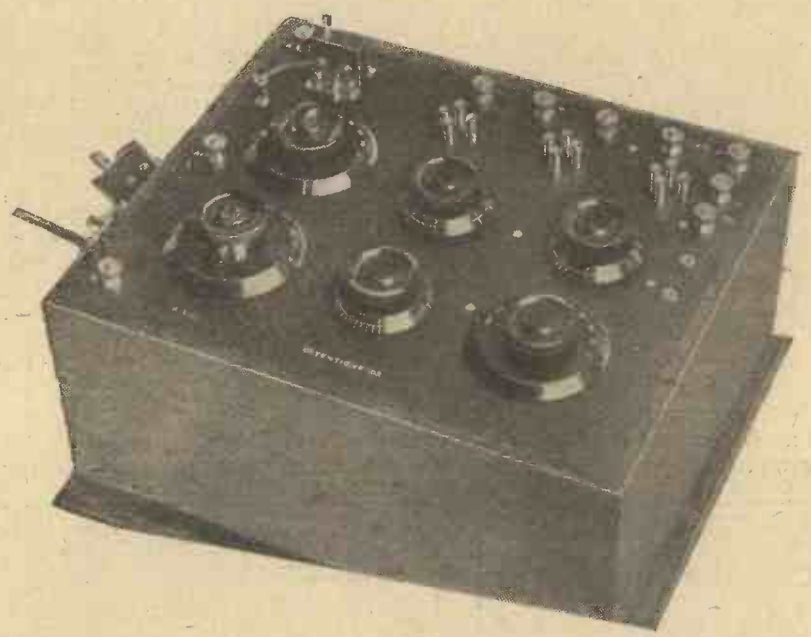


In this circuit diagram of the rece condensers are indicated with arro L5 and L6 may

WAVETRAP SET

HARTT, B.Sc.

author describes a receiver t type of wavetrap, used in ive form of aerial coupling. possible the reception of nterference from a powerful y station.

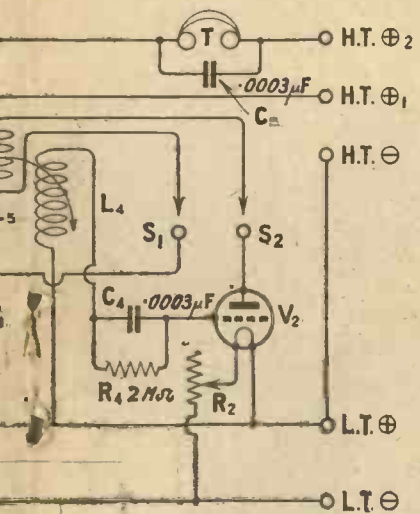


This photograph gives a closer view of the panel layout. The wavetrap coil is plugged into the socket mounted at the back of the panel.

former, the primary of which is tuned in the usual way. In actual practice with this arrangement it is possible to obtain an appreciable build up of signal strength and to work near the oscillation point by careful manipulation of the fine adjustment device on the reactor.

Auto-Coupling

The aerial tuning arrangements shown in the circuit diagram require some explanation. The tapped coil L2, tuned by the variable condenser C2, is the aerial tuning inductance, and here a Lissen "X" coil has been used; this gives an auto-coupled aerial circuit with the option of two tapping points. With some types of aerial it may be advisable to wind some coils and to experiment with the positions of the tapping points, if it is desired to obtain the maximum effect which is necessarily a compromise between signal strength and selectivity. For further information on the subject of auto-coupled circuits the reader is referred to the articles by Mr. G. P. Kendall in *Wireless Weekly*, Vol. 5, No. 20, and Vol. 6, No. 2.



eiver the moving plates of the variable w heads. Either of the reaction coils be used separately.

The Wavetrap

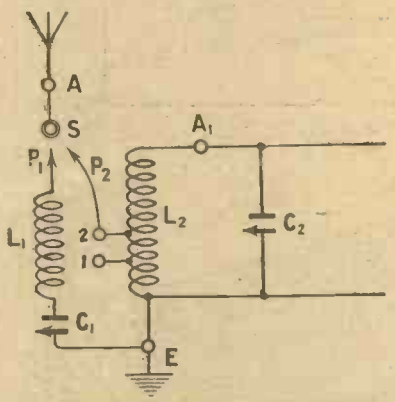
The coil L1, in series with the variable condenser C1, the whole series "acceptor" circuit being shunted across the aerial turns of the auto-coupled circuit, forms the very successful wavetrap which was described by Mr. A. D. Cowper in a recent issue of *Wireless Weekly* (Vol. 6, No. 7). This makes possible the complete elimination of a powerful transmission, and reception, even on nearby wavelengths, is then practicable.

In order that the wavetrap may be used conveniently on even the high wavelengths a .0005 μF variable condenser with vernier is used for C1, while a single coil mount away from the A.T.I. is provided for L1. For the best results with this trap the H.F. resistance of this series circuit should be kept as low as possible, and for this reason a good type of coil should be chosen.

Obtaining Reaction

It will be noticed that a coil L6, which can be plugged in the moving socket of a two-way coil holder and coupled to the A.T.I., may also be included in the anode circuit of the detector valve and used to give reaction on to the

aerial. The scheme of this arrangement is such that the reaction coil L6, or the reactor, or both, may be used to obtain re-



This diagram shows in theoretical form the terminal arrangements on the aerial side of the receiver. P1, and P2 indicate Clix plugs, while S is a Clix socket.

action. A suitable coil plugged into the appropriate socket, and a connection made between the Clix sockets S1 and S2, by means of two Clix plugs connected by a short length of flex, gives the former arrangement. To use the reactor alone a shorting plug is inserted in the place of L6 and the flex leads from the reactor are fitted with Clix plugs for connection to the sockets S1 and S2.

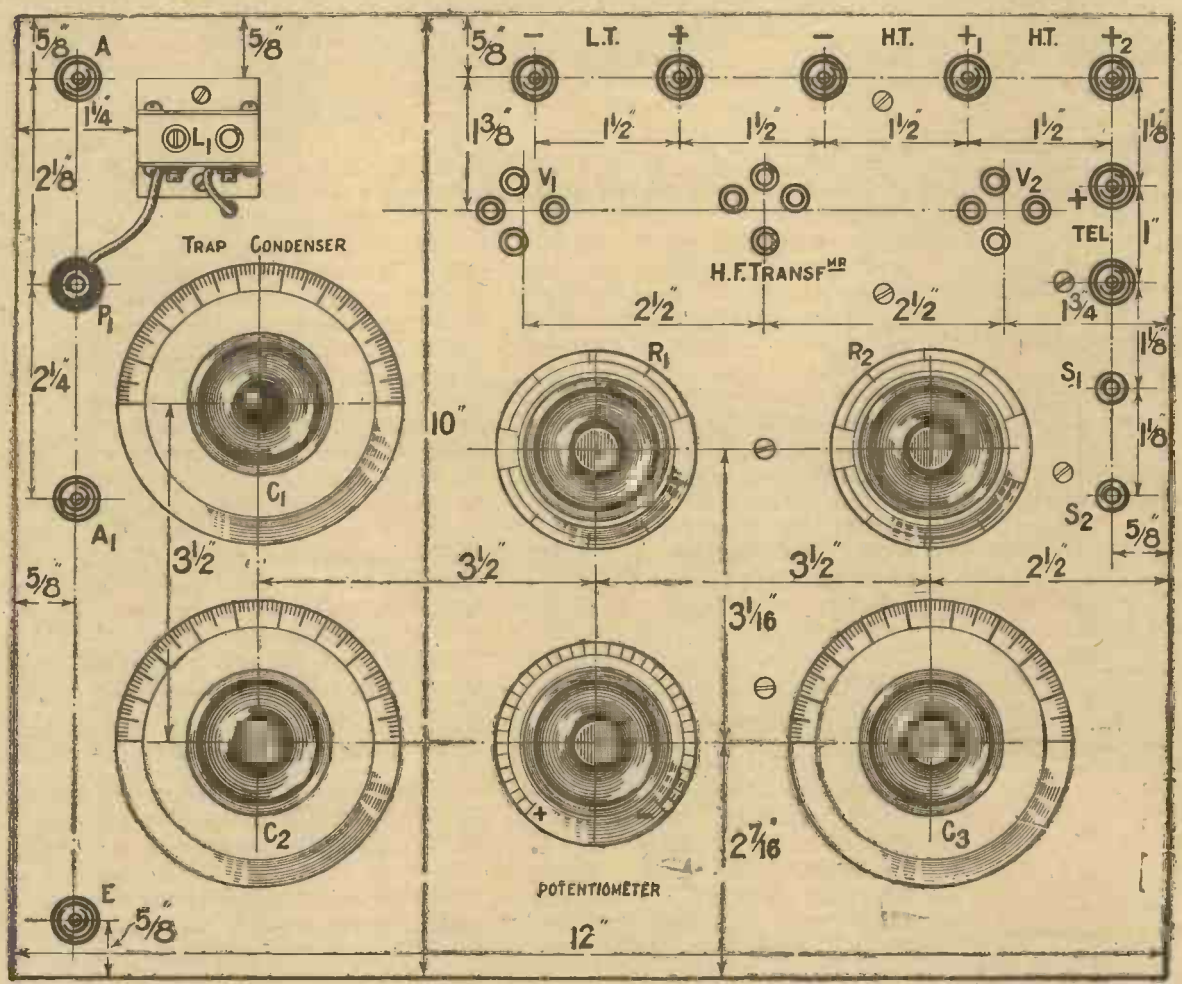
Oscillation Control

Potentiometer control of the grid of the H.F. valve has been included as a desirable refinement for oscillation control when searching for distant stations. An H.F. by-pass condenser C6, of .006 μF, is connected between the slider of the potentiometer, and the negative filament leg of the first valve.

The terminal arrangements on the aerial side of the set are shown in a separate theoretical diagram. The aerial terminal A is connected to a Clix socket marked S, and a second aerial terminal A1 joined to the grid side of the A.T.I. From the end of L1 not connected to the trap condenser, a flex lead terminating in a Clix plug P1 is taken. Then a second short flex lead equipped with a Clix plug P2 enables either of the tapping points 1 and 2 (which in the case of Lissen "X" coils are brought out to terminals on the sides of the coil plug) or the terminal A1 (for direct coupling, if required) to be connected outside the set to the socket S. To cut the trap out of operation the plug P1 is simply withdrawn and left free.

Panel Layout

The photographs should give a good idea of the general appearance of the set and the disposition of the various components. Note that the two-way coil holder is placed on the side of the containing box and the single coil mount for the trap coil is at the back of the panel at the left-hand side. Immediately in front of this coil-mount is the trap condenser, and in front of this is the A.T.C., the



Complete dimensions for the marking out of the panel to obtain the layout embodied in the actual set are given above.

condenser tuning the primary of the H.F. transformer being in a corresponding position on the right-hand side. The potentiometer dial is seen between these latter two condensers, the two remaining dials being those of the filament resistances.

Component List

In the list of components given subsequently a specification of those actually used in the set photographed is indicated, but the discriminating constructor has a wide choice in selecting suitable components :—

One ebonite panel, 12 by 10 by ¼ in. (Paragon).

One .0005 μF variable square-law condenser with vernier (Jackson Bros.).

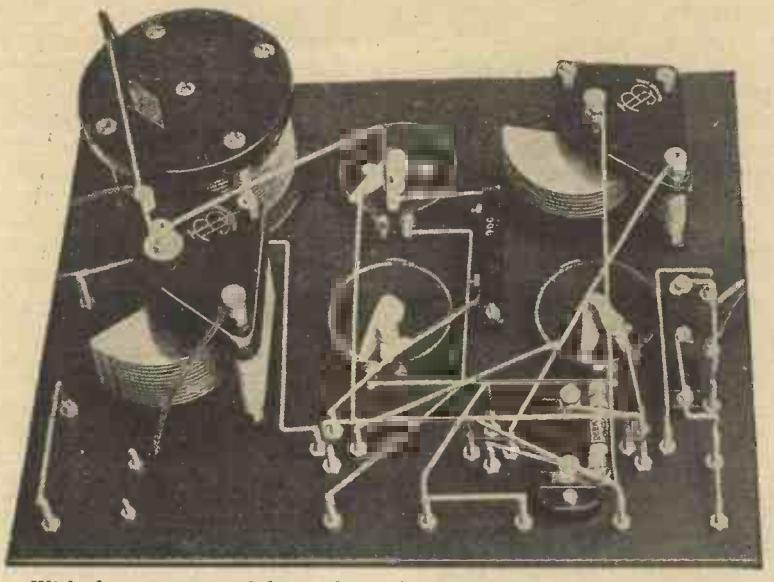
One .0005 μF variable square-law condenser (Peto-Scott Co., Ltd.).

One .0003 μF variable square-law condenser (Jackson Bros.).

Two filament resistances, dual type (L. McMichael, Ltd.).

One potentiometer (L. McMichael, Ltd.).

One two-way coil holder (Peto-Scott Co., Ltd.).



With the exception of the leads to the aerial, reaction and wavetrap coils, the wiring of the receiver is carried out with stiff square section wire.

One single-coil mount (Burne-Jones and Co., Ltd.).

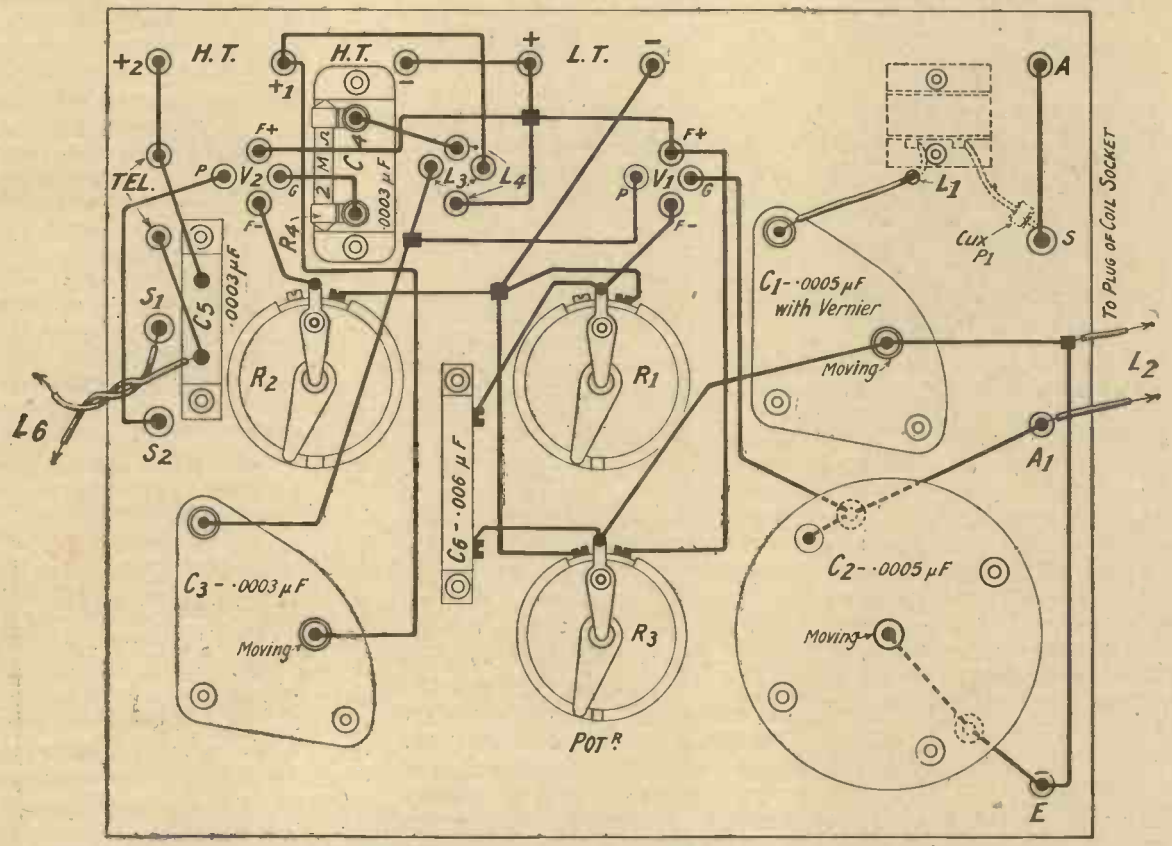
Twelve valve sockets (Burne-Jones and Co., Ltd.).

Ten terminals.

Three Clix sockets and six Clix plugs (Autoveyors, Ltd.).

One .006 μF fixed condenser (Paragon, Peter Curtis, Ltd.).

One .0003 μF fixed condenser with clips (type 610), and one gridleak, 2 meg. (Dubilier Condenser Co., Ltd.).



Those who are not accustomed to wiring a receiver from a circuit diagram should follow the practical wiring diagram given above. The flexible leads to the reaction coil L6 may be twisted together. The letters S, S1, and S2 indicate Clix sockets.

One .0003 μF fixed condenser (Dubilier Condenser Co., Ltd., type 620).

Lissenagon " X " coils (Lissen, Ltd.) and H.F. transformers (L. McMichael, Ltd.) for the wavelength ranges desired.

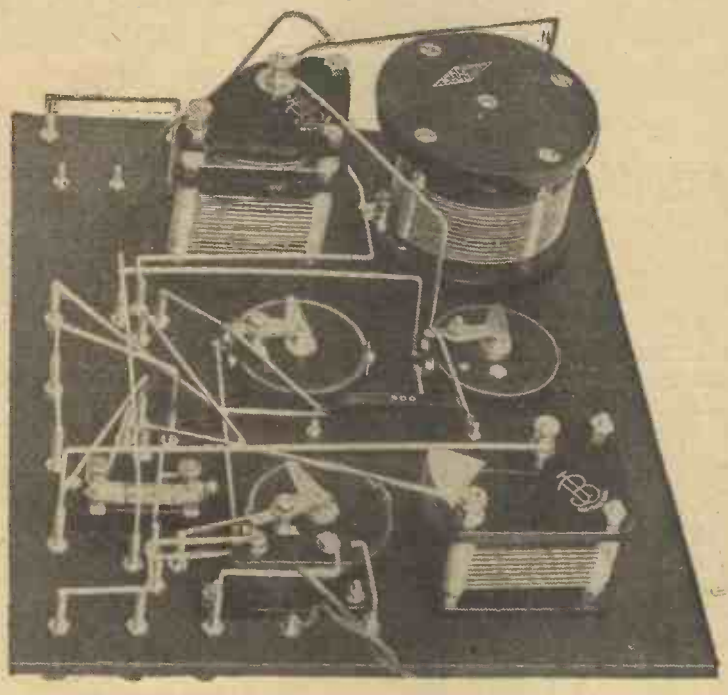
One H.F. reactor (L. McMichael, Ltd.).

Suitable containing box (Camco).

Square section tinned copper wire and some rubber-covered flexible wire for wiring.

Radio Press panel transfers.

The construction of a duplicate of the actual receiver should be quite a straightforward matter if the drilling and wiring diagrams are followed carefully. The necessary dimensions for the marking out and drilling of the panel can be taken from the front of panel layout diagram. It will be more convenient in the case of marking out drilling centres for the holes to take the valve and transformer sockets to use one of the templates put on the market for this purpose.



A further view of the under side of the receiver. The wiring is kept as short as possible, consistent with adequate spacing between the wires.

Drilling and Assembling

The panel should be marked out on the back, bearing in mind, of course, that the whole layout is then reversed. When the drilling has been completed and the panel cleaned and dusted, the components, particularly the variable condensers and the valve sockets, should be cleaned, if this is necessary, and subsequently assembled. In the actual set clearance holes were drilled for the valve sockets, and these were secured by thin nuts at the back of the panel.

The wiring of the receiver is shown clearly in one of the accompanying diagrams, and an inspection of the back-of-panel photographs before commencing this operation will prove helpful in obtaining an idea of the disposition of the various wires. In the case of the flexible connections, these may be soldered to the various points as indicated, and sufficient length allowed for connections to the coil holder.

Connections to the X Coil

Here it is important to note that if Lissenagon " X " coils are to be used, then the flexible connection from that wire joining the earth terminal and the moving plates of both the trap and the aerial tuning condensers should be connected to the plug on the fixed mount of the two-way coil-holder. The reaction leads should be twisted together and brought out through a small hole in the side of the containing box.

Preliminary Tests

When the receiver is ready for testing, cut the wavetrap out of operation and try the set out first, using direct aerial coupling and no reaction, that is, connect the aerial to A1, insert a shorting plug in the L6 socket and short the Clix sockets S1 and S2. Then plug-in the valves, the H.F. transformer, and a suitable coil in the aerial socket, and take the usual precautions of ascertaining that the L.T. and H.T. circuits are wired correctly before connecting up the batteries.

If the set is wired correctly and everything is in order, it should then be possible to tune in some sort of signals to get the " feel " of the set. Next take out the connecting link between sockets S1 and S2 and put the H.F. reactor into circuit. Try reversing the positions of the Clix plugs in order to obtain the correct reaction effect. Finally insert a small reaction coil into the moving coil socket of the two coil holder, and with the potentiometer set about half-way between positive and negative, ascertain the correct way round for the connections so that the set will oscillate when the aerial and the anode circuits are brought into resonance.

The set is then ready for operation; either the H.F. reactor or aerial reaction may be used, or, with careful manipulation, both, and after preliminary adjustment of H.T. values on both valves and filament temperature, the potentiometer should be set so that the receiver goes into oscillation smoothly when reaction coupling is increased.

Using Auto-Coupling

When auto-coupling is employed the aerial tuning is fairly critical, and some little practice will be needed to bring the aerial and the anode circuits into tune when searching for more distant stations.

To operate the wavetrap a suitable coil, equivalent to a

(*Continued on page* 310.)

RADIO NOTES AND NEWS

Some brief items of interest relative to wireless events.

The Irish Free State Government's policy on broadcasting was outlined recently in the Dail by Mr. J. J. Walsh, Postmaster-General, who said he had had a conference with the Minister of Finance on the question of broadcasting, and that the latter had agreed to his proposal that broadcasting should be run by the State.

It was intended to erect the main station in Dublin and a subsidiary one in Cork. The laying-down cost would come to £9,000 and the mechanical upkeep and cost of the programme would work out at something like £20,000 a year. They hoped that in the third year the station would be able to pay its way.

* * *

We understand that radio transmissions on a 21-metre wavelength, recently sent out by the Metropolitan-Vickers Electrical Co., Ltd., have been heard in New Zealand. The transmissions were made from G2AC, the experimental station of the company at Trafford Park, and were picked up by Z4AG, the station owned by Mr. Ralph Slade, of Dunedin, New Zealand.

It is now probable that the experiments will be continued by the company using increased power and reflector aerials.

* * *

From the Manchester station, on Friday, June 12, at 7.35 p.m., Dr. E. H. Chapman, Staff Editor of *Wireless Weekly*, is speaking on the subject of Derbyshire. This talk is to be the first of a series of six or eight talks on the counties served by 2ZY.

* * *

A light programme, particularly suited for a hot summer evening, will be given at Manchester on Wednesday, June 17. The 2ZY Octet will provide a light, semi-classical programme, ranging from "The Marriage of Figaro" overture to the waltz, "Nights of Gladness." Mr. Andrew Shanks will contribute two groups of songs, and Mr. Peter Bernard will give a "speciality entertainment" consisting of humorous and popular songs.

Members of the North Middlesex Wireless Club and some of their apparatus.

* * *

Starting on Thursday, June 11, at 11.45 a.m., a series of weekly talks to schools on the choice of employment will be given at the Manchester station. The first four talks will be given by Mr. E. G. Greenwell, of the Manchester Education Committee, on "The Juvenile Employment Bureaux."

* * *

At the Manchester station on Friday, June 19, Mr. Edward Isaacs intends to disprove the contention that Bach is dull. On that date he is giving a pianoforte recital, with explanatory remarks, from the lighter music of J. S. Bach, showing that a composer, whom many appear to consider as dull and stilted, has produced works of unusual geniality and lightness. Mr. Isaacs is very interested in wireless as a means of popularising good music. He has done a great deal himself for the musical education of Manchester, being the founder of the Edward Isaacs International Chamber Concerts, which have been responsible for bringing to Manchester such famous instrumentalists as the Lener Quartette, the Copenhagen Quartette, and the Capelle Quartette.

Some Notes on Aerial Joins

(Concluded from page 295)

this tightly towards the solid portion of the aerial wire. Proceed in the same manner with the remaining strands, then start again at the middle and bind the other set of strands in the same way along the other untwisted portion of the wire. Then run solder into the join as before, and cover with a protective coating. The resulting joint will be extremely neat and at the same time very strong. In the case of joining the lead-in to the horizontal portion of a "T" aerial an effective method is to divide the strands of the horizontal span and to interleave the strands of the down lead, afterwards seizing and soldering as before. To join the lead-in to the lead-in insulator it is effective to separate the strands and to solder them to a large brass washer, clamping the washer tightly between two nuts on the brass rod of the leading-in tube.

The Loud-Speaker in the Garden

By JOHN UNDERDOWN.

Now that warmer days are with us, many will turn their attention to the enjoyment of wireless in the open air. In the following article a simple means of using the loud-speaker in the garden is described.

The filter unit used by the author in his experiments.

WITH a good set which will work a loud-speaker efficiently indoors there is no reason why the programme should not be enjoyed at a considerable distance from the set, in a garden, for instance, with little or no difficulty. Two alternative methods are usually available. Either the volume can be boosted up so that the loud-speaker, when placed by an open window, is audible at some distance, or long flex leads can be taken from the set so that the loud-speaker is available where desired. To the first there is the objection that too large volume is far from restful and may not be acceptable to one's neighbours. The use of very long twin leads is somewhat expensive, and in some cases not always satisfactory. A solution of the difficulty occurred to the writer when constructing the "Filter Unit," described in the current issue of *The Wireless Constructor*.

Use of the Unit

The unit consists essentially of a suitable choke coil which is placed in the anode circuit of the last valve in place of the telephones. From the side of the choke coil which is joined to the plate of the last valve, a lead is taken to one side of a 2 μF condenser. The other side of this condenser is taken to the negative loud-speaker terminal, whilst the positive of this latter is joined to the other side of the choke coil, which is, of course, connected to H.T. plus inside the set. This arrangement is a very simple one for protecting the somewhat delicate windings of loud-speakers, the choke carrying the direct plate current supply to the last valve, whilst the loud-speaker windings are isolated by the 2 μF condenser. This method, however, only stops the passage of direct current, and the fluctuations which represent actual signals are communicated through the condenser and actuate the loud-speaker in the normal manner, since the impedance of the condenser is negligible to audible frequencies, although infinite to direct current. Instead of taking the lead from the positive terminal of the loud-speaker to the side of the choke coil joined to the positive telephone terminal it may be taken to the negative side of the high-tension battery. This at once suggests an easy method of using the loud-speaker at a distance, only one long lead being necessary.

The Arrangement Used

The practical method adopted will be easily followed from Fig. 1, in which a choke coil is shown connected across the loud-speaker terminals. From the side connected to the negative 'phone terminal, that is the terminal connected to the plate of the last valve in an ordinary straight set, a 2 μF condenser is connected. The choke and the 2 μF condenser are connected close to the set, whilst from the further side of the latter a long lead is taken to the negative terminal of the loud-speaker, of which the positive terminal is connected directly to earth. At this juncture it should be observed that if a coupled circuit is used it is essential that the lower end of the secondary coil be connected to earth. The lead from the condenser to the loud-speaker may be any kind of wire, and in practice No. 24 d.c.c. wire was used. For the connection to earth a further length of No. 24 gauge wire was used soldered on to an old brass stair rod 2 ft. in length. From the diagram it will be seen that the return connection from the loud-speaker is *via* the earth connection at the loud-speaker end and the earth connection at the set, the actual connection being through the ground.

Experimental Results

The actual experiments with this method of using the loud-speaker at a considerable distance from the set were carried out in Bexley, which is roughly twelve miles south-east of 2LO. An ordinary detector and one low-frequency amplifier circuit was used, the receiver being the "Two-Valve Drawing Room Set" described in the April, 1925, issue of *Modern Wireless*. The filter arrangement consisted of the filter unit previously mentioned. A lead of No. 24 d.c.c. wire was taken from the negative terminal of the unit to the negative terminal of the loud-speaker, of which the positive terminal was

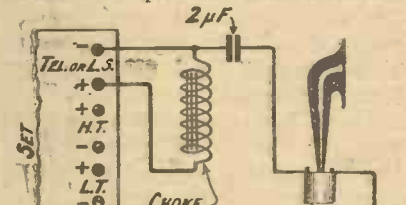


Fig. 1.—The simple connections necessary for remote loud speaking.

earthed by using the brass stair rod. No lead, of course, was taken from the positive loud-speaker terminal of the filter unit. On a good aerial excellent loud-speaker results are obtained with the two-valve set, and the loud-speaker connected to the filter unit in the normal manner.

The first experiment consisted of taking the loud-speaker about 10 ft. from the set, its positive terminal being earthed in fairly moist soil. No difference in volume from normal could be

observed when this connection was made. Actually, with the earth connection held in the hand audible signals could still be heard in the loud-speaker. When the stair rod was merely lying on fairly dry soil signal strength was only 50 per cent. of that normally obtained, but directly the earthing-rod was inserted into the soil an inch or two no difference in signal strength from that obtained in the house could be distinguished aurally.

Longer Leads

For this and succeeding experiments the long lead of No. 24 gauge wire was merely taken over trees, rustic arches, and along the tops of fences. From this it will be observed that a high order of insulation for this lead does not appear to be necessary in dry weather. Continuing experiments the loud-speaker was taken a distance of 15 yards from the set and the earth connection again made. With the loud-speaker standing on a board 1 in. in thickness no difference in signal strength could be observed from that obtained in the house, and with no earth connection whatever, signals were still audible in the loud-speaker. At 25 to 30 yards, namely, about the length of the outdoor aerial, and underneath the latter a little diminution in signal strength was noticed.

Results at 50 Yards

Having taken the loud-speaker the full distance of the garden and underneath the aerial, permission was now obtained to take it through into the next garden, and at a distance of 50 yards from the set good loud-speaker strength was still obtained, although the volume had dropped somewhat. The general impression of a number of independent observers was that about one-third of the normal signal strength had been sacrificed by taking the loud-speaker the extra distance past the end of the aerial. Probably the explanation is to be found in the fact that the soil in the next garden appeared to be considerably drier owing to the sloping nature of the ground.

Easily Arranged

At that distance from the set signals were sufficiently loud to be comfortably audible to a number of listeners on the lawn despite the fact that tennis was being played within a few feet of the loud-speaker. The arrangement seems to be an ideally simple one for those who wish to enjoy the pleasures of broadcasting in the garden and at a considerable distance from the set. There is no need to make up an elaborate filter circuit arrangement, as any choke coil, providing its impedance is sufficiently high, will be found satisfactory for the purpose if used in conjunction with a 1 or 2 μF Mansbridge type of condenser. Actually the writer has used the primary winding of an ordinary step-down type of telephone transformer normally used with 120 ohm type telephones, and also the secondary of an old L.F. transformer of which the primary had broken down in service.

Experimenting

A number of interesting experiments may be carried out on the lines of those given above, the effect of an anode resistance being tried in place of the choke coil shown in the diagram. It should be remembered, however, that when a resistance is used a considerable drop in voltage will be experienced, and this must of necessity be made up by applying extra high-tension to the plate of the last valve. Where a counterpoise earth is available the actual wire of the counterpoise may be used in place of the earth return.

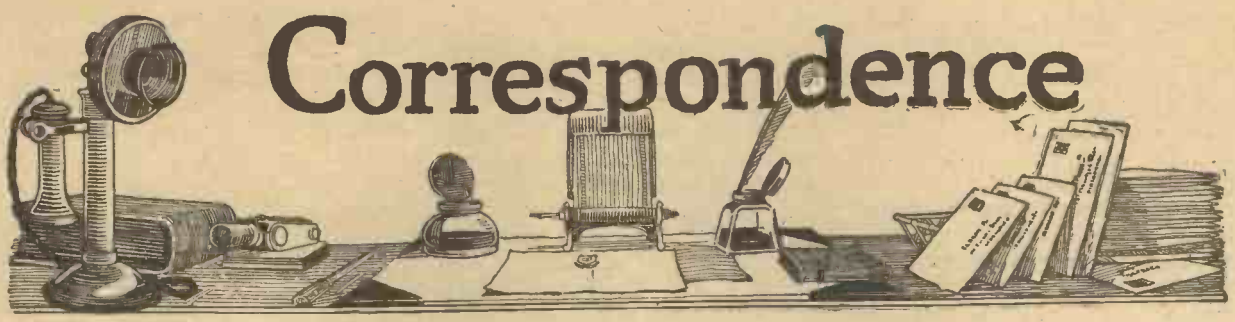
Interesting Results

During the experiments given above some further interesting points were noticed. When the end of the long lead from the 2 μF condenser was held in one hand and the negative loud-speaker terminal held in the other hand audible signals were received, and, in fact, were still received when three people were linked in series between the long lead and the negative loud-speaker terminal. If, instead of connecting the positive loud-speaker terminal to earth it was held by the writer audible signals were still received, and these improved with the number of listeners who held hands. It was also observed that better signal strength was obtained with the earth connection lying on the lawn than when this was lying on the fairly dry soil of the garden, indicating that the dryness of the soil has an important bearing on results obtained with this arrangement.

B.B.C. engineers at Miss Beatrice Harrison's house, with the relaying apparatus used for broadcasting the song of the nightingale.

British Amateur Heard in India

The wireless section of No. 5 Squadron R.A.F., at Kohat, India, has recently reported that they have heard signals transmitted by a British amateur, Mr. N. G. Baguley, of Newark, Notts (G2NB). Only one valve was used for reception, and signals were heard on several occasions.

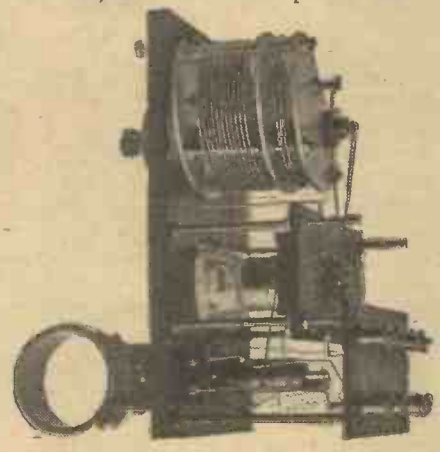


Correspondence

A READER'S NEGADYNE RECEIVER

SIR,—I think your readers would be interested in the enclosed two photographs of my one-valve set employing the Negadyne circuit, described by Mr. A. D. Cowper in *Wireless Weekly*, Vol. 5, No. 15.

The set is compact, measuring 8½ in. by 4¾ in. by 4½ in. All supply terminals are at the back of the set, and the three panels are



Mr. Aylmer-Coates' Negadyne Receiver.

held relatively fixed by screwed brass rods so that the entire wiring is in one unit. This enables the whole arrangement to be withdrawn from the cabinet *tout ensemble*. The quick change of inductance is one of the most fascinating characteristics of the circuit.

On this little one-valver I have received all the B.B.C. main stations, and of foreign broadcast have heard Radio-Paris, Eiffel Tower, Ecole Superieure des Postes et Télégraphes, Breslau, Munster, and Munich, also a few fainter stations that were not recognised. KDKA comes in on a seven-turn coil with condenser in parallel, the aerial being a vertical wire 4 ft. in length. The best value for high-tension voltage in this case is 3 volts. On wavelengths of from 300 to 500 metres 6 volts and 9 volts appear to bring in equally satisfactory results.

Wishing every success to *Wireless Weekly*.—Yours faithfully,

E. S. AYLMER-COATES.

Loughborough, Leicestershire.

A SIX-VALVE T.A.T. RECEIVER

SIR,—I enclose herewith a photograph of a receiver made up with one of Mr. Scott-Taggart's T.A.T. circuits, which I hope you will not mind accepting. I must say the photograph does not do the set justice. The components are built on a Mahoganite panel which matches the Jacobean oak cabinet.

There are two high-frequency valves, one detector and three low-frequency resistance-coupled valves.

Several stations are heard on the loud-speaker, Continental and B.B.C. stations being excellent strength.

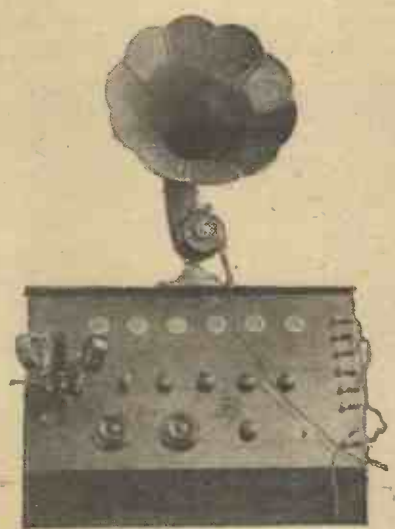
Any further advice upon this subject which you may publish will be welcomed.—Yours faithfully,

W. OVERY.

Manchester.

AN IMPROVED TWO-VALVE RECEIVER

SIR,—In the January issue of *Modern Wireless* you published the

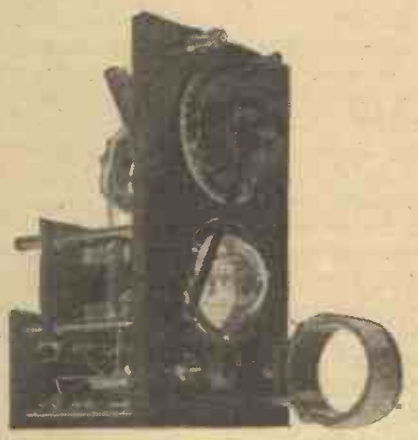


Mr. Overy's 6-valve T.A.T. Receiver is extremely neat in appearance.

"Improved Two-Valve Receiver," by Mr. Stanley G. Rattee, and as I have made up several of these for my friends, I should like you to know that they one and all give every satisfaction. I find the set quite as good as a well-advertised three-valve set. We have had Brussels on the loud-speaker and other Continental stations on 'phones, but it really excels on London and Chelmsford loud-speaker work.—Yours faithfully,

C. H. EDWARDS.

Rochford.



Note the novel manner of mounting the valve in Mr. Aylmer-Coates' Receiver.

LOW-LOSS CRYSTAL SET

SIR,—In January last I made up the "Low-loss Crystal Set" according to the directions set out by Mr. Percy W. Harris in the February issue of your valuable journal, *The Wireless Constructor*.

I was more than pleased with the splendid results I obtained on an indoor aerial here, which is fixed about 25 ft. from ground level. The Bournemouth station, which is about 10 miles away, came in almost twice as loud as on a variometer tuned set previously used.

Recently, using a 1,600-metre coil with this set, between 6.30 and 7 p.m., when Bournemouth was closed down, I was surprised to hear Chelmsford station quite clearly, and that in broad daylight, as previously with the variometer set I had only been able to get 5XX after dark, and then only very faintly indeed.—Yours faithfully,

L. H. STREETS.

Wimborne, Dorset.

THE THREE-VALVE DUAL RECEIVER

SIR,—I want you to know that last September I built the Three-Valve Dual Receiver (April, 1924, *Modern Wireless,* by Mr. John Scott-Taggart), and although I had a little trouble at first due to a faulty valve socket, when this was remedied I got excellent results. Within a month I had a log of 15 English and Continental stations.

I then constructed a pleated paper diaphragm loud-speaker as described in *Wireless Weekly,* August 6, 1924, which also was very successful, being clearly audible all over the house. It may interest others to know that I found "imitation parchment," coated with cold metal lacquer after pleating, to be the best. I then painted it with silver paint. The purity of tone is indisputable.

On the publication of "The Simplified Three-Valve Dual" in March, 1925, *Modern Wireless,* also by Mr. John Scott-Taggart, I reconstructed my original receiver, and found it an improvement. With it in less than ten days I logged the following stations: All the B.B.C. main stations and Swansea, Radio-Paris, Petit Parisien (medium loud-speaker), Eiffel Tower, Postes et Telegraphes (medium loud-speaker), Nuremburg, Munster (weak loud-speaker), Leipzig, Breslau, Stuttgart, Konigsburg, Frankfurt, Munich, Voxhaus, Radiofonica, Rome (weak loud-speaker), Hilversum, Holland, and Amsterdam (fair loud-speaker). Also four German-speaking stations I can always get at will, but can never find out who they are. All the above are obtained with a pair of coils made as per Mr. Kendall's instructions (*Wireless Weekly,* February 11), *i.e.,* cross-coil formers wound with 22 gauge wire, aerial coil 37 turns, reaction coil 50 turns. For long waves, 1,000 to 2,000, I use cross coils wound with 26 gauge wire 140 turns for aerial coil, 98 turns reaction coil.

I also made a 900-2,000 metre H.F. plug-in transformer, using a cross-coil former with eight slots in each arm and winding 36 turns in each alternate slot for primary and 36 in the remaining alternate slots for secondary. It gives me Hilversum and Chelmsford in conjunction with cross coils louder than Messrs. XYZ coils with an XYZ H.F. plug-in transformer. I will not mention names. Since, I have made several H.F. transformers in this manner, and all give excellent results.

Now, on behalf of several friends and myself, could you give us an "all stations real loud-speaker set"? One after the style of Mr. Cowper's in *Wireless Weekly,* Vol. 5, No. 21, but one that does not need three coils and can be used with less expensive dull emitters and less H.T. voltage. Mr. Cowper's circuit appeals to us, but as Mr. Cowper says, with that delightful frankness which characterises all your articles, "this is a circuit for the expert." We do not want a circuit which will give quite such volume, but one that would give loud-speaker strength clearly (pleasantly) audible in a small room, but which would give us, in this manner, all the principal English and Continental stations, but not too difficult to handle and requiring, if necessary, up to six valves.

Perhaps Mr. Cowper could simplify his circuit even if it slightly cut down signal strength and give it to us in your usual way with detailed instructions for building it, as we are not expert enough to work from a diagram, such as appears in his article.

Trusting this will interest you and wishing you all the success you deserve with your excellent publications.—Yours faithfully,

A. HANDSCOMB-EDGE.

Wimbledon, S.W.19.

Our correspondent is referred to *The Wireless Constructor* for January and February, wherein are given full details for the building of the "Anglo-American Six," by Percy W. Harris.

PROF. GOOP HAS A RIVAL

SIR,—Having read so much about the Goop-Wayfarer circuits, which seem to have created some stir in the ether, I feel it my duty to inform you that Professor Goop is not the only atmospheric in the earphones. I, too, have been experimenting with various circuits, and have had some extraordinary results, so much so that I would like to give to the general public the benefit of my experiences and allow them to make use of them.

The first experiment was with a new type of hyper-crystal *cum* 50-watt lamp as a dual amplifier after two stages of H.F. The results were so remarkable that even when using only half the lamp I was able easily to obtain the most distant signals.

This set requires no outdoor aerial, earth, H.T. or L.T. batteries, the juice being supplied by a line from the nearest gaspipe.

My second experiment was with a small piece of carbon dioxide as a crystal, but the results were only equal to the ordinary common or garden crystal one can buy anywhere. This was substituted for a lump of calcium carbide, and with a .0002764 μF variable condenser in parallel, 2 B.A. spanners and a telephone directory (1924) in series. I got admirable results from all the B.B.C. stations and most of the Continental stations as well. After about ten minutes, however, I heard the most violent and terrifying atmospherics, which I could not understand until I discovered that my hound, Dogsbody, had sneezed in close proximity to the crystal, whereby causing it to give off nauseating fumes. Our experiments on that evening were brought to an abrupt conclusion owing to the fact that I threw the offending crystal into the fire. Except that I experienced a cyclone of unprecedented fury, coupled with the most appalling flash of lightning, I have but a hazy recollection of what happened.

The next week was occupied in retrieving bits of my laboratory from the neighbouring countryside. This was fraught with some danger, as most of it seemed to have lodged on the roofs of houses round about. One variable condenser, which I found in a field some five and a half miles away, had unfortunately died through having cut one of its vanes on a barbed wire aerial near by.

Having re-erected my laboratory, I continued my experiments. This time I added a worn-out Ediramconi light globe. Some preparation was necessary before this would function properly. Putting the lamp in a vice, I drilled two holes through the bottom of the lamp. In one side I inserted a crooked handled umbrella which I opened after insertion. Next I introduced a large magnifying shaving mirror fastened on to a new type of extending telephone arm. Obviously the drilling of the two holes allowed the air to enter the bulb, but just prior to sealing the holes up again I got an empty soda-water syphon, held it against one hole and pressed the trigger. This blew all the air out of the bulb, and before it could return I stuck some stamp paper over the two orifices.

Having completed my valve, I stuck it on the panel. Using the fender as an aerial, I was surprised to find that even before connecting the phones I could hear WGY coming through quite plainly. Some oscillation was evident, but eventually I discovered that the inadvertent pressure of my foot on the rear antenna of my cat was the cause. After connecting up all available spare wire, within two minutes I was able to pick up 37 stations situated round about the Falkland Islands, all the U.S. broadcasting stations and nearly all the B.B.C. stations except London.

I hope shortly to have some more data which may be of interest to your readers.—Yours faithfully,

ARDENT AMATEUR.

London.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

"Maxtone" Auto-Detector

A crystal detector of the semi-permanent type has been submitted for trial by Messrs. Maxton & Co. This is of the modified perikon type, interest in which has been revived recently by the exploitation of a substitute for the ordinary reddish zincite (which normally forms one of the pair of crystals) in a yellow transparent mineral. It resembles zincite in its physical and some of its chemical properties, but it shows a far better performance in various combinations, such as that used here, a sulphide mineral being opposed to it, as in the original perikon arrangement. The crystals are mounted in an ebonite tube 1⅝ in. long and about ¾ in. diameter, fitted with substantial screw caps, under which are also secured the metal fixing brackets to be screwed on the panel. The detector can be removed for examination by loosening the end caps and sliding it out of the slotted brackets. The yellow crystal was mounted at the end of an adjusting spindle, and was kept up to its work by spring pressure. Such adjustment as was necessary and possible was made by withdrawing the spindle slightly, rotating it, and allowing it to spring back gently until another contact was made. The crystals must not be ground together; it was found that they soon crumbled if this was done. On actual trial, on six consecutive settings, an average signal strength of 14.3 microamperes was obtained from the local station on a low-loss tuner, as against 24 microamperes from the standard good galena, or 60 per cent., the variation being from 7 microamperes to nearly the maximum.

The detector was neatly and strongly made, and is very suitable for experiments with crystal combinations. With the most favourable combinations it should give every satisfaction; in practice, it was found to be extremely stable, and could even be removed and replaced without losing a crystal setting which had been found favourable.

"Gecophone" Grip Terminal

Messrs. General Electric Co., Ltd., have brought out a new type of wire terminal, in both the spade and the pin form, which, judging from the samples submitted to us, represents a considerable advance over the usual type, both in the man-

ner of application to the wire, and in appearance and finish when applied. These have short coloured insulating sleeves, either red or black; the tail of the metal spade or pin has a hinged jaw, equipped with shark's teeth grips closing into a grooved plate, which is closed down securely on the end of a wire flex threaded through the sleeve and inserted in the jaws, by pushing the sleeve forward; the bore of the sleeve is made conical for this purpose. The result was found, on trial, to be that an exceedingly secure grip (and good electrical contact) was obtained on the end of the flex, whilst externally the appearance of the device was of the neatest. To insert or remove a wire was a matter of seconds only. The terminal proved to be more suitable for flex than for application to d.c.c. wire of medium gauge; for H.T. and L.T. connections, and for temporary wiring connection in experimental work, also for aerial and earth leads, they can be well recommended. Whilst costing rather more than the ordinary spade connector, the life will, undoubtedly, be much greater, and the appearance, as suggested, is decidedly superior.

Low-Loss Coil-Formers

Samples of coil-formers of the open form suitable for the winding of low-loss coils with stout wire properly air-spaced and with the minimum of energy-absorbing dielectric, have been submitted by Messrs. Precision Screw Co., Ltd. They have six ½ in. diameter ebonite tubes supported in end rings by a neat device of screw and set-in lining bush at the ends, and having each a coarse screw-thread turned on them, so as to provide shallow notches in which to wind the turns of wire, spaced as desired by one, two or more threads. Thus even bare wire can be wound with care. The 6 in. diameter former submitted proved convenient to wind the optimum winding for low H.F. resistance for a given inductance of No. 18 enamel-covered (or bare) wire well air-spaced being readily obtained. We can recommend the formers for experimenters desirous of exploring these new fields of low-loss efficient receiving circuits. By the method of mounting, the former can be made of any convenient length, and when of considerable length a supporting ring or rings are conveniently introduced between the end rings to avoid sagging.

L.T. Accumulator with Charge Indicators

We have had submitted to an extended practical trial a large specimen of the L.T. accumulators supplied by Messrs. Peto & Radford, equipped with tell-tale gravity floats (hydrometers) which indicate when the cells are nearly discharged, and approximately to what extent. A small white float sinks when the cell is 50 per cent. discharged, a blue float at 75 per cent., and a red one indicates approaching danger at 95 per cent. discharge. On charge, the floats give corresponding information as to the degree of charge accomplished. One can feel sure that if these floats are watched (they can easily be observed through the transparent sides of the cells), and if the makers' very careful instructions as to rate of charge, etc., are followed, the usual troubles experienced with small radio accumulators will be largely obviated. The battery tested was of 4 volts, 80 ampere-hours (ignition rating) capacity, the cells being arranged in a strong, handy, wooden carrying-case, with wide strap for carrying and open ends for observing the tell-tales. Effective, large, non-splash vents were provided, and large insulated terminals clearly marked for polarity. In an extended test in actual reception, and on the bench, the cells showed full continuous-rate capacity, and maintained their voltage on heavy discharge.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

L.F. (GRAVESEND) has two pairs of 120 ohms 'phones and one pair of 2000 ohms 'phones, and wishes to know whether he can use these simultaneously on an ordinary type of set consisting of a detector and one low-frequency valve.

Our correspondent can readily use both his high and low-resistance telephones on the set he mentions, but it will be necessary that a telephone transformer be used in conjunction with the two pairs of the 120 ohm type. Telephone transformers may be purchased with a suitable step-down ratio for use with this type of telephones, or alternatively can be made, one winding consisting of 4 oz. of No. 42 S.S.C. wire, while the other winding consists of ½ oz. of No. 38 D.S.C. wire. The 4 oz. of 42 gauge wire will be used for the primary winding, which will be inserted in the plate circuit of the last valve of the receiver, whilst the 38 gauge wire forms the secondary across which winding the low-resistance telephones are connected. For the core of the telephone transformer a bundle of iron core wire may be used. This should be, roughly, ¾ in. in diameter and 8 ins. long, the ends of the wire being bent round the bobbin taking the windings until they almost meet. A suitable length for the bobbin would be from 2 to 3 ins.

The method of using the three pairs of 'phones previously mentioned is quite simple, the high-resistance telephones being connected in series with the primary of the telephone transformer, whilst the two pairs of low-resistance 'phones are connected in parallel across the secondary winding. The series connection of the high-resistance 'phones and the primary of the telephone transformer is made by joining one tag of the high-resistance 'phones to one telephone terminal on the set, the free tag of the high-resistance telephones to one terminal of the primary winding of the telephone transformer, whilst the other terminal of the primary is taken to the second telephone terminal on the set.

F.L. (ABERDEEN) experiences considerable trouble from crackling noises in his set which he is unable to trace. He has tried several different H.T. batteries,

L.T. batteries, grid-leaks, and valves, but the noise still continues.

As our correspondent appears to have examined all the likely sources of this trouble, and as the connections are well soldered, it is very probable that the noise is due to a defective L.F. transformer or, alternatively, to the insulation of the loud-speaker being partially broken down. In both these cases the remedy is obvious, but we would suggest that to determine from which source the noise arises a loud-speaker known to be working efficiently is substituted and tested against the one at present in use. If the trouble is not found to be located in either the loud-speaker or an inter-valve transformer, we would advise that if any flex leads are used in the set, these be examined carefully, as sometimes noises arise through partial breaks in leads of this type.

A Two-Valve Wavetrap Set

Concluded from page 300.

No. 50 or 75, for eliminating a station on the broadcast band, is plugged into the appropriate socket and the Clix plug inserted into socket S. By carefully rotating the trap condenser, the station it is desired to eliminate can be reduced to complete silence on the headphones. For complete elimination the tuning is somewhat critical, and hence a vernier has been used on the trap condenser.

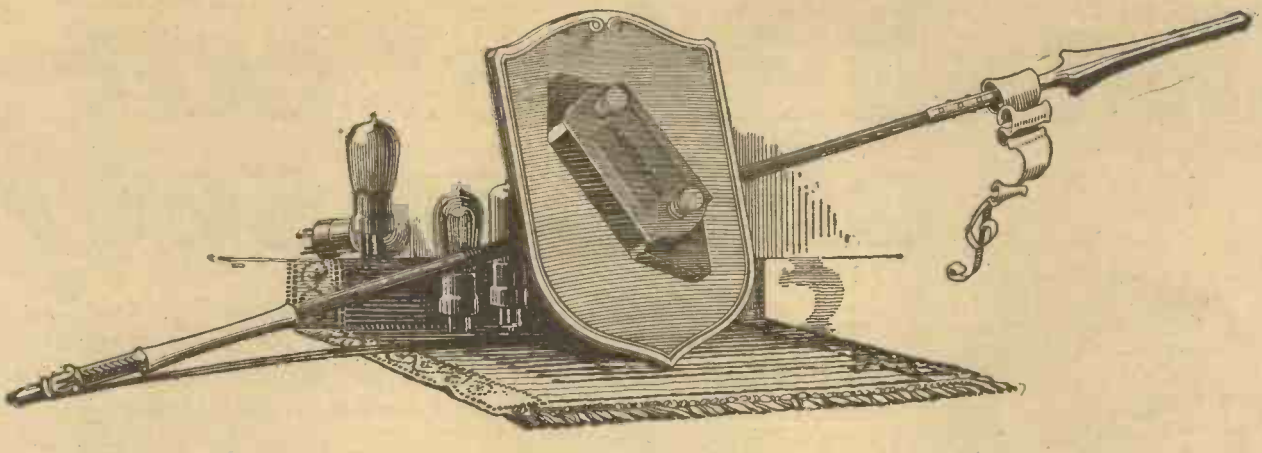
When the set was tested on a good outdoor aerial about nine miles from 2LO, a Gambrell B coil was used successfully in the wavetrap socket, and the powerful signals from 2LO could be reduced to complete silence. Using a No. 60 Lissenagon "X" coil with the aerial connected to the 10-turn tapping, it was easily possible to receive Bournemouth clearly at good telephone strength without the slightest trace of interference from 2LO. In all the stations subsequently received there was also no trace of interference from 2LO.

When aerial reaction was used on the broadcast wavelength, a Gambrell "a" was used for the reaction coil, and the coil marked 20 was found to be suitable in the reactor, using a 300-600-metres transformer.

Results

Other stations heard during the course of the tests included Newcastle and Birmingham, both of which were of good telephone strength and free from any interference from 2LO. Of the French stations, Ecole Superieure and Petit Parisien were tuned in at good telephone strength, but the latter station was subject to serious fading at fairly regular intervals. Another French station, giving the call-sign "Radio Toulouse" and operating then on a wavelength of about 300 metres, came in very well. Chelmsford and 2LO are of course received loudly.

German stations were also received, among them being Munich and Hanover, judging by the wavelengths on which these were heard, namely, 485 and 295 metres respectively.



PROTECT YOUR VALVES
with the
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THE disconcerting flash that occurs when the filament terminals of a valve are accidentally touched across the anode and grid sockets of the valve-holder is one of the expensive kind—say 8/- or more. Every amateur probably flashes away quite a lot of money this way every year. There is also a similar effect when the H.T. leads are mistakenly connected to the L.T. terminals, and the valves switched on.

These mistakes are like all others — expensive.

Valve immunity, however, can now be purchased for SIX SHILLINGS. That is the price of the new Dubilier Dubrescon, which makes it impossible for valves to be burnt out by accidental short-circuiting or similar causes.

The Dubrescon must be inserted in series in one of the H.T. leads—quite a simple operation. The H.T. current can then never exceed the usual filament current, and your valves are secure for ever. The Dubrescon does not interfere with the passage of the H.F. currents.

It is advisable to buy one now, ready for next time. And in doing so, be sure that you

Specify Dubilier

THE DUBRESCON
Insert in series in one of the H.T. leads for protection of valves.

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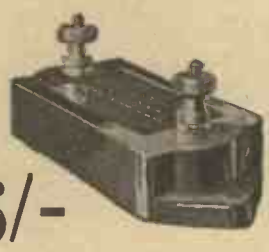

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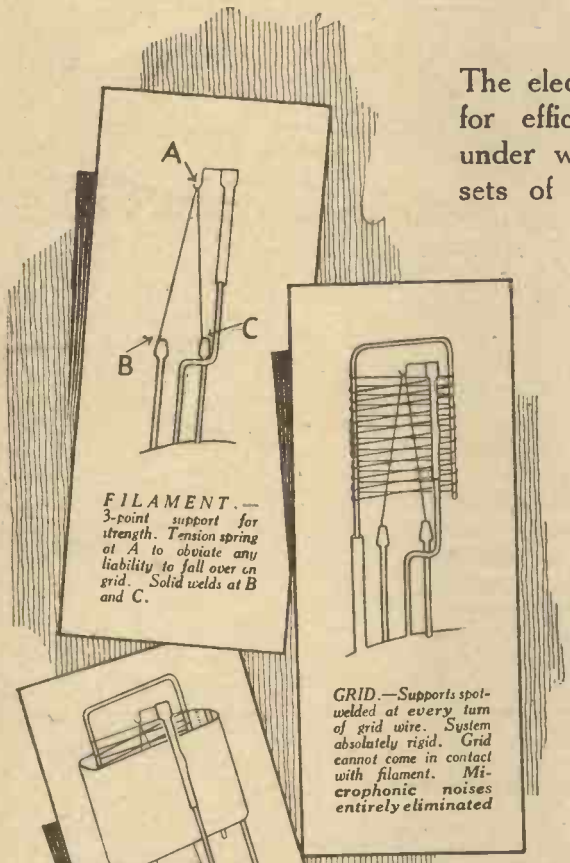
The electrode system for a given type of valve must, for efficiency, have strict reference to the conditions under which the valve is to function in use. Different sets of conditions demand different electrode systems.

Types R.5.v. and D.E.5. are designed on the scientific principle shown in the accompanying diagrams. Note the unique features of these famous valves.



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General purpose receiving valve. With relative adjustment, functions as high- or low-frequency amplifier, detector, or low-power oscillator. Filament volts, 5; filament current, 0.7; anode volts, 30/120; amplification factor, 9.

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Dull emitter, low frequency power amplifying valve. For distortionless loud speaker reproduction, with low filament consumption. Filament volts, 5 to 6; filament current, .25; anode volts, 20/120; amplification factor, 7.

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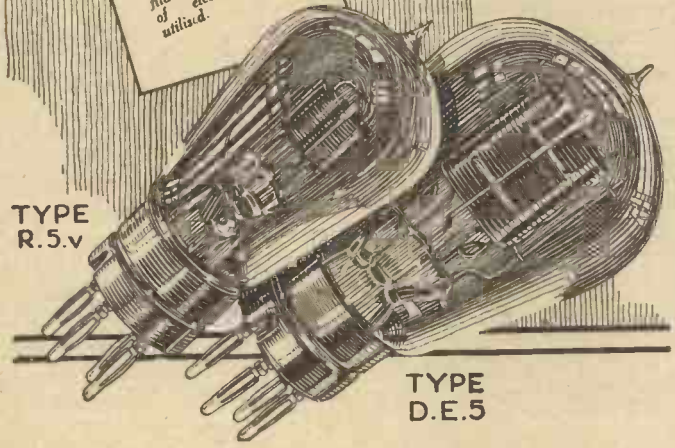

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Not so liable to burn out as 4-volt valve. Utilises electricity which would be wasted in filament resistance by using 4-volt valves. Greater length of filament increases the number of electrons emitted.

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Rigid. Supports spot-welded. Contact with filament is impossible.

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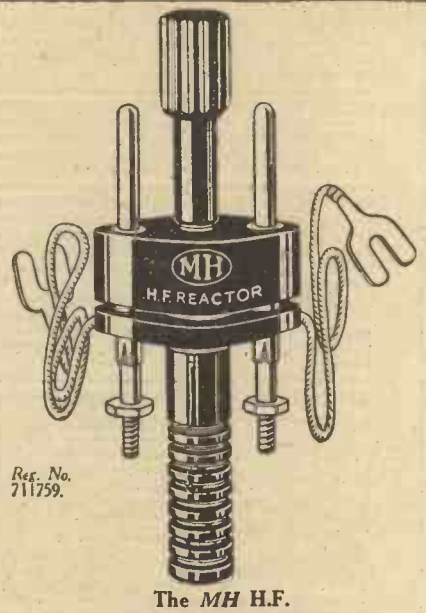
Of generous dimensions. Whole of electron stream attracted to plate and under controlling influence of the grid.



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The *MH* H.F.

REACTOR

Price* 15/- *each.

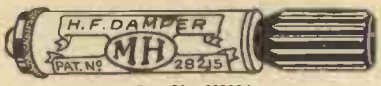
The REACTOR is a patented device for applying reaction to the H.F. Transformer instead of to the aerial coil, thereby largely preventing re-radiation and gives increased selectivity. A closer control with sharper tuning is more easily obtained by this method.

Builders of sets have always found MH Components good and sound.

You can add High Frequency Amplification to your receiver with the certainty of success.

The MH H.F. components here illustrated give you maximum efficiency with the greatest ease of control.

Beside the Pride of Achievement there is the Pride of Possession when MH components are incorporated in a set.

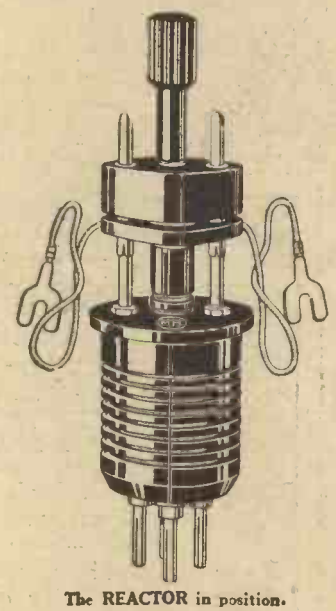


Pat. No. 228834.

The *MH* H.F.

DAMPER

Price (as illustrated) **2/-.**



The REACTOR in position.

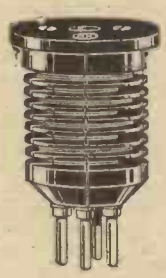
The MH Reactor circuit is undoubtedly the most easily applied and flexible reaction system ever introduced to the public. The illustration shows how it is used in conjunction with the MH H.F. Transformer.

The DAMPER in position.

THE DAMPER is a patented device which, when inserted in the central hole of the transformer, has the property of stabilising a circuit which otherwise would oscillate.

The simple expedient of introducing the Damper into the MH H.F. Transformer will, in nine cases out of ten, cure all oscillation troubles.

The pre-eminent position of the MH H.F. Transformer is not a casual happening based on chance, but on sound technical knowledge and experimental work. It was designed with a view to future development. The wisdom of this foresight is now shown by the production of the two new MH components—the H.F. Reactor and the H.F. Damper—described on this page.



The *MH* H.F.

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MH H.F. TRANSFORMERS

Supplied in six ranges of wavelengths, covering from 80 to 7,000 metres.

No. 00	80 to 150 metres	10/-	No. 1	300 to 600 metres	10/-	No. 3	1,100 to 3,000 metres	10/-
No. 0	150 „ 300 „	10/-	No. 2	550 „ 1,200 „	10/-	No. 4	2,500 „ 7,000 „	10/-

A 6, Neutrodyne Unit (Broadcast Wavelength) each 10/- No. 3 Transformer is suitable as a Neutrodyne Unit for 5XX

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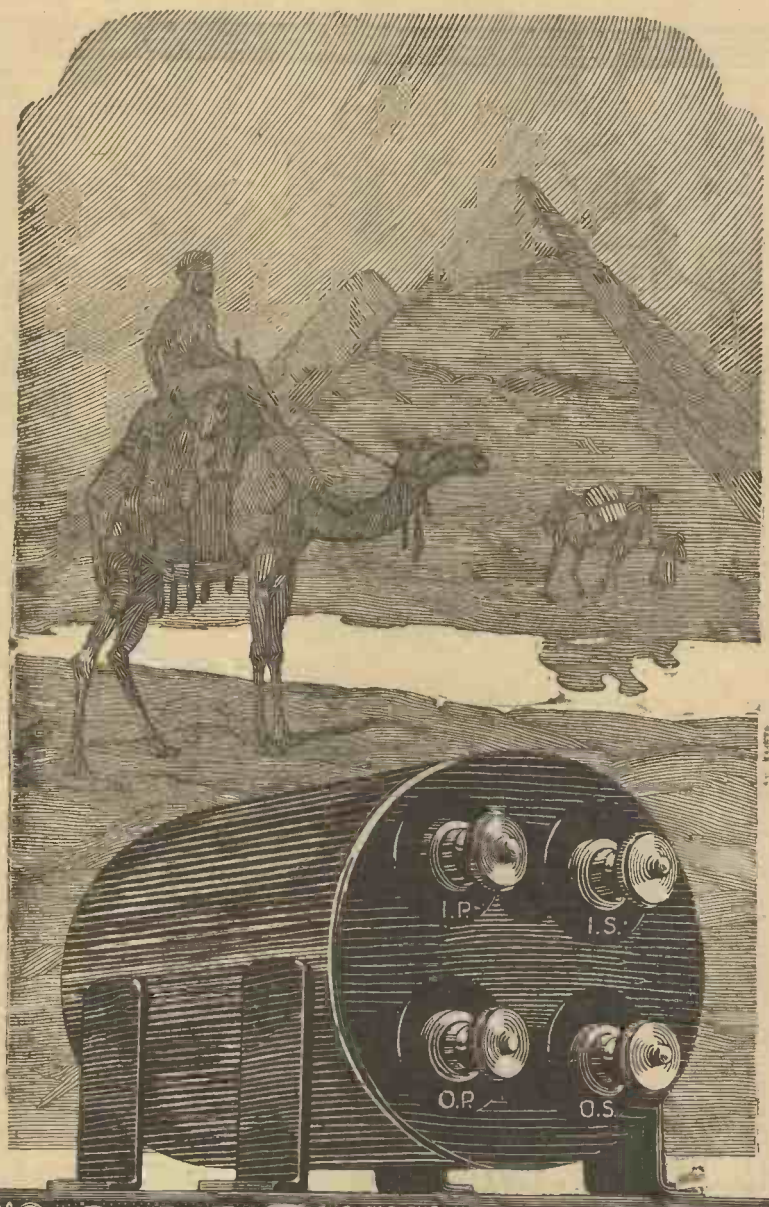

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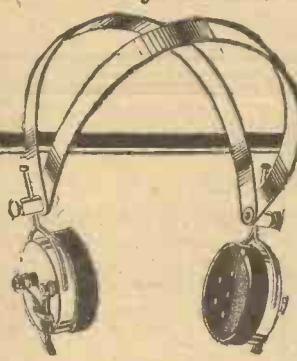

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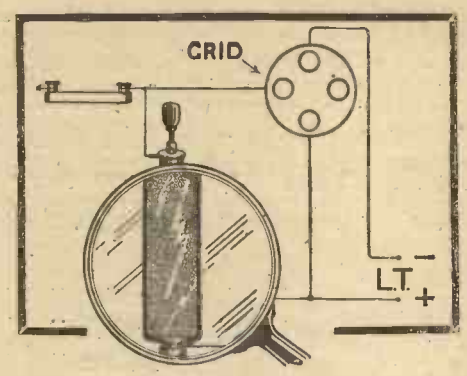

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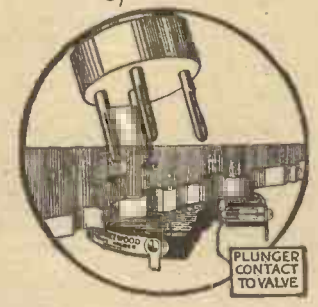

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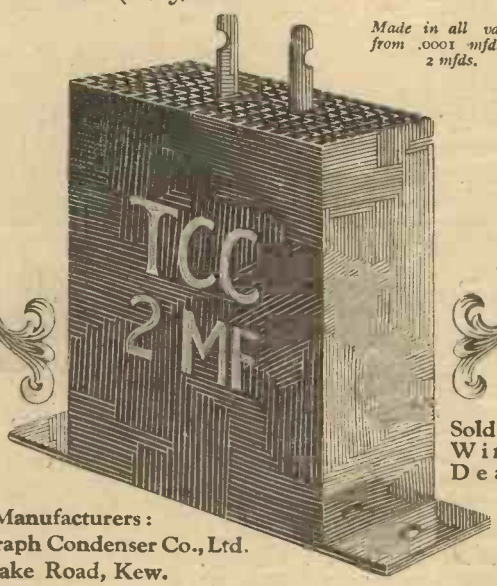

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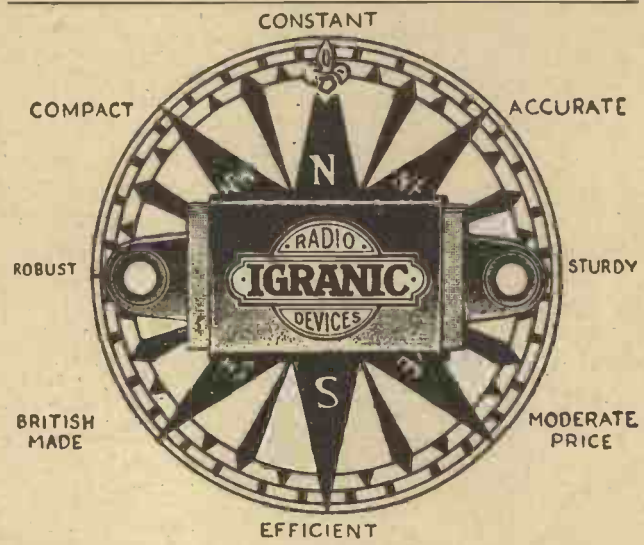

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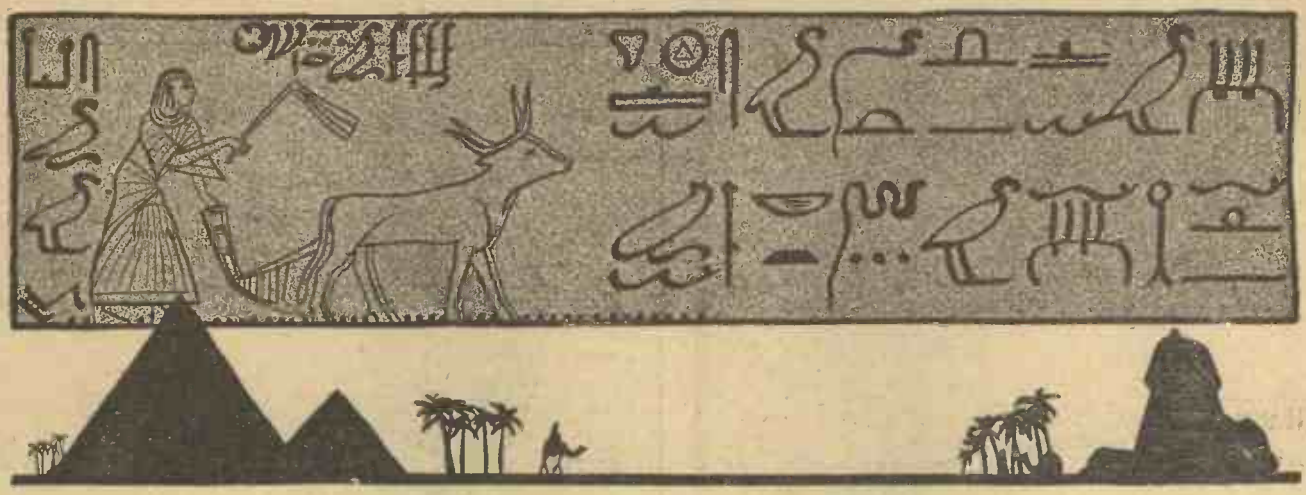

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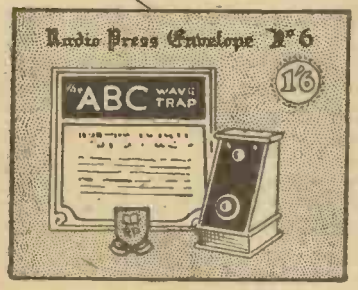

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Wireless Weekly, 6d. Net. Wednesday June 17th, 1925

Wireless Weekly

Vol. 6. No. 11.

PITFALLS IN NEUTRODYNE CIRCUITS

By JOHN UNDERDOWN

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"Low-loss"

AT the present time, if two wireless enthusiasts are heard talking, the odds are strongly in favour of the first words overheard by the listener being "low-loss." The official journal of the American Radio Relay League is suggested to have been the first to have used this phrase in its present wireless signification, but be that as it may, its use rapidly became something in the nature of a craze in America and signs are not wanting that something similar is developing in Great Britain.

Developments in variable condenser design were taking place in America at about the time of the popularisation of this hard-worked adjective in wireless circles, along the lines of improvement as regards losses in the dielectric materials used for the separation of fixed and moving plates, and to the new products the adjective "low-loss" was naturally applied, and it is, perhaps, in this connection that we are most familiar with it.

In the United States, however, manufacturers have been quick to realise the selling value of the expression, and it has been almost indiscriminately applied to an extraordinary variety of components. To such lengths has the practice been carried that Mr. Sylvan Harris, whose work on condenser losses is familiar to readers of "WIRELESS WEEKLY," has hinted that he would not be surprised if someone brought out a "low-loss" filament rheostat. There is little fear of the more sober British manufacturer indulging in such extravagances, so that at present the principal component which we see being re-designed with a view to being described as "low-loss" is the variable condenser, and new instruments of appreciably higher efficiency than the old are being welcomed upon the market by the more discriminating constructor.

It is to be hoped, however, that the dislike of the British manufacturer for the type of absurdity that is taking place in the exploitation of the low-loss idea upon the American market will not limit his attention strictly to the tuning condenser. It is doubtful, in the light of the work of Mr. Sylvan Harris, whether the variable condenser does truly deserve to be regarded as one of the considerable sources of loss at all in the tuned circuits: he has shown that the high-frequency resistance of most variable condensers of good design and construction is quite low when compared with that of the average tuning inductance or aerial and earth system.

In actual fact, a reasonable exploitation of the low-loss idea cannot fail to produce a real improvement in the breed of our components in general, done, as it would be in this country, upon the basis of conscientious investigation into the losses in so many of the parts, which constant usage alone has made us tolerate. The fact that losses in tuning inductances can be so high as to swamp almost entirely those of the variable condenser is one with which we are all familiar, and the point requires no labouring, yet how many new coils are appearing upon the market in which the now well-accepted methods of reducing losses are embodied?

Far short as many of the coil experts consider the average plug-in component to fall of the standard possible upon low-loss lines, it is not unprofitable to wonder what would be said by one of those who preach efficiency in tuning inductances if it was suggested to him that he should use tuning coils consisting of a winding of quite fine wire without any other separation of turns than that produced by slot winding, the whole inductance to be embedded in a lump of ebonite. His scorn would, no doubt, be vitriolic, yet is not the description which we have just given an approximately correct one of the average high-frequency plug-in transformer?

It may, perhaps, be argued that the losses to which we are accustomed in high-frequency transformers serve a useful purpose in stabilising our sets, but it may safely be left to the designer of circuits to make good use of a really low-loss high-frequency transformer, if the manu-

(*Continued on page* 340.)

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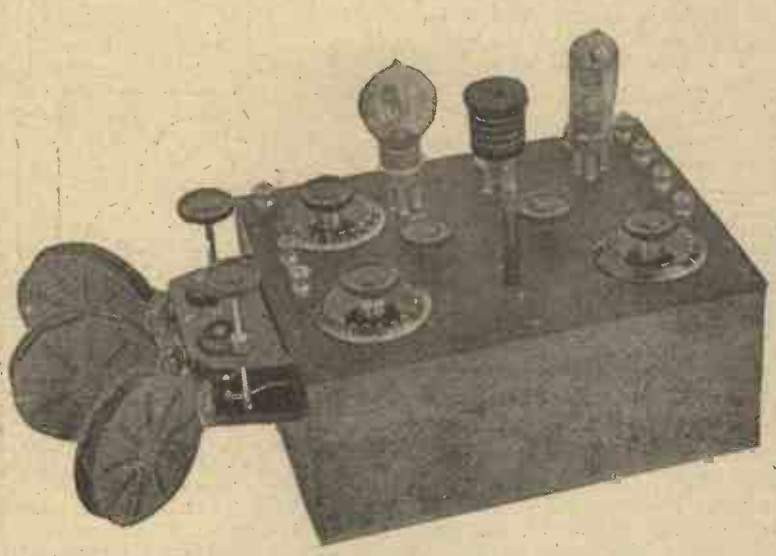
PITFALLS IN NEUTRODYNE CIRCUITS

By JOHN UNDERDOWN.



A double-circuit neutrodyne receiver, using a neutrodyne unit, described by the author in the November, 1924, issue of "Modern Wireless."

SINCE the publication of a Neutrodyne modification by A. D. Cowper, M.Sc., in *Wireless Weekly*, of September 5, 1923, considerable interest in this form of stabilising high-frequency amplifying valves has been aroused, and a number of excellent designs have appeared in various Radio Press publications from time to time. Certain troubles peculiar to this type of circuit have also made themselves felt, and a considerable amount of experimental work has been necessary to elucidate the causes. Much has been done by the Radio Press Test Department, under the supervision of Mr. Tingey,

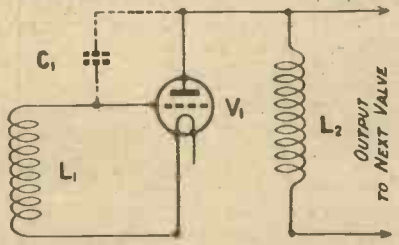


Fig. 1.—A single H.F. stage. C1 represents the plate to grid capacity of the valve.

and it is proposed in this article to give a resumé of some of the work, and also of the author's experiences on this fascinating and somewhat puzzling subject.

The Neutrodyne Principle

Before going into the subject of the particular faults which sometimes arise it is advisable that some idea of the underlying principles in this excellent method of counteracting the tendency towards self-oscillation of high-frequency valves be given.

Self-Oscillation

Referring to the circuit diagram of Fig. 1, L1 and L2 are the grid and anode coils of a single high-frequency amplifying valve, the batteries being omitted for the sake of simplicity. If, now, these two coils are magnetically coupled in the correct phase, energy will be transferred back from the plate to the grid circuit, and if this is sufficiently large to overcome the effect of losses, continuous oscillations will be generated. In cases where little or no magnetic coupling exists between the two coils self-oscillation may still occur if the inductances are of efficient design due to energy transfer taking place through the internal plate to grid capacity of the valve itself, this capacity being shown dotted as C1 in Fig. 1.

It being shown that the cause of self-oscillation in high-frequency amplifiers lies in the capacitative coupling in the valve itself as well as in stray couplings in the wiring, it now remains to deal with the methods of overcoming these difficulties in practice. The most common method used was that of applying a positive potential to the grid by the use of a potentiometer, grid current being allowed to flow, thus introducing sufficient damping to overcome any tendency to break into self-oscillation. This method, though excellent in many ways, results in a considerable positive bias being necessary if a number of stages are used and a loss of efficiency results.

The neutrodyne method, however, strikes at the fundamental

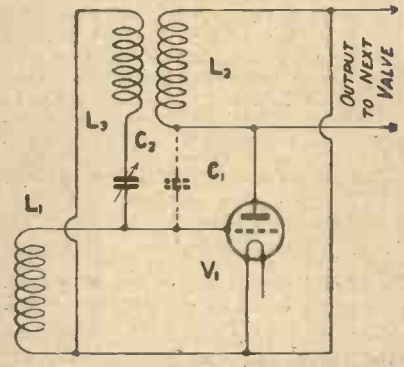


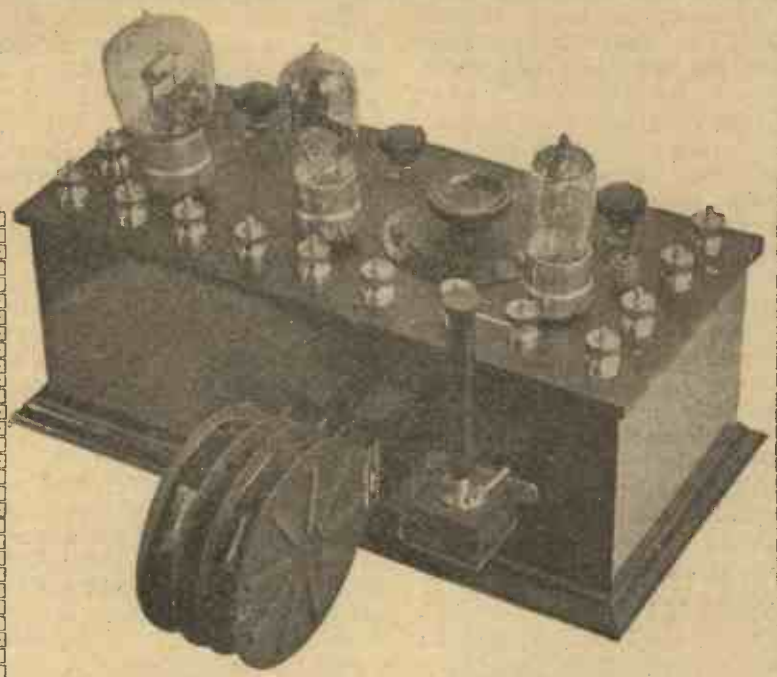
Fig. 2.—A theoretical explanation of the Cowper neutrodyne arrangement.

cause of the trouble by aiming at the neutralisation of the unwanted reaction effects produced by the valve. Reference to Fig. 2 will make the principle clear.

Alternating voltages across L2 due to the reproduction in this circuit of some incoming impulse in L1 will cause voltages to be impressed back on to the grid of the valve via the internal grid to plate capacity C1, which will set up self-oscillation in exactly the same way as it is produced by intentional capacity reaction.

Now if a coil L3 be coupled to L2 a voltage will be induced across it due to the current in the latter. If the voltage in L3

An explanation of the neutrodyne principle with valuable hints on the particular troubles peculiar to this type of set.



In this amplifier, described in "Wireless Weekly," Vol. 4, No. 14, plug-in coils are used for the anode and neutrodyne circuits.

be applied to the grid of the valve via the condenser C2 in such a direction as to neutralise the voltage communicated to the grid through the capacity represented by the dotted condenser C1, the two will "cancel out," and hence no potential is impressed on the grid which will give rise to self-oscillation. In practice, the small variable neutralising condenser C2 may be connected either between the grid and the lower end of L3 or between the lower end of L1 and upper of L3. Balance, or neutralisation, is obtained by adjusting this condenser when the correct connections to L3 have been made. If stabilisation is not obtained with one arrangement the leads to L3 should be reversed.

Practical Circuits

Having grasped the underlying principle of the neutrodyne method of stabilisation, we will deal with practical circuits and pitfalls therein. Fig. 3 shows an excellent all-round three-valve circuit consisting of a high-frequency valve, a detector and a stage of low-frequency. A coupled circuit is shown, so that the full advantage of the sensitive neutrodyned stage of H.F. may be obtained. Such arrangements have appeared in *Wireless Weekly*, Vol. 4, No. 14, and in *The Wireless Constructor*, Vol. 1, Nos. 3 and 4. Either two plug-in coils may be used for L3 and L4 or some types of high-frequency transformers, but discrimination in the type chosen is necessary. Where plug-in coils are used—a practice favoured by the writer—the spacing between coils and type of coil chosen has an important bearing on the results obtainable.

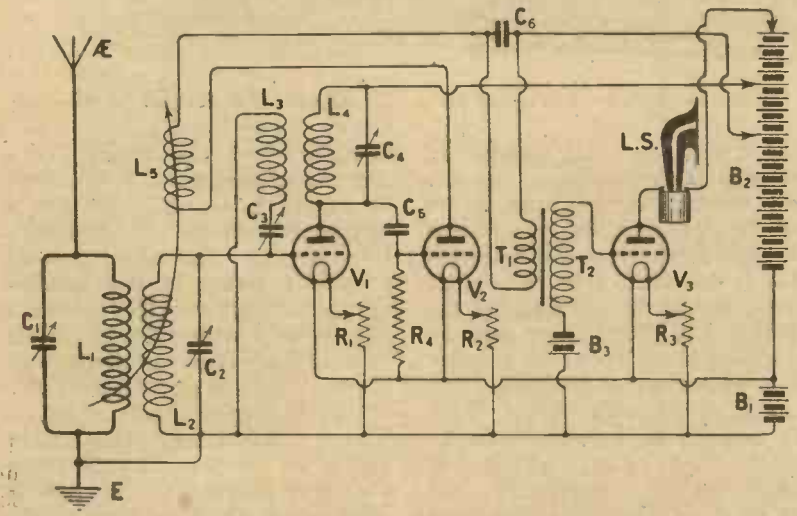


Fig. 3.—An excellent 3-valve general purpose circuit, using neutrodyne stabilisation.

Experiments

In my original experiments two Gambrell "C" coils were used, the centres of the coil blocks being separated by 1⅛ in., leaving roughly ⅛ in. spacing between the coils. C3 was one of the small neutrodyne condensers of which a large number of makes are now available. C2 and C4—that is, the condensers across the secondary and anode coils—were of .00025 μF. With these a wavelength band of 300 to 600 metres was satisfactorily covered, one setting of the neutrodyne condenser holding for the whole of this wavelength band, although, of course, needing readjustment when the coils were changed. A similar set was constructed by a friend, but a type of honeycomb coil, heavily impregnated with shellac, was substituted for the anode and neutrodyne coils. These were spaced so as to almost touch, and the set was found to stabilise in quite a normal way, but one setting did not hold for the whole of the wavelength band covered by the coils with the attendant tuning condenser, C4, in the diagram. The con-

nections were traced and found to be correct in every respect, and on substituting other coils the set functioned excellently. Subsequently the effect of separating the coils was tried, and before satisfactory stabilisation was obtained for the whole range, it was found necessary to place the coils at an angle of approximately 45 deg., and the signal strength was reduced somewhat.

From the above experiments it would appear that the coupling between L3 and L4 should be essentially magnetic in nature and high mutual capacity between coils avoided as far as possible, whilst attention should be paid to the spacing.

The Use of H.F. Transformers

Where H.F. transformer windings are used for L3 and L4 most satisfactory results are obtained where the above conditions are fulfilled, and it is advisable that a barrel type be chosen, with primary and secondary wound in separate slots. Should a type in which a higher number of turns is used for the secondary than for the primary winding be chosen, the secondary should be made the anode coil L4. This brings us at once to an observed fact in practice, namely, that with this arrangement an ordinary 300- to 600-metre type generally will only tune down to about 350 metres. In the case of a number of neutrodyned stages the above effect becomes more pronounced. This fact has been taken into account, and a number of specially designed transformers known as Neutrodyne Units are now on the market.

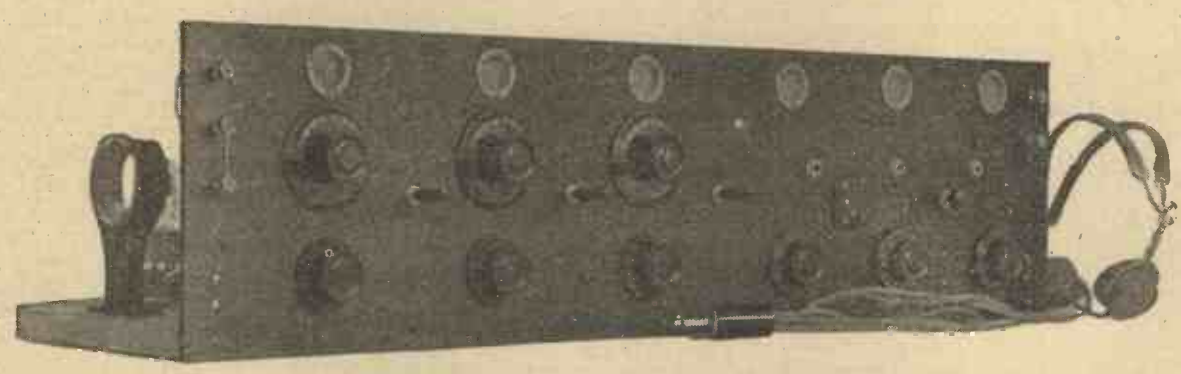
Neutrodyne Condenser Sizes

The original neutrodyne condensers placed on the British market were designed for use with plug-in coils, and for this purpose acted admirably. Where, however, the H.F. transformer type of units are used, when more than two high-frequency stages are incorporated, a somewhat larger capacity is required, and either small vernier condensers, consisting of two plates only, may be placed in parallel with the neutrodyne condensers or several types of vernier condensers of slightly larger capacity adopted.

Methods of Neutrodyning

Very little difficulty should be experienced, even by the novice, in carrying out the neutrodyning of a set, but this should not be carried out haphazardly. A rule-of-thumb method is possible where only one high-frequency stage is incorporated in the set, and taking, for example, a set with a circuit of the type shown in Fig. 3, the procedure to follow is to first remove aerial, earth, the aerial coil L1, and the reaction L5, which latter must be short-circuited by either a piece of wire across appropriate terminals, or a shorting plug. With L3 and L4 of suitable value to cover the desired wavelength range, and the secondary coil L2 of a size to cover the same range with its tuning condenser C2, set the anode condenser C4 at some intermediate value—say 30 deg.; swing the secondary condenser gradually through the whole of its scale whilst tapping the grid of V1. Oscillation will announce itself by loud ploneks over a number of degrees of the secondary condenser C2, say from 10 deg. to 50 deg. Gradually increase the value of the neutrodyne condenser from a minimum, and this band should be found to narrow down until at one definite spot oscillation ceases completely for all values of C2. The set is now stabilised. If no setting of the neutrodyne condenser gives this condition, reverse the leads to L3 and repeat.

With more complex sets, such as, for example, the Anglo-American Six, described by Mr. Percy W. Harris in *The Wireless Constructor*, Vol. 1, Nos. 3 and 4, and shown theoretically in Fig. 4, no rule-of-thumb method can be given. The set is best stabilised on an outside aerial during non-broadcasting hours or on a frame or a coil suitable for a secondary circuit during this time. All of the neutrodyne condensers should be set at a minimum and the tuning condensers rotated until some kind of signal is heard. Where a buzzer wavemeter is available this should be used. Now gradually screw in the neutrodyne condensers by like amounts and retune on the various tuning condensers. When in tune, touching the grids of any of the H.F. valves will give loud ploncks. The neutrodyne condensers should be screwed in until these are not obtained; the tuning condensers at the same time being adjusted to give maximum signal strength. This sounds rather complicated, but a little practice will soon show that the operation is comparatively simple.



The "Anglo-American Six" described by Mr. Harris has three neutrodyned H.F. stages.

Reaction

With neutrodyne sets reaction may be obtained either magnetically, by the use of a reaction

coil, as in Fig. 3, or by slightly upsetting the neutrodyne settings in Fig. 4. Where the former method is used a very much smaller reaction coil is usual than used with an ordinary circuit, and reaction control is delightfully smooth. This coil will often be of the order of a No. 25 or even smaller.

Faults

When trouble due to instability or the reverse is experienced, it is by no means easily located, and the following information should prove extremely useful.

Dealing first with the case of instability, this is often traceable in such sets as the Anglo-American Six, where a double condenser is used for the first two H.F. stages, to badly-matched neutrodyne units, partially-made joints or bad contacts in the bearings of neutrodyne condensers. This latter trouble may be cured by flex safety leads, doing away with rubbing contacts. Where the set does not function quite rightly, and the neutrodyne settings seem to require changing from night to night, the trouble may often be traced to poor joints, one case brought to my notice being a dry joint to a coupling condenser (C4 in Fig. 4), between the first two H.F. valves. Double condensers with the two sets of vanes too close together are also occasionally responsible for instability.

Lack of Oscillation

A peculiar trouble sometimes met with is that the set will not oscillate, or only do so with the neutrodyne condensers at minimum capacity settings. This effect is almost always traceable to the neutrodyne units, and is generally cured by reducing the number of turns in the neutrodyne windings, a proceeding I should not advise readers to attempt for themselves.

Instability

Another cause of lack of stabilisation has been traced to dirt between the vanes of tuning condensers, whilst a case in which the first H.F. valve could not be stabilised was traced to a break in the aerial circuit. In this latter case a too short screw in the aerial coil socket was responsible.

A set which neutralised perfectly but signals were either lacking or variable in strength, was traced eventually to the grid condenser of the rectifier valve. This condenser was mounted direct on to the usual wooden base-board, which apparently was somewhat damp. On being raised slightly from the baseboard, signals were received at normal strength.

Hints for the Experimenter

A few hints to the home constructor and experimenter will not come amiss here. Under no circumstances is it advisable to alter the layout on the H.F. side for the sake of saving space with any of Radio Press neutrodyne designs, since these are the result of considerable experiment. It should be remembered that it is useless to neutralise valve capacities unless a layout is adopted which avoids couplings between neutrodyne units. Another point sometimes raised is, can a dual condenser be used for two neutrodyned stages only?

The Use of a Dual Condenser

The answer to this is that in practice the readings on two separate matched condensers vary by a too large amount, even when matched neutrodyne units are used, to make this arrangement advisable. With three H.F. stages, the first two may be well tuned by this type of condenser, but it is advisable that the same type of valves be used throughout these stages, and these preferably of a low internal capacity type.

Major faults such as previously indicated are not always the reason for either instability or refusal to oscillate with sets of this type. A break in the neutrodyne winding has in many cases been found to be the only cause of instability, whilst the same effect is sometimes caused by bad connections, such as those made in the valve sockets taking the neutrodyne units.

In one or two cases where a set has refused to oscillate, the cause has been found in faulty insulation between valve legs, or a deposit of flux. This constitutes a leak which may impress a sufficiently positive bias from the high-tension battery on to the grid to prevent the set oscillating. One or two rare cases have been met with, where a short circuit in the neutrodyne condenser, due to the thread of the spindle wearing and depositing brass dust between the moving and fixed plates, has given rise to trouble.

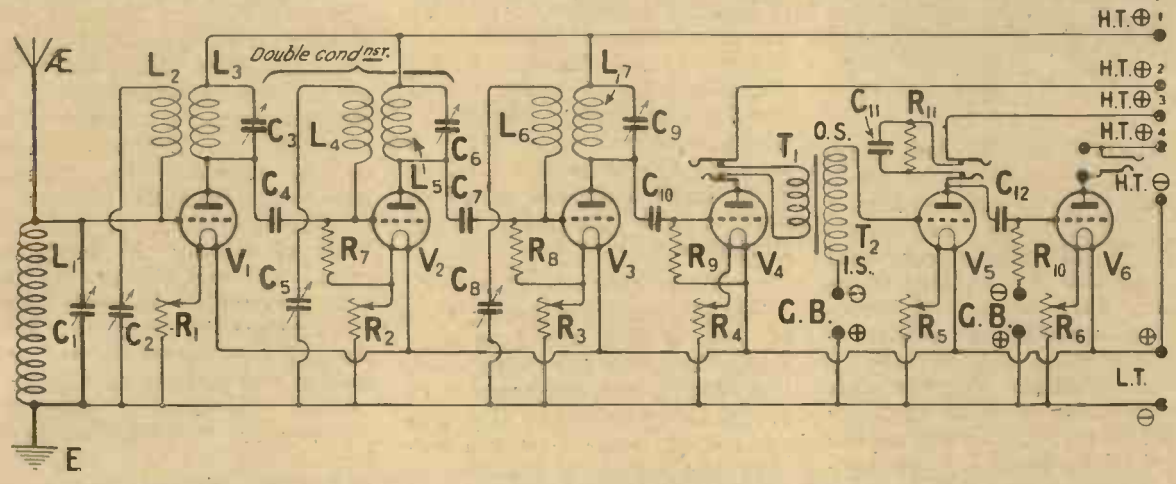


Fig. 4.—The theoretical circuit of the "Anglo-American Six," which employs three neutrodyne stages.

Integral or Separate Verniers?

By G. P. KENDALL, B.Sc., Staff Editor.

Some brief notes upon a subject which often perplexes the wireless constructor.

THOSE who can remember the conditions obtaining when the wavelengths most used by amateur transmitters were in the neighbourhood of 1,000 metres will recollect that when one spoke of a vernier condenser in those days one was referring to an appliance which often had as many as five plates, three fixed and two moving, and was capable of giving quite a considerable capacity variation.

Modern Practice

It seems perhaps a little strange in the light of present practice that a vernier condenser should have been needed at all upon such long wavelengths, but it must not be forgotten that most of the work was done with telephony rather than with Morse, and since low-power signals did not carry well upon these waves (by comparison with the remarkable ranges covered upon what we now regard as short waves), and therefore those of us who attempted long-range reception spent much of our time in endeavouring to follow the very weakest of speech.

Possibly if we attempted to perform the same operations with the aid of the skill which we have acquired in making delicate adjustments upon the shorter waves, we should find that vernier devices were no longer necessary upon 1,000 metres; but be that as it may, verniers certainly achieved a certain amount of popularity at that time, and since they had to produce comparatively large capacity variations, it was customary to provide them with either five or three plates. A capacity variation of such an extent called for a separate small condenser, and therefore it was decidedly unusual to see one of the integral arrangements with which we are now so familiar. A separate condenser was used, of quite small size, and wired in parallel with the main tuning condenser.

Shorter Wavelengths

The change to the shorter wave of 440 metres, the increasing popularity of the 180-metre wave, and, finally, the development of broadcasting on waves of 300 to 500 metres, brought about a considerable change in practice. A large range of capacity variation in the vernier device was no longer necessary or desirable, and a single pair of plates of standard size and spacing was found quite adequate for the purpose. It was then practically possible to incorporate the vernier device with entire success in the condenser itself by the simple expedient of providing a hollow spindle carrying the main set of moving vanes, an inner spindle passing down through this and bearing upon its lower end a single moving plate, which could be operated independently of the main set.

There are, of course, a great variety of possible mechanical arrangements of the device, but the main principle of incorporating a single separately controlled vane in the condenser for fine adjustment purposes is generally described as an "integral vernier device." At the same time the separate vernier condenser has undergone much modification, becoming smaller in general dimensions and in its capacity range.

Separate Verniers

Take first the method of obtaining fine adjustment which places in parallel with the main condenser a separate miniature one consisting of perhaps one moving and one fixed plate, which we have been considering under the description of a separate vernier condenser. The attractions here are that we have entirely separated the "fine" adjustment from the "coarse," so that one quickly acquires the habit of moving the hands instinctively from the one to the other, as tuning is carried out.

These are the principal attractions of the separate vernier, and they appear to have considerable weight in the minds of many designers; but against them must be set the fact that additional wiring is involved, and while this may be a minor matter in the hands of a good designer, if the spacing of the component is not done with a certain amount of discretion the casual capacities of the extra leads may have a considerable harmful effect upon the minimum capacity of the tuning condenser. In any case the minimum capacity of the vernier condenser will be added to that of the main condenser, and this may in some designs be quite a serious factor. Another serious objection to the separate vernier is to be found in the fact that any losses which it may possess in the way of dielectric losses in the insulating materials of which it is built, and so on, will be added to those of the main tuning condenser, and in some designs which I have seen this must, no doubt, be quite a serious consideration.

(*Continued on page* 334)

Aperiodic Primaries and Signal Strength

By A. D. COWPER, M.Sc., Staff Editor.

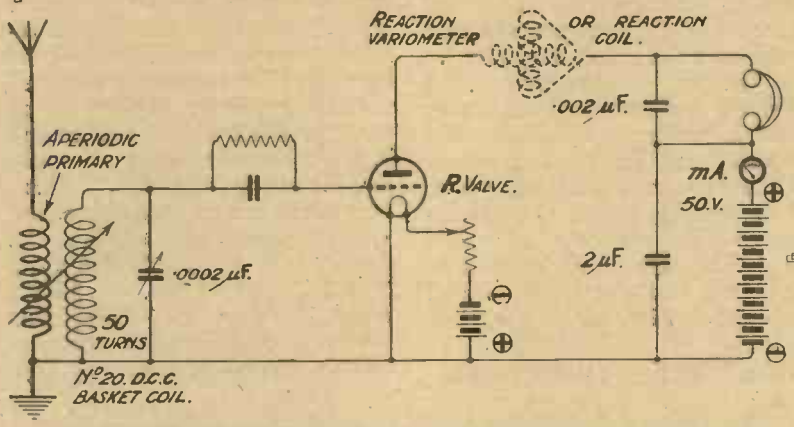


Fig. 1.—The circuit used by Mr. Cowper for measuring signal voltage with different aperiodic primaries.

In this contribution Mr. Cowper describes his observations following upon experiments with untuned aerial circuits. This form of coupling is extremely popular in America, and Mr. Cowper gives below measurements of signal strength with this and the more common direct-coupled method.

IN connection with experiments carried out by the writer with the ultra-low-loss type of inductance, wound with spaced No. 18 wire on large skeleton formers, in order to obtain extreme selectivity it was found necessary to use aperiodic primary coils very loosely coupled to the low-loss secondary. The question immediately arose regarding to what extent signal-strength is sacrificed to selectivity in such combinations, particularly when using (as usual) critical and finely-controlled reaction.

Aperiodic Aerials

I learn on excellent authority that aperiodic aerial coupling (generally with a primary coil of about 20 turns placed inside a secondary coil wound on a bakelite former about 3 in. in diameter) is increasingly popular in the States, so that practically every new receiver of any pretensions (not a "super-het.") is equipped with it: careful experimenters have long ago discovered, we are told, that the exact design of this aperiodic primary is not a matter of great moment—so that the real "low-loss" inductance should be the secondary—and that any advantage accruing from the use of a *tuned* primary is far outweighed by the extra tuning difficulties involved.

Some pioneer work in this field of loose-coupling and signal-strength relationships has been done by Mr. G. P. Kendall, whose articles on the subject in *Wireless Weekly*, Vol. 5, Nos. 14 and 20, and Vol. 6, No. 2, will repay careful study, particularly in relation to tuned-primary and auto-coupled circuits. The writer has lately made some observations with the aperiodic-primary loose-coupled circuit, in connection with low-loss secondary inductances, which support in a surprising way the current practice in American selective receivers; these observations are summarised here, but without expressing any opinion as to what extent this current practice is based on experimental data rather than on manufacturing and operating convenience.

The method of procedure was similar to that detailed by Mr. Kendall in his articles, using the well-known Moullin thermionic voltmeter, calibrated approximately directly in volts for convenience in recording results: a Weston Model 375 galvanometer, shunted by a resistance of 13 ohms, together with a Pye plate milliammeter, being used to record the depression of the plate-current resulting from the received signals. 2LO's wave at about a dozen miles was used, received on a very large high aerial or on a low single-wire one adjacent, alternatively. The Weston instrument was shunted so as to read one volt (applied signal-voltage) per five divisions, thus saving much time and calculation.

Experiment

First the results obtained by Mr. Kendall with auto-coupling on various aerials with a single-layer coil of No. 22 d.c.c., 50 turns on a 3 inch ebonite former, were checked on the ultra-low-loss coil, with 45 turns of No. 18 enamel-insulated wire air-spaced on a 6 inch diameter skeleton former; the substantial identity of the signal-strength without the use of reaction, as well as when

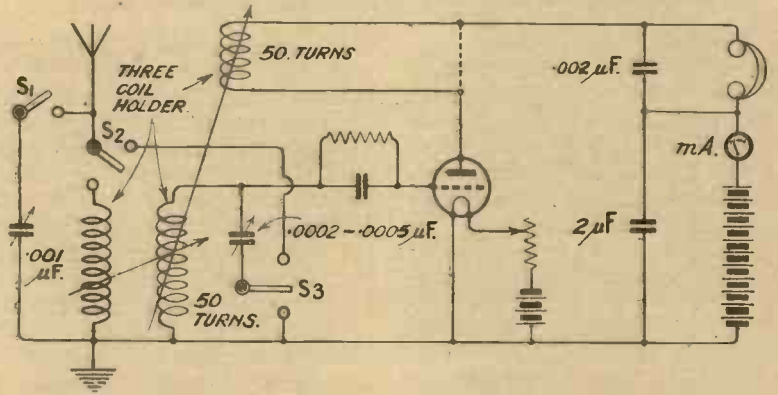


Fig. 2.—An arrangement for comparing signal strength with tuned and untuned primaries, and direct coupling.

using reaction pushed to the limit consistent with good quality, with an aerial-tap at the 10th turn or with simple direct series-aerial-condenser coupling, was also established on both aerials. Reaction was obtained with a plate variometer of considerable resistance and distributed capacity, giving easy control.

Direct Coupling

Then the effect of various designs of direct-coupled inductances (such as would be used later as primary coils) on signal-strength was investigated, without the use of reaction. (It is a commonplace to most careful observers that by the use of powerful reaction almost any kind of poor high-resistance inductance can be forced to give fair signal-strength on a local powerful station, if selectivity and a silent background are ignored, so that there is little point in making elaborate measurements in this field.) The rather surprising fact was noticed that, in common with crystal-reception, the resulting unaided signal-strength was largely independent on the *type* of inductance used, provided that it was of reasonably good design and tuned to the wavelength with approximately the same amount of added tuning-capacity. By the well-known expedient of introducing series resistance in this oscillating circuit until the signal-strength is approximately halved, the effective resistance of the circuit could be investigated, and came out in each case at an astonishingly large figure, in spite of good aerial-connections and insulation, and an excellent direct earth. The low-loss inductance when used with a series tuning-condenser was much more sensitive to added resistance than an ordinary type of coil; but there was little to choose between them when used with about the same amount of parallel tuning-capacity. This observation explains perhaps why progress has been so very slow in the matter of improving the efficiency of tuning-inductances used in ordinary receivers; but beyond that it emphasises the fact of the enormous damping power of the outside aerial, close coupling to which makes it impossible to develop the remarkable sensitiveness and selectivity of real low-loss circuits.

Signal Strength Measurements

The final stage was the measurement of resulting signal-strength when various types of primary coils were coupled loosely with a secondary of low-loss design: for convenience when using an ordinary three-coil-tuner the secondary coil adopted here was a large basket-coil of No. 20 d.c.c., loosely wound and with skeleton mounting, the 50 turns giving a convenient tuning-range with either direct-coupling, with series-condenser, or as a secondary coil with small tuning capacity (around the .0001 μF neighbourhood). This was shown previously by actual measurement to possess an H.F. resistance quite comparable with that of an ultra-low-loss coil, though, of course, of appreciably greater magnitude.

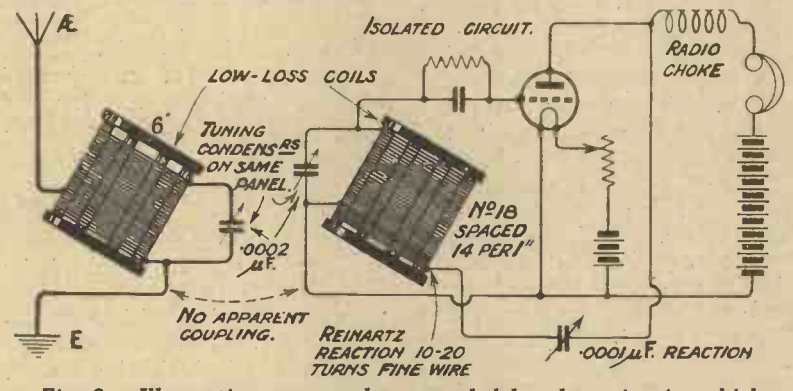


Fig. 3.—Illustrating apparently uncoupled low-loss circuits which are nevertheless close coupled when eighteen inches apart.

Aperiodic Primaries

Without reaction the signal-voltage was measured, first with direct coupling and then with various primary coils of inductance-value insufficient to tune the aerial to the received signal-frequency, used "aperiodically," and lastly with the aerial coil tuned with a variable condenser in parallel (as in Mr. Kendall's experiments in *Wireless Weekly*, Vol. 5, No. 14). Briefly, the results showed that on the whole the best signal strength was obtained with an aperiodic primary of 25 turns of thick d.c.c. wire wound in some manner giving a fairly low distributed capacity. There was not much to choose between a large basket-coil of No. 14 d.c.c. and a roughly-taped-up "hank" coil of No. 18 d.c.c.; whilst neither of these was *markedly* superior to a commercial No. 25 coil of extremely high resistance.

Optimum Coupling

Evidently the relatively enormous resistance-damping of the outside aerial almost completely swamped any difference in the H.F. resistance of the aperiodic primary coil, as it does in practice with direct-coupled circuits. A fairly well-marked optimum position of coupling was noticeable, which differed for different types of coils, just as Mr. Kendall noticed for *tuned* primary coils.

Tuned and Untuned

Comparing now the signal-voltage recorded with *tuned* and *untuned* primaries, the surprising observation was made that on the aerial used, and with the 25-turn primary necessary to cover the whole short-wave belt of broadcast stations, British and Continental, on this aerial, the signal-voltage was sensibly greater (2.6 volts against about 2.5) with aperiodic primary at optimum coupling than with parallel-tuned primary; and was not inferior to the signal-voltage obtained with direct, series-condenser coupling to the aerial.

Reaction

With magnetic reaction direct on the secondary coil, there was again nothing to choose between the couplings as far as audible signal-strength went, nor by observation of the rather uncertain value of apparent signal-voltage just before self-oscillation set in.

Estimating roughly the degree of selectivity by the number of condenser-degrees over which

loud-speaking resulted on the local station, with *fixed* aperiodic primary the selectivity was much of the same order as with direct series-condenser coupling; and was improved upon with tuned-primary coupling only when full advantage was taken of the power of the latter to maintain signal-strength when aparently more loosely coupled, *i.e.*, at a greater distance.

Distant Reception.

Repeating the test, but with full reaction, on distant stations (French, German and Spanish), using a single R valve and the large aerial, it very soon became obvious that any slight improvement in signal-strength made, *e.g.*, by using a (low-resistance) 35-turn coil for *tuned* primary, having but small additional tuning-capacity in the primary circuit, was far more than compensated for by the very much greater ease and certainty of tuning with a 25-turn *aperiodic* primary, fairly loose-coupled at the start, and used in the last stage for fine tuning-adjustment by slight alterations of the coupling. The selectivity was quite adequate for separation of distant stations on wavelengths that did not actually heterodyne mutually. For tuning out the loud local station a series-acceptor-circuit across this aperiodic primary (as suggested on several occasions lately by the writer) gave practically complete relief and a silent background.

The use of tuned-primary inductances dates from the days of exclusively medium or long-wave telegraphy reception; what is excellent sound practice in that connection must not be allowed to dominate practical short-wave telephony reception. The experiments outlined here, confirming completely the soundness of current American practice, indicate that the extra complication of a tuned primary is well-nigh pointless in fact; and they should vindicate to some extent the technique suggested by the writer in connection with ultra-low-loss circuits of getting away, as it were, as far as possible, from the heavily-damped and frequently shock-excited outside aerial, by extending the principle of loose-coupling to an aperiodic primary.

Opening of the High-Power Station at Daventry

We understand that the B.B.C. have every hope of opening the permanent high-power broadcasting station at Daventry on July 30.

The great masts which are being erected to support the aerial are now well under way, and are being rapidly completed.

The two masts are of lattice construction and triangular in shape, and a beacon light is to be placed at the top of each one to prevent the possibility of low-flying aeroplanes dashing into them in the dark. When completed they will be 500 ft. in height, and a distance of 800 ft. apart. A special ladder has been built inside the masts so that the engineers may climb to the top with a minimum of difficulty.

Among the most unusual features of the new station is the earth system, which is a tremendous ring of metal encircling the whole station, and buried below the surface of the ground. Wires radiate to this ring from a point below the centre of the aerial.

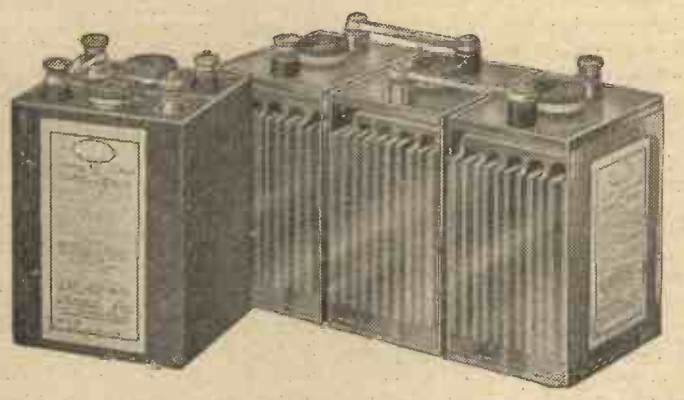
CANTERBURY CATHEDRAL.

Placing the microphone in position for broadcasting the tercentenary celebration of the well-known church musician, Orlando Gibbons, from the Canterbury Cathedral on June 5th.

Precautions in Charging Accumulators from D.C. Mains

By S. H. PAGE, C.M.G., F.S.I., M.R.San.I.

Some notes on the precautions advisable to be taken with a view to preventing fires occurring during the charging of secondary cells in celluloid cases from supply mains.



IN view of the possibility of fires occurring through charging batteries in celluloid cases from the ordinary supply mains, it seemed to the compiler of these notes to be essential to carry out some actual experiments in order to verify, or perhaps otherwise, certain theories and views he had formed as to the causes of those fires.

The author wishes to acknowledge very fully the great assistance he has received from Mr. C. E. Hume, the engineer in charge of the Ramsgate and District Electric Supply Works, who has devoted much time and trouble to assist in the experiments, and has himself made a number of valuable suggestions.

Experiments.

The experiments will firstly be recorded, and some suggestions put forward for necessary precautions to be observed, to which latter will be added some explanations as to the reasons for their observance.

(A) An ordinary piece of wood, quite dry and sound, had some electrolyte (sulphuric acid, spec. gravity 1.250) split over a portion of it, in order to reproduce artificially the usual condition of the wood on which it is so frequently found that accumulators on charge are standing; it should be noted that about half the length of the wood was thus impregnated with acid, and the rest of it was carefully kept dry.

Wires were then taken from the negative live main and the earthed positive main, giving a potential of 240 volts, and resistances were introduced into the negative lead in order to limit the maximum possible current to 2 amperes.

The two wires were then applied to the dry end of the wood, at a distance of only half an inch from each other.

Result—no leakage of current apparent, and no sign of any effect on the wood over many minutes duration of the test.

The two wires were then applied to the end of the wood which had, some time previously, been impregnated with acid; for this test the wires were placed over 2 in. apart.

Result—the whole of the wood between the two wires started to char within a very short time, and within ten minutes had burst into flames.

(B) A piece of celluloid cut out of an accumulator case, and damp with acid, was then placed on the wood and the wires applied, again at somewhat over 2 ins. apart.

Result—nothing apparent for some minutes, and then a very slight jarring of the bench caused a slight arc, which gradually increased until the celluloid burst into flames.

(C) An accumulator in a celluloid case was stood on a piece of wood, known to be impregnated with electrolyte; the wire from the live negative main was taken through resistances to limit the maximum current to 3 amperes, and was attached to one terminal of the accumulator; the second wire, from the positive earthed main, was laid across the wood on which the accumulator was standing, at a point rather more than 2 ins. away from the nearest part of the accumulator, and on the opposite side from where the negative wire was attached to the terminal; thus, if any current was to pass, it had to pass down the outside of the celluloid case and then pass along the wood to the second wire.

Result—on the current being turned on, there appeared to be no effect for the first ten minutes; soon after this, very minute sparks were observed round the base of the accumulator below the part where the live wire was attached to the terminal, and therefore some distance away from where the bare wire was lying on the wood; charring of the wood began to be apparent round the base of this part of the accumulator, and sparking and charring gradually developed from the wire lying on the wood.

After fifteen minutes, the base of the accumulator caught

fire, and the wood round the second wire was red glowing tinder; at sixteen minutes the fire subsided, and the flames round the accumulator went out; the wood round the second wire was still glowing, and considerable sparking was going on round the base of the cell; at twenty minutes, the base of the accumulator suddenly burst into flames and burnt through the celluloid case, letting all the acid out; the flames then went out, but the wood continued to glow and there was much vivid sparking inside the case.

The experiment was stopped after an hour, and it was then found that the whole of the base of the case had been burned away, whilst the wood was charred through, almost to the back.

Observation of the actual amount of current passing was made throughout the experiment, and it was found that, for the greater part of the time, the current did not exceed half an ampere, falling at times to about a quarter of an ampere, but that on two occasions, when there were bursts of flame, the current rose to 2 amps.—it did not exceed the latter figure at any time during the experiment.

(D) An accumulator in a celluloid case was coupled up to a circuit of 240 volts at 2 amps. current; one of the wires was carefully secured to one terminal and the other wire was loosely put on the other terminal, and not properly tightened down.

Result—nothing abnormal over a period of several minutes, after which a very slight vibration was started on the battery, when some slight sparking was observed at the loose terminal; the vibrations were allowed to continue, and about ten minutes later there was a sudden brilliant arc from the loose terminal to the case, and the whole battery blazed up so fiercely that it had to be promptly extinguished to prevent damage to the surroundings.

(This experiment was not conclusive; it was intended to allow the vibration to be initiated by the excessive gassing of the cells, but time did not permit this, and artificial vibration was introduced, which is, of course, open to criticism. It is hoped to repeat the experiment, when a favourable opportunity offers, to ascertain if natural vibration is sufficient to induce an arc.)

(E) A Megger resistance tester generating 500 volts was connected to the top and bottom respectively of a

perfectly dry celluloid battery.

Result—no current whatever passed, the instrument recorded "infinity."

(F) The Megger was applied to the top and bottom of the same case after a piece of cotton wool, which had been damped with electrolyte some two or three days previously, had been rubbed over it. The feel, and appearance, of the case after this had been done was little different from that of the "perfectly dry" case as used in Experiment E, and was certainly not nearly so damp as the majority of cells are whilst charging.

Result—the dial showed the resistance had fallen from "infinity" to 8 megohms.

(G) The case was then artificially damped with electrolyte to reproduce what appears to be the usual state of many cases when the cells have been strongly gassing for some time, and the Megger test was applied as before.

Result—no indication of any resistance was obtained; the full output of the current was passing over the outside of the case from one wire to the other.

(H) The two wires from the Megger were held against the dry end of the wood used for Experiment A, and about 2 ins. apart from each other.

Result—no current passed, the dial recorded "infinity."

(I) The two wires were then held against the part of the wood which had had electrolyte spilt on it the previous day. This part had now the appearance of being quite dry—the wires were kept rather over 6 ins. apart.

Result—the current passed freely across the 6 ins. of wood, the dial recording not the slightest sign of any resistance whatever.

Lessons Drawn from the Experiments

The lessons which appear to be conveyed by these results are:—

1. That wood should never be used to stand celluloid cells upon whilst being charged; experience shows that such wood *always* gets a certain amount of acid impregnation.
2. That celluloid is a perfect non-conductor when *perfectly dry*, but a very dangerous material when even slightly damped with acid; experience shows that cells, whilst charging, nearly always get at least slightly damp, and often very damp.
3. That, when the connections to the terminals are perfectly tight, the chief danger arises from any wooden base they stand on, and

that although the bottom of the battery itself may be charred and even burned away, the case itself does not appear to tend to burst into flames until the wood itself ignites and sets fire to the celluloid case.

4. That, when the connections to the terminals of the battery are at all loose, there is a grave danger of the celluloid case being ignited by an arc at the top, when the whole case burns rapidly with intense heat and a large amount of flame.

An attempt has therefore been made to formulate some suggestions which would have the effect of minimising the risk of fire, and to confine them to simple rules which may be appreciated by the ordinary user. After careful consideration these suggestions have finally reached the forms given below; explanatory notes are appended which may help to clear up any doubt as to the reason for the suggestion.

Precautions to be Observed to Minimise Risk of Fire

Under no circumstances shall any accumulator stand on, or otherwise touch, any wood or other absorbent material whilst connected to any live main. Any vertical woodwork should be at least 4 ins. away from any accumulator on charge.

(Experiments A, C, and I are sufficient explanation to prohibit wood being placed under or near the cells. As heavy gassing from the cells invariably makes everything round slightly damp with the condensation from the gas given off, the need for the regulation as to vertical woodwork will also be apparent.)

All accumulators, whilst connected to any live circuit, must stand entirely on glass, porcelain, glazed earthenware or slate, which must be kept clean and in a condition to act as an efficient insulator from the earth.

(See the results of Experiments A and C; the necessity for keeping the insulators clean is shown by the fact that where large lead-lined wooden cells are used at a station, each cell is generally supported on independent insulating feet, and it is generally found that if the wood of any cell shows signs of charring on the outside, the cause may be traced to the insulators below having become dirty and thus allowing a passage of current to earth.)

Whenever two or more accumulators are being charged in series, there shall be a clear space of not less than 1 in. all round every part of each separate accumulator.

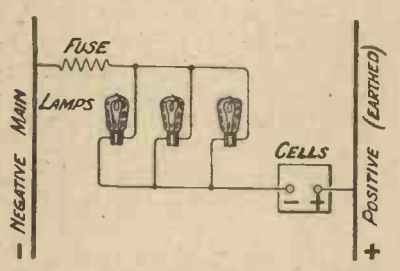


Fig. 1.—Arrangement of connections necessary when the positive lead of the D.C. mains is earthed.

(It has been observed that it is common practice at garages and wireless shops, where charging is carried on commercially, to put all accumulators on charge more or less bunched, without care whether they touch each other or not. As the pressure drops about 2½ volts for every cell (not battery) through which the current passes, it is evident that there is frequently a difference of potential between the first and last cells, sometimes amounting to 100 volts; if, then, say the corner of the last cell is touching the side of the first cell (as in the case of a U-shaped bunch of batteries connected to a pair of leads at one end of the bunch), there is a constant pressure of considerable voltage trying to get across from the terminal of the first battery to the terminal of the last battery. Experiments B, D and G show how vital it is to eliminate any danger arising from this.)

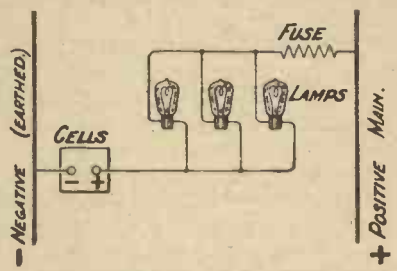


Fig. 2.—When the negative lead of the D.C. main is earthed the accumulator should be connected as shown.

No naked lights and no smoking should be allowed within two yards of batteries on charge.

(The mixture of gases produced by batteries when completing their charge, i.e., gassing, is hydrogen and oxygen, and is very explosive; cases of accidents occurring from this cause, and of cells being actually and literally "blown to pieces," are not unknown; although no actual case of fire originating in this way is known to the compiler, it is manifest that it is not outside the scope of probabilities.)

Where supply mains are from a three-cable system (i.e., two live mains and one earthed main) no charging plant shall ever be connected to more than one live main—the second wire of the charging plant shall be connected only to the earthed main.

(This is not likely to concern the ordinary user, as the supply from the mains would, in all ordinary cases, be from one live and one earthed main, but in cases where a special power circuit of, say, 440 to 500 volts is supplied to users of machinery, it would apply; it would seem needless to make a regulation of this nature, but cases of its non-observance have been met.)

Wherever supply is taken from mains, of which one wire is earthed, the accumulators are always to be coupled direct to the earthed wire (with no lamps or other resistances intervening), and the lamps, or other resistances, should be introduced between the accumulators and the live wire (i.e., the wire that is not earthed.)

(The reason for this is that, if a sudden rush of current should break down the lamps or blow the fuse on that side, the current would be cut off and the cells would be connected only to "earth potential" and consequently no pressure on them; if, on the

(*Concluded on page 329*)

A Loud-Speaker Circuit on the Omni Receiver

Another circuit which may readily be tested by those readers who possess Omni Receivers.

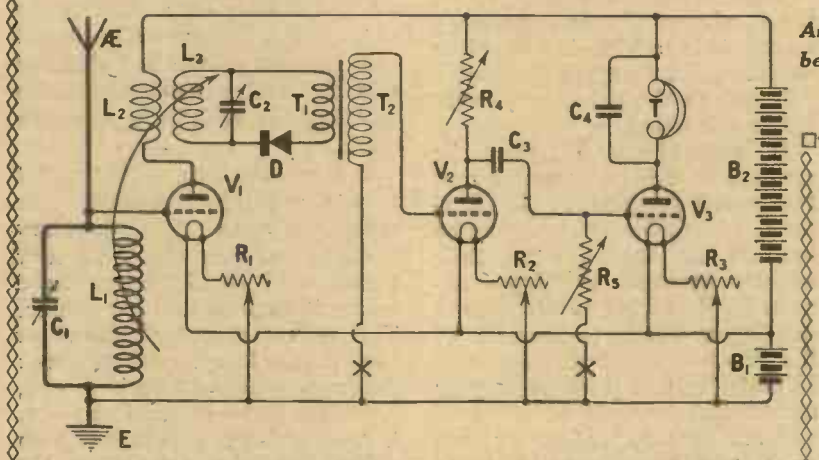


Fig. 1.—The theoretical diagram of the circuit discussed below.

HERE are several circuits suitable for use where loud-speaker reception from the local station is required, and that shown in Fig. 1 should appeal to many. Two stages of low-frequency amplification are employed, the first stage being transformer coupled, while the second stage is coupled by means of the resistance-capacity method. A crystal detector is employed, and in the present circuit "Tri-coil tuning" has been used in order to obtain a high degree of selectivity.

Functions of the Circuit

The aerial is tuned by the coil L1 and variable condenser C1 of 0.0005 μF capacity, the incoming impulses being applied to the grid of the valve V1 which amplifies at high frequency. The coils L2 and L3 comprise a high-frequency transformer, the latter coil being tuned by C2 of 0.0005 μF capacity.

Rectification is carried out by the crystal detector D, the resultant rectified currents being transferred to the grid of V2 through the low-frequency transformer T1 T2. The amplified low-frequency currents in the anode circuit of this valve set up varying potentials across R4, whose resistance is of variable value, these being applied to the grid of the last valve through the condenser C3, whose capacity may be between 0.002 μF and .5 μF. The usual leak R5 is placed between the grid and negative side of filament. The telephones are included in the anode circuit of the last valve.

Connections for the Omni

Those readers who possess Omni receivers may easily wire up this circuit, the following connections being required upon the terminal board:—

51—33	30—14
33—34	29—48
42—41	6—36
41—52	44—24
33—12	36—45
52—48	46—16
4—25	16—13
17—24	5—48
1— 2	8—31
9—10	23—24
10—20	32—40
28—21	31—38
22— 2	37—23

Coils

The three coils L1, L2 and L3 are mounted in the three-coil holder on the left-hand side of the cabinet, their positions being respectively front, middle and rear sockets.

Suitable sizes for the broadcast wavelengths are L1, No. 25, 35 or 50, depending meanly upon the size of aerial employed; L2, No. 75; and L3, No. 50 or 75. For the reception of the high-power station 5XX, L1 will be a No. 150 coil, L2 and L3 each No. 250.

Operating the Receiver

With suitable coils inserted, and the batteries, telephones, aerial and earth connected to their respective terminals, tuning may be commenced. The two variable condensers should be adjusted simultaneously, and the setting of the crystal detector altered occasionally until signals are heard. When first tuning it is advisable to keep L1 well away from L2, and the latter coil close to L3. It should also be seen

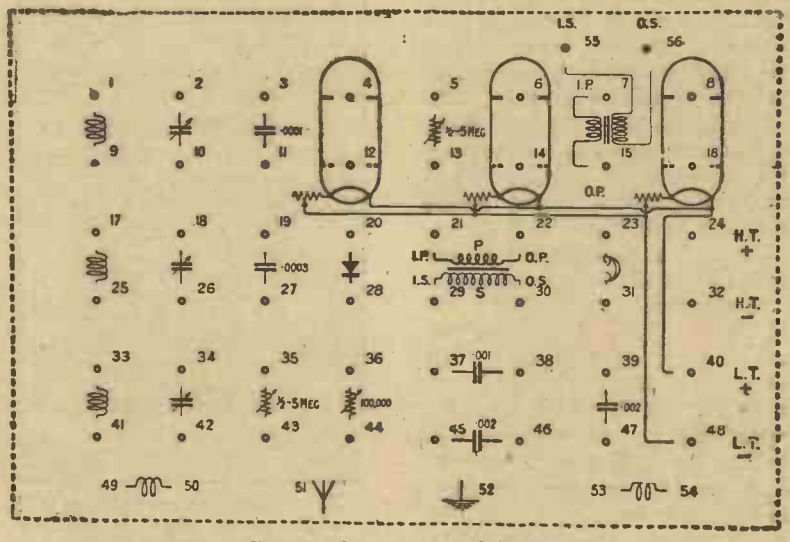


Fig. 2.—The terminal board.

that the anode resistance R4 is in circuit, and should be varied by screwing the knob up or down according to results. The same remarks apply to the grid-leak R5.

Upon receiving signals, the crystal detector may be adjusted for best results, and experiments with the coil couplings carried out. L1 may be brought slowly towards L2, retuning at the same time upon C1, and occasionally re-adjusting C2. Should the receiver fail to oscillate upon arriving at a certain point, the connections to L2 should be reversed by disconnecting the leads 4—25 and 17—24, and joining 17—4 and 25—24. The procedure previously outlined should now be repeated.

Selectivity

The coupling between L2 and L3 may now be loosened for experimental purposes, when it will probably be found that a readjustment of the coupling between L1 and L2 has become necessary, as well as further variation of the two variable condensers. The circuit is a little difficult to tune, but practice soon enables the maximum results to be obtained with good selectivity.

The effect of reversing the connections to L3 should be tried, since it is sometimes possible to effect an improvement in this manner.

Separate H.T. Tappings

Although it is undoubtedly convenient to use only one H.T.+ terminal, it is generally possible to obtain better results when each valve is given a suitable anode potential by means of separate tappings to the H.T. battery. In the present case, for instance, the last two valves, while performing similar functions, are given different anode potentials owing to the presence of the high resistance R4 in the anode circuit of the second valve. If we disconnect the leads 17—24 and 44—24, we may regard the terminals 17, 44 and 24 as the points of high-tension supply to the anodes of V1, V2 and V3 respectively. The negative terminal of the H.T. battery may be left connected to its terminal, and separate voltages applied to the terminals mentioned, the most suitable values being determined by experiment.

Grid-Bias

When using high voltages on the anodes of the low-frequency valves, it is advisable and often necessary to apply negative voltages to the grids to prevent undue distortion.

If the circuit diagram be studied, it will be observed that two points are marked X. Batteries of suitable voltage may be inserted at these points, their negative terminals being connected (through transformer winding and leak) to the grids of the two valves. Small batteries suitable for this purpose may be obtained at any wireless stores, and are generally of six or nine volts maximum, tapped every 1½ volts. The two connections 29—48 and 5—48 must be removed and the + terminal of each battery connected to terminal 48, while terminals 29 and 5 are each equipped with a flexible lead terminating in a wander plug, the latter being inserted in each case into a suitable negative socket of one of the batteries. As in the case of the H.T. tappings, suitable voltages must be determined by experiment.

Some Experiments

It is, perhaps, unnecessary to advise adjustment of the resistances R4 and R5. The knobs of these components should be turned until it is found that the most suitable values of resistance are in circuit. In the case of the leak R5, it is generally found that the best results are obtained with the knob screwed well down to bring the resistance to a low value.

Before deciding that best results are being obtained, the connections to the secondary winding of the low-frequency transformer should be reversed to see if an improvement results. The necessary modifications of the original connections are: Disconnect 29—48 and 30—14, and join 30—48 and 29—14. Should it happen that reception suffers instead of improving, the original connections must of course be made once more.

The present value of the low-frequency coupling condenser C3 is 0.002 μF—a lower value than that generally employed. A useful experiment, therefore, is to place in parallel with this condenser another condenser of similar value, making a total of 0.004 μF (it will be remembered that the total capacity of a number of condensers in parallel is the sum of their separate capacities). The following extra connections are required: 45—47 and 46—39.

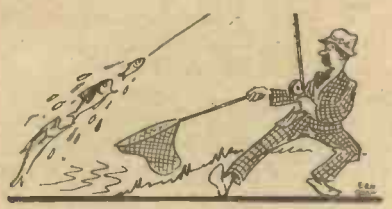
H.M.S. "PRESIDENT."

The microphone on board H.M.S. "President" together with some of the crew. Readers will remember that part of the London programme was given by the crew of this ship on St. George's Day.

Jottings by the way

Rose Tales

ALL wireless men worthy of the name can (and will if you are not careful) tell you stories about the inexplicable behaviour of receiving sets in certain circumstances. This is partly because strange things really do happen and partly because wireless has a wonderfully stimulating effect upon the imaginative faculties of the average human being. I once knew a perfectly truthful fisherman. He would admit at the end of the day that a fish which



. . . *He had never performed this feat* . . .

he lost when it was at the last gasp after the most exciting adventures was quite a small fellow; the fish which he caught did not show the phenomenon, quite common amongst trout, of growing rapidly after their demise; he had never performed the feat of hooking a small trout which, as it was drawn towards the bank, was seized by a perch which was itself grabbed a moment later by a 20-lb. pike; he had never dropped his watch over the side of a boat into the sea to recover it half an hour later from an obliging cod; he would have scorned to carry the special angler's spring balance invented by Professor Goop which automatically multiplies the weight by three. He was, in fact, a perfectly truthful man, even though fishing of all kinds was his pet hobby.

The Longbow Heritage

Yet when this man took to wireless a change came over him. When I tell you that he was one of the first to receive KDKA on a crystal you will see exactly what I mean. After all, you cannot fight against heredity. You have only to borrow "Little Arthur's History of England," or whatever book they use nowadays, from one of the younger members of your family to realise that the glory of our country was built up, with the help of the good English longbow, on the fields of Crécy and Agincourt and lots of other fields that both you and I have forgotten, though their dates were one of the nightmares of our school-days. It is in the blood. Our forefathers turned out on Sundays and holidays to speed their cloth-yard shafts at the local archery butts, and doubtless drew still longer bows as they quaffed their mead or sipped their sack in the evening at the "Dogge Withe Foure Tayles." To-day we exchange the wireless set for the archery butt and afterwards display our longbowmanship at the wireless club.

Temperament

But, as I was saying, it is very strange to notice how, longbow effects apart, wireless sets do appear to have characters of their own. Some are cheery, good-natured fellows always willing to be useful whenever you call upon their services. Some are sluggards which need any amount of gingering up in order to keep them up to the mark; leave them alone for a moment or two, and they go back on you at once. Others are real bad hats, simply out to play up on every possible opportunity. And the funny thing is that you can make two sets, using in each case the same layout and identical components, one of which will be first-rate whilst the other is unprintably bad. If all sets of evil character would only be quite frank about their intentions from the very beginning matters would be very much simplified. But, as it is, they are too often hypocrites of the worst sort. You make a set, you try it out; its loud-speaker brings in a topical talk on "How to Clean Pigsties," or "Conchology as a

. . . *The title is obviously wrong* . . .

Hobby," speaking with the clarity of a professor of elocution. When a prima donna warbles, it coos as gently as any dove. Your wireless dreams are eclipsed. At last you have made a perfect set. You rush round to tell your friends, and probably bring a few of them back to hear it.

Practical Tests

With trembling hands you switch on once more. The noise which now comes from the throat of the loud-speaker is such as to suggest that the B.B.C., ever in search of novelties, has installed a microphone in the pig-sty whilst cleaning out is in progress. Your pale hands flutter over the knobs, and matters become rapidly worse. At the distant transmitting station the prima donna is

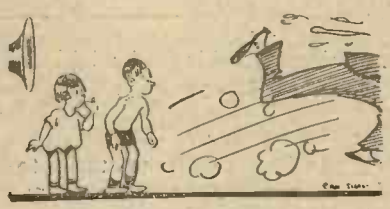
taking her stand once more before the microphone. That asthmatic hurdy-gurdy is the piano playing the opening bars of the accompaniment. The lady bursts into song. She has sandpapered her throat, she is trying to swallow a potato, someone is throttling her, her voice cracks on the high notes and grunts are all that you hear of the low ones.

Fate

The friends smile. You ask them not to be silly, and say that it will be all right in a moment. The next item is announced as an orchestral piece. The title is obviously wrong. It is Washing Day at Euston. You can hear the splashing of the washtubs, the crushing of buttons, the rending of neckbands, the shrieking of the engine whistles, the buzz of escaping steam, the slamming of carriage doors, and even the wild cry of the man who misses his train by slipping on the soap as he dashes past the washtubs. An excursion train is leaving one platform with a cargo of trippers playing different tunes on mouth-organs, concertinas and penny whistles. The friends have ceased now to smile; they are shouting with vulgar laughter, pulling your best chair covers out of shape as they roll about, and stamping their muddy boots on your carpet. And then, just as a grand finale, the loud-speaker emits an ear-splitting hoot, and five valves go up simultaneously in blue flames.

The Limit

You have lost your friends, you have lost your valves, you have lost your reputation; the world is a cold, grey place composed chiefly of dust and ashes and bitterness. Anyhow, you will never, as long as you live, use that set again. Possibly you will never use any wireless set. The next day you present it to your ten-year-old eldest son, telling him that he can pull it to pieces and use the parts for himself. About two evenings later he begs you to come and hear some wireless. You go to the playroom, where he and his little sister have rigged up the set, now provided with five new valves, borrowed from your shelves. He switches on. The topical talk on "How to Become a Tripe Dresser" (Careers for Our Boys, No. 9) comes through to perfection. Sopranos, contraltos, tenors and baritones succeed one another, each singing as they have never sung before. The orchestra strikes up. The air is filled with real music, every note having its true and perfect value. If you are a strong man, able to keep your real feelings thoroughly in hand, pat the lad upon the head, give him half a crown, and predict a great future for him in



. . . You rush from the room . . .

wireless. But if you are such as I am, a mere human being of ordinary clay, you rush from the room, and go out hatless and speechless into the great open spaces, feeling that everybody hates you.

Stunters

Some sets again I can describe only as stunters. These things normally give you quite decent working, having a range that is neither very great nor unduly small, and produce signals of respectable quality with satisfac-

. . . "Earn big money! Be a Radio-Psychometrist" . . .

tory strength. Sometimes, for no reason that you can explain, they fall off altogether. You have not touched a thing since you last used the set, yet when you connect up the aerial it seems tired and listless. Nothing that you can do will bring its voice up to its usual heartiness, nor can you get any station but the one that is nearest to you. The next night, perhaps, the thing suddenly appears to have been touched by a magician's wand. Stations that you had never dreamt of hearing are picked up with consummate ease; your selectivity is so remarkable that you feel that if you wanted to you could separate 5 from XX. And strength! So enormous is the volume that you are forced hastily to discard one or more valves. When you finally go to bed at somewhere round about breakfast time you are quite sure that at last you really understand that set, and that in future your reception will be nothing short of phenomenal. In your notebook you jot down the position of every dial; you take readings with the voltmeter and milliammeter. With these data at your command you will, of course, be able to get the same results at will on any evening. Unfortunately on the next occasion you find that the set has either returned to its normal mediocrity or that it is having one of its bad fits. If you ever do manage to obtain wonderful results again you find that all your readings are entirely different from what they were on the first occasion.

A New Career

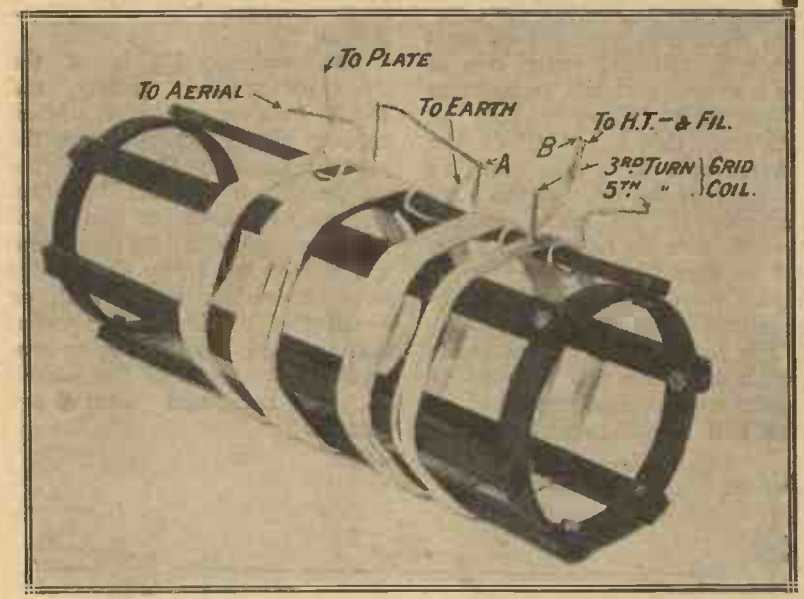
So far as I know, no explanation of any kind has been offered for these remarkable vagaries on the part of wireless receiving sets. Professor Goop and I have done an enormous amount of experimental work with a view to discovering some solution of this mystifying problem. I regret to inform you that up to the moment of writing we have found no light at all. We feel, however, that this is a side of wireless that should be studied seriously. Possibly in the future the radio-psychoanalyst will be called in when things go wrong to discover the particular complex that is at the bottom of the whole trouble. In the American papers we shall see amongst the announcements of golden opportunities:—"Earn Big Money! Be a Radio-Psychometrist. I Can Teach You This Money-Getting Profession in Twelve Easy Lessons at Your Own Home." I mention America because Big Things generally start over there. Possibly Mr. Hercy Parris is even now studying this new branch of wireless knowledge.

WIRELESS WAYFARER

Some Notes on the Meissner Circuit

By JOHN W. BARBER, (6DD)

A useful article dealing with a modified Meissner circuit used by the author in which values and coil turns are given.



The low-loss transmitting coil used by Mr. Barber is wound upon a home-made ebonite former. The purposes served by the various tappings are indicated.

IT would appear, from observations made by amateur transmitters in the writer's area, that some difficulty is experienced in the successful operation of a Meissner transmitting circuit, and it is the purpose of the present article to endeavour to clear up some points of difficulty which may possibly stand in the way of efficient working, and so enable others of the fraternity to commence, or possibly to resume, work upon a circuit of fascinating possibilities.

Disappointment

Cases have been brought to the writer's notice where published forms of the Meissner circuit have been tried, and the results have been so disappointing that all efforts to make the circuit work have been discontinued, and the attention turned to some other form of transmitting arrangement.

Incidentally, this type of trouble is not by any means confined to one circuit, as cases have been heard of in which the Hartley and Colpitts circuits have been troublesome. The fault, however, is most decidedly not in the circuit itself, as with good apparatus properly handled all of the well-known circuits will oscillate and put power into the aerial, some being easier to operate than others on the very shortest wavelengths.

Valves

In cases of non-oscillation, however, it is quite frequently that one finds the whole situation relieved by the substitution of a valve of lower impedance for that already in use. Transmitting valves, of the "5-watt" and "50-watt" variety, which are used by our friends on the other side of the Atlantic, have an impedance of the order of 2,000 ohms, and when some of the circuits found in American publications are tried with British valves of far higher impedance, the result is a bad case of non-oscillation. In the writer's case, a well-known British 15-watt valve of 25,000 ohms impedance absolutely refused to oscillate in a certain American transmitting circuit, and this effect was verified by Mr. Percy W. Harris, of 2MQ. The substitution of another valve of well-known manufacture, the impedance of which is of the order of 5,000 ohms, completely cured the trouble, and excellent results were obtained with the circuit.

Plate Coils

A frequent cause of trouble with circuits which refuse to function correctly is traceable to too little inductance in the plate circuit, possibly owing to the fact that the particular inductance in use does not permit of an increase of turns. Add a few more turns and the circuit oscillates, but fail to do so and it is shelved as one which won't work, and the attention is turned in another direction.

The Circuit

The modification of the Meissner circuit which it is proposed to discuss is of American origin, and gave considerable trouble at first owing to a stubborn refusal to oscillate. As stated above, this was eventually traced to a valve of too high an impedance, and the substitution of another valve gave the desired kick to the arrangement.

Fig. 1 shows the details of the circuit, and it will be seen that the aerial coil is inductively coupled to that in the anode circuit of the valve, the latter being split into two halves. Below the lower half of the plate coil is the grid coil, and it will be necessary to arrange tapping points on this coil for grid and tuning condenser connection. One end of the grid coil is joined, as shown, to the lower end of the lower plate coil.

Constructing the Coils

The inductances were wound with No. 16 S.W.G. double-cotton-covered wire on a skeleton former composed of ebonite rings 4 in. in diameter and ½ in. wide, secured to which are six ebonite strips, 12 in. long, ½ in. wide and ¼ in. thick, evenly spaced round the circumference of the rings, one of which was placed at each end and one in

the middle, of the skeleton former.

Tappings

The coils are wound all in the same direction, and are spaced as follows: First wind on the nine-turn plate coil, securing its ends either by twisting round one of the lengthwise strips, or by holes in one strip. Roughly half an inch from this coil wind on the thirteen-turn aerial coil, securing its ends as before. A tap may conveniently be taken at the seventh turn on this coil, as this will be found useful when working on wavelengths in the neighbourhood of 40 metres.

The second half of the anode circuit inductance is now to be wound on, at a distance of an inch and a half to an inch and three-quarters from the aerial inductance, while the grid coil is commenced at a distance of $\frac{3}{8}$ in. from the previous winding. Tap this coil at the third turn, and put on two more turns, when the coils are completed.

Connections

Connection to the ends of the various winding may conveniently be made by means of Burndept spring clips, as it is then not necessary to bring out the soldering tackle whenever a large change of wavelength is desired.

Series Condenser

The aerial circuit series condensers should be of the very best quality, the writer personally using a Bowyer-Lowe on the aerial side, and an ex-Navy oil-immersed .95 jar condenser in the earth lead. The latter condenser is minus the oil, and there are still several to be obtained from Government Disposals Stores.

The condenser C_3 is of the .0005 μF low-loss variety, and should be chosen particularly on account of a good contact to the moving vanes. On the higher wavelengths a "pigtail" connection may be used, but this is not to be recommended to those who are attempting really short-wave transmission (or reception!), on account of the inductance variation caused by expanding or contracting the turns of the pigtail as the condenser vanes are rotated.

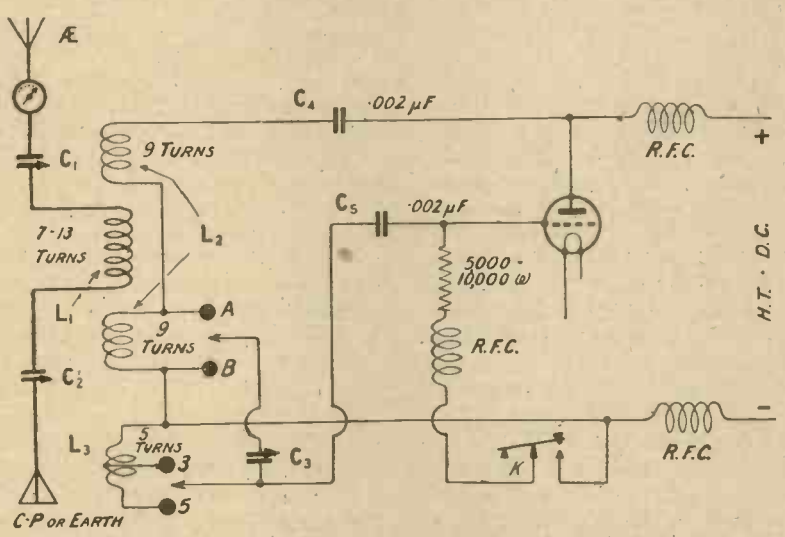


Fig. 1.—The modification of the Meissner circuit favoured by the author, details of which are given in the text.

Wavelength Band

For the band of wavelengths from 90 metres upwards to 200 metres, the grid connection is made to the fifth turn of the grid coil, while the other end of the grid tuning condenser C_3 is joined to the point A, thus tuning the grid coil and one portion of the anode coil. For the lower band of waves, between 40 and 90 metres, the grid clip is put on the third turn, while the condenser lead is moved to the point B, thus tuning only the three turns in the grid circuit. On this band it may be found helpful if the earth or counterpoise lead is taken through the series condenser to the seventh-turn tapping, although it is not recommended that the unused turns should be allowed to remain if the circuit is to be permanently operated on the lower band, as, if this is allowed, it will be difficult to determine the correct coupling required, owing to the high electrostatic coupling of the "dead" turns.

Coupling

Whilst on the subject of coupling, it may be said that, for turns as given above, the spacing will be found correct, but should the aerial turns be permanently reduced, fresh coupling will need to be found between the aerial and lower plate coils.

In the first place, each coil was separately wound on a strip of cardboard tube of sufficient width, and the whole shifted about on a supporting rod of wood until the optimum coupling was obtained in each case, when the distances apart of the coils from turn to turn was carefully measured. These figures checked up with those obtained by Mr. M. W. Goldberg, U9APW, and Mr. Harris, G2MQ.

Operation of the Circuit

Having connected up the circuit as shown in Fig. 1, with the exception of the aerial and counterpoise or earth leads, turn on the valve filament and connect up the anode power supply. Press the key and measure the wavelength by means of a suitable wavemeter or a calibrated receiver. The wavelength is controlled by the tuning condenser C_3, and the circuit will be found easy to control and smooth in operation over practically the whole dial on both ranges. Now join up the aerial and counterpoise leads, and bring the aerial circuit into resonance with the oscillator by variation of the series condensers. Resonance is indicated by maximum deflection of the aerial ammeter needle.

Maximum Efficiency

Variation of the tuning condensers will show that a variation takes place both in the aerial current (which many wrongly refer to as "radiation") and anode feed current, and for maximum efficiency matters should be so adjusted that the ratio of aerial current to anode feed is a maximum. When so adjusted, the aerial current may

not be at the highest point obtainable in the circumstances, but the circuit will be operating most efficiently. If desired, the highest aerial current reading may be adjusted for, in the hope that a greater range be obtained, but for economical working this is to deprecated.

The Grid Leak

The grid condenser should be well insulated, and capable of withstanding far higher voltages than are likely to be impressed upon it, while the capacity will be about right at .002 μF. The leak may conveniently be a " Zenite " rod, of 15,000 ohms total resistance, tapped at 10,000, 5,000 and 2,500 ohms, while the radio-frequency choke coil may consist of 250 turns of No. 30 d.c.c. wire on a 2½-in. cardboard tube.

Operation

Start operating with the grid-leak at its maximum value, and decrease in steps if necessary, or as the input is increased. Increasing the leak resistance will lower the anode feed current and the aerial current, and may also render it possible to work with a reduced filament voltage, although in this case the output will be reduced.

Stray Capacities

It is possible for the circuit to oscillate at undesired frequencies, due to stray capacities and inductances in the leads, so take care when laying out your transmitter to keep all leads as short and direct as possible, to minimise their inductance, and space them well to reduce stray capacities.

Precautions in Charging Accumulators from D.C. Mains.

(*Concluded from page* 322)

other hand, they were connected the other way round, there would still be the pressure of the potential of the live wire trying to get to earth. Experiments C, F, G and I show how highly dangerous this might be.)

A proper cut-out fuse (not exceeding 10 *amps.) must be in the circuit between the lamps, or other resistance, and the main switch.*

(It would be preferable to limit this to 5 amps., but such a limit would not be feasible for garages or for initial charges to new batteries of, say, 120-amp. hours or over. The great majority of circuits would already have got such a fuse, which preferably should be " double-pole," but the regulation would appear necessary to cover such cases as branch feeds from a large installation.)

Great care must be taken to see that every wire attached to batteries on charge is securely connected and the terminals securely screwed down. This applies to every connecting bridge and wire throughout the whole chain of cells.

(The great importance of this is emphasised by the results of Experiment D, which made a great impression on those who witnessed it.)

A few practical suggestions may perhaps not be out of place.

For a stand.—For a few batteries, an old glazed earthenware sink is excellent, provided the glaze on the bottom has not been damaged.

For single batteries, a large glass dish, or an old meat dish.

For a large number of batteries, a few old glazed earthenware sinks are hard to beat, as they tend to automatically sectionise the bunch.

Here a word of warning is necessary; it is found that, owing to the unevenness of the bottoms of many sinks, there seems to be an instinctive tendency to put wood slats below the accumulators to give them a firm base to stand on; *this should not be allowed;* the cells should stand on the sink with no wood intervening.

Where it is inconvenient to use sinks, and it is proposed to utilise sheets of glass, porcelain, or slate, some provision must be made to prevent any spilt acid from flowing over the edge of each sheet.

To ascertain which pole is earthed (if any)—the bare wire from an earthed main can be touched without receiving a shock (or at most, only very slight), whilst the live wire is always palpably " live "; the supply company can usually provide the information from their record of connections, or would generally send round an electrician to decide, if so desired.

It is practically always known which wire is negative and which is positive (in any case, a simple test with pole-finding paper soon settles it), but it is seldom found that the user has the faintest idea as to which of his wires is earthed, although it is a very important point.

In conclusion, these few notes do not profess to expound any new theories or to state other than what is already well known by many who take the trouble to think; they are simply illustrations of well-known facts demonstrated by a few actual experiments with the object of emphasising the danger from risks of fire when inadequate precautions are taken in charging accumulators from direct current supply mains.

Control of the Erection of Wireless Aerials

The question of the control by local authorities over the erection of wireless aerials recently came before the Local Legislation Committee of the House of Commons on a Bill presented by the city of Bath, and the chairman of the committee said :—

" We are of the opinion that the public must be protected, and somebody must therefore be held to be responsible. We think the local authorities should have this responsibility, and we therefore allow the powers asked for by the Bath Corporation."

SOME EXPERIENCES ON

By STANLEY G. RATTEE

The receiver illustrated be wavelengths below thirt contribution Mr. Rattee r met with upon these shor next issue the construc with some notes upon op short wavelengths, will b

THE large interest created during the past winter months by the success of experiments in transmission and reception upon short wavelengths is in no way waning now that summer has come. The popular station KDKA is still to be received with fair volume upon 68 metres, while the American amateur transmitters, though perhaps not quite so loud, are still received at good strength upon a detector valve alone.

Summer Conditions

During the heat wave of this last week quite good reception upon wavelengths down to approximately 50 metres has been the experience of the writer with a single-valve reaction circuit of the type illustrated in Fig. 1, and though fading has at times been rather prevalent, the general conditions have been encouraging.

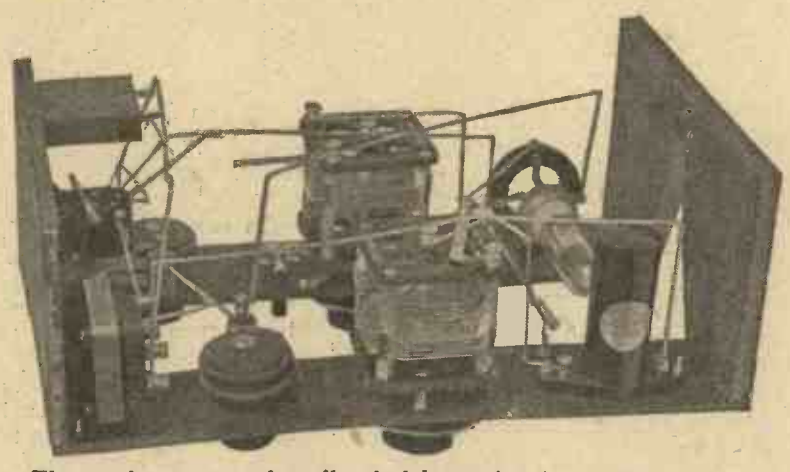
There are perhaps among *Wireless Weekly* readers a few who have as yet not entered the field of short-wave reception, and for the benefit of those few, the following remarks relative to how best to go about things and what to avoid in order that results may attend their efforts, will prove of interest.

Reception on 68 Metres

For reception upon 68 metres, the only wavelength upon which there is at present some certainty of receiving broadcasting, the circuit given in Fig. 1 will be found quite successful, and a receiver built to the specifications given was described by the present writer in the March, 1925, issue of *Modern Wireless*. The coupling between the untuned aerial coil and the secondary is in the present case fixed, the actual spacing between the two coils being $1\frac{1}{8}$ in. Such a circuit as this is simple to operate, and with ordinary four-pin valves gives satisfactory results down to approximately 50 metres.

Oscillation

A peculiarity which is observed when receiving upon 50 to 68 metres is the fact that it is not by any means easy to tell when the receiver is in an oscillating condition, whereas, in the writer's experience, upon shorter wavelengths the oscillating condition is most marked. With such a circuit as that under review, practically any aerial may be used with equal success, and for many months the aerial used by the writer was a wire 30 ft. long carried round the picture rail of a first-floor room.



The wood support at the coil end of the receiver is cut away so as to dispense with superfluous material and possible losses.

The short-wave receiver is built u hold the condensers and rheostat means of valve l

SHORT WAVELENGTHS

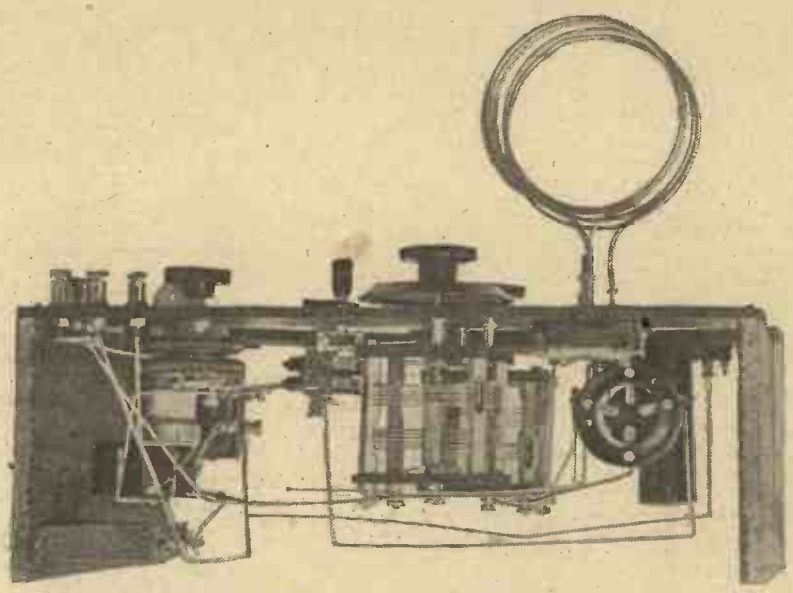
, M.I.R.E., Staff Editor.

low is designed to cover y metres and in this elates some experiences t wavelengths. In our tional details, together eration of receivers on e given.

It may be found in the case of the Fig. 1 circuit that in the course of tuning there is one particular spot upon the condenser at which the receiver will not oscillate, which indicates that the secondary circuit is tuned to the natural wavelength of the aerial circuit, and should this spot occur at a point upon which it is desired to receive, then a small coil or condenser should be added in series with the aerial, when the difficulty will be overcome.

Though this type of circuit appears to be satisfactory down to the 50-metre wavelength, experience indicates that some other arrangement is desired for the higher frequencies, and the receiver illustrated in this article was designed to meet the requirements.

oon two strips of ebonite used to , while the coil is mounted by gs and pins.



The valve-holder, which is an anti-capacity type, is held secure by the stiff wire connections.

The Circuit

The circuit employed is that developed and described by Mr. A. D. Cowper in the May 27 issue of *Wireless Weekly*, though some departure is made in the way of values of condensers *et cetera*.

With this instrument, a constructional description of which will be given in a later issue, amateurs transmitting upon a wavelength of 20 metres have been received, whilst the receiver oscillates upon wavelengths well below this figure. Though there is unfortunately practically nothing at all to be received upon wavelengths below 20 metres, considerable interest exists in making such a receiver oscillate when using an ordinary four-pin valve *without* the precaution of removing its mounting.

The coil used in the receiver and illustrated in the photograph complies in every way with the description given by Mr. Cowper, and is mounted by means of valve pins and sockets, thus ensuring good electrical contact.

Aerial Arrangements

Experiments conducted with this arrangement were largely in the direction of ascertaining the best form of aerial, and some remarks upon these experiments will now be given.

The Aerial Coil

Using as the aerial coupling coil two turns of No. 12 bare copper wire wound to give a diameter of 4 in. and spaced ¼ in., the coil was sufficiently rigid to be self-supporting. One end of this coil was secured under one terminal of a boxed-in variable condenser of .001 μF capacity, whilst the other end was connected to the normal earth, consisting of two Climax earth tubes. To the other terminal of the variable condenser an indoor aerial of some 30 ft. was connected in the manner shown in Fig. 2.

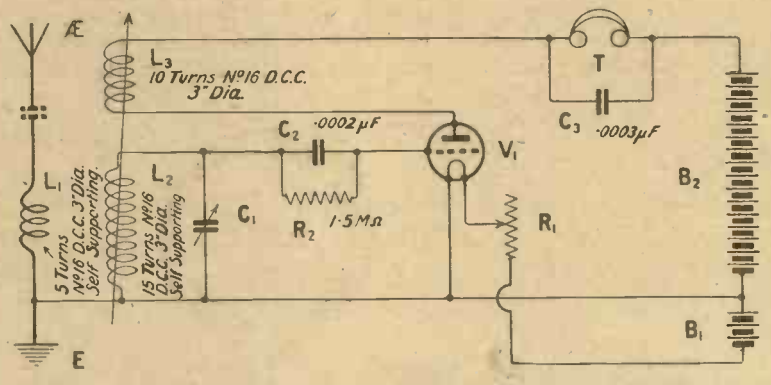


Fig. 1.—A useful circuit for the reception of KDKA upon 68 metres. The coupling between the coils L1 and L2 may be fixed.

Coupling

This arrangement was now moved to within 4 in. of the grid coil of the receiver, and upon endeavouring to make the receiver oscillate, considerable interference was experienced from motor traffic upon one particular spot on the grid tuning condenser. The receiver gave a good indication of oscillation over the whole of the condenser scale, and subsequent results showed that the aerial coupling coil could be brought to within 2 in. of the grid coil with this arrangement before any difficulty arose with regard to oscillating. During the course of these experiments, signals were picked up upon what I believed to be a little below the maximum wavelength of the receiver when using the six-turn coil, and the station transmitting proved to be 1RG, working upon 20 metres approximately. The transmission was fortunately a fairly long one, and allowed of the coupling between the aerial and grid coils to be varied before terminating, and in this manner the optimum coupling appeared to be when the two coils were nearly 6 in. apart.

Motor Traffic

By means of motor traffic, the "noises" from which are believed to indicate a wavelength of approximately 20 metres, various other degrees of coupling were tried which finally resulted in dispensing with the aerial circuit altogether.

Another Arrangement

A further experiment with the aerial circuit consisted of using a length of No. 16 d.c.c. wire arranged as in Fig. 3 (supported at each end with a piece of string), coupled to the grid coil by approximately 1 in., and though the receiver gave every indication of oscillating over the whole range of the tuning condenser, no signals other than motor "noises" were received; with this aerial arrangement moved to half an inch of the grid coil, oscillation could only be obtained at various positions of the condenser.

Indoor Aerial

The next arrangement of aerial circuit consisted of the indoor aerial previously referred to, connected to two turns of No. 12 bare copper wound to 4 in. diameter, the "earth connection" being three lengths of rubber-covered flexible wire stretched fan-wise across the floor of the room. Coupled to this circuit, the receiver oscillated freely over the whole scale of the condenser, and at the lower reading of this latter, "noises" were obtained similar to those heard previously at a higher condenser reading.

Observations

For a considerable time the origin of these noises seemed beyond trace, for though motor-cars passing within visual range made no indication of their presence by "noises" upon this setting of the condenser, the noises still occurred at intervals. By careful observation of the roads and with the condenser still set at its original adjustment, the noises appeared to coincide with the approaching and passing of motor-cycles, though whether the two have any bearing upon each other I am not prepared to commit myself.

Above 20 Metres

Using the aerial circuit previously described and illustrated in Fig. 2 with the coil given in Fig. 3 in Mr. Cowper's article in the May 27 issue, many amateur transmissions were received without difficulty, and upon increasing the aerial turns to three with the same diameter, tuning became even easier without appreciably altering the freedom of oscillation.

Valves

As to valves which may be used upon these short wavelengths, so long as every care is exercised in removing all unnecessary ebonite from the set itself and making a very careful layout of the wiring, very little difficulty will be experienced in using ordinary valves quite successfully. In the receiver illustrated, the majority of the work done was carried out with a B.T.H. B4, with an anode potential of 50 volts, whilst at other times a French .06 valve

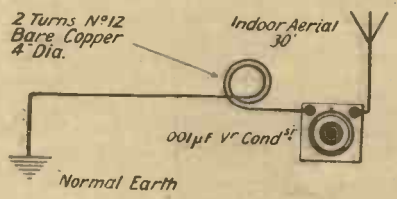


Fig. 2.—The aerial arrangements first used by the author.

gave equally satisfactory results, though this valve was not quite so free in its oscillation, still using 50 volts H.T.

Opportunity

For the reader who wishes to experiment in short-wave work, the receiver photographed should make strong appeal in that its simple layout makes its construction easy, while the absence of the conventional panel eliminates possible difficulties which may arise from losses in the receiver itself. Further experiments

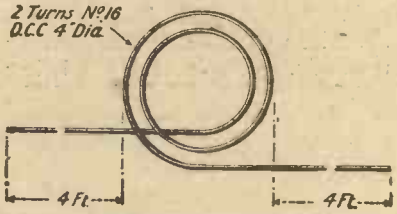


Fig. 3.—This form of aerial system gave results though no actual signals were heard other than motor "noises."

along the lines indicated may be tried without in any way disturbing the receiver, thus opening a little-known field to the serious experimenter. The day and night effects observed by John L. Reinartz upon wavelengths of 20 metres may be observed for oneself, whilst the possibilities of reception upon wavelengths below this figure are for many experimenters in this country a definite object for observation and careful study.

A VALVE TIP

A useful tip which users of dull emitter valves will appreciate.

ALTHOUGH it is a fact that the sensitivity of a dull emitter valve may often (where the filament is intact) be restored by a simple method, this method does not seem to be generally known or utilised.

Suppose, for instance, that a dull emitter taking a voltage of 2 volts has been inadvertently inserted in a valve holder where the filament sockets are connected to terminals with a 4-volt (or perhaps greater) supply.

This valve will usually be found, on again using on a 2-volt supply, to be wholly or partially insensitive.

Sensitivity

To restore sensitivity the valve should be left with the filament glowing, and on the correct filament voltage (but with the H.T. entirely disconnected), for a time varying from 20 minutes to 10 hours.

A dull emitter of well-known make was once, as an experiment, tested by the writer by applying varying voltages across the filament up to and including 38 volts from an old H.T. battery, this 38 volts being applied six times for periods varying from a mere touch up to 10 seconds. The filament remained intact but sensitivity was completely destroyed, and an attempt was therefore made by the above method to restore the emission, and was successful in almost completely restoring the sensitivity after the valve had been alight all night and the day following. Of course, this instance must be regarded as exceptional, but indicates the possibilities of the method.

Service

Even, however, where complete sensitivity is not restored, it will often be found that a sufficient degree of emission will be regained as to enable what was regarded as a useless valve to give many hours' service in a receiver employed for reception from the local station when a very high degree of sensitivity is not usually required.

Members of the Inland Revenue Radio Society and some of their apparatus on the occasion of a field day spent in company with the Golders Green and Hendon Society.

MR. HARRIS IN AMERICA

A preliminary report has been received from Mr. Harris concerning his first few days in New York, and some notes extracted therefrom are given below, which give some indication of the extremely valuable opportunities for the acquisition of interesting information which are being accorded to him.

ARRIVING in New York eighteen hours late, as a result of a fog encountered near the end of the voyage, Mr. Harris found himself immediately in the thick of the enthusiastic welcome for which the American wireless man is famous. When Mr. Harris landed, the thermometer stood at 92 deg. in the shade, and he appears to have found the somewhat lengthy formalities of the Customs distinctly trying, although he was helped through in the most expeditious manner possible by a representative of the Commercial Cable Company, who had very kindly been specially sent to assist him.

At some stage during these proceedings he had to face the inevitable battery of Press cameras, and one of the results was seen on page 284 of our last issue, the photograph in question having been sent round to the American Press with a rather extraordinary legend about " the best radio announcer." Saturday and Sunday being in the nature of " off " days, Mr. Harris seems to have spent most of his time making a study of the windows of the principle radio " stores," from which he will no doubt have gleaned some interesting information about American components and materials.

On the Monday Mr. Harris began his investigations in earnest, and among other activities the day included a meeting to which he had been looking forward with much pleasure, viz., a lunch in the company of M. B. Sleeper, who is so well known as one of America's foremost designers of sets for the home constructor. A little later in the week a lunch was given in his honour at the Harvard Club, the list of guests including names so well known as those of Cockaday, Gernsbach, Kendall Banning, Sleeper, and nearly all the radio editors, including those of the leading New York newspapers.

On the following day he intended to go to Philadelphia as the guest of the Attwater-Kent Company (one of the leading American manufacturers), in whose factory he will no doubt gain a valuable insight into American production and testing methods. Philadelphia being within easy reach of New York, however, he was returning the same evening to Long Island, where he intended to spend the night actually listening to American broadcasting, as part of his scheme for obtaining a really thorough acquaintance with American conditions. So far details have only been received of the first few days' investigations, but on June 11 a cable was received, stating that Mr. Harris was on the point of leaving New York for his next stopping place.

Integral or Separate Verniers?

(Continued from page 316.)

Integral Verniers

The integral vernier, on the other hand, can be so designed that it does not involve the use of any additional insulating material in the building of the main condenser, and it seems probable that with efficient design the losses on the main condenser are not in any way increased. Futhermore, no increase of a serious order results in the minimum capacity of the condenser, and therefore it would seem that the integral device is free from the two most serious defects of the separate one.

The provision of a vernier plate with the necessary means of adjusting it is no very easy mechanical problem, but there are now a sufficient number of properly designed integral vernier condensers available to enable one to make a fair comparison between this and the separate device, and it would seem to me that the verdict should be in favour of the integral type.

One of the difficulties encountered in producing a good integral vernier concerns the provision of some means of indicating the setting of the vernier plate, and in this instance many of the arrangements on the market fall short of perfection. In any calibrated circuit it is, of course, essential to have some standard setting for the vernier plate, and for this reason it is desirable to have some scale provided for the reading of this plate. Such scales have been devised, and when such an arrangement is provided, my own experience leads me to the view that when this difficulty has been overcome, the integral arrangement is very definitely to be preferred.

Some Notes on Long Distance C.W. Reception

By A. V. D. HORT.

The author logged no fewer than 800 stations during the period October 1924 to March 1925, using a single valve receiver, and in this contribution he gives some useful tips upon how long distance reception may best be obtained.

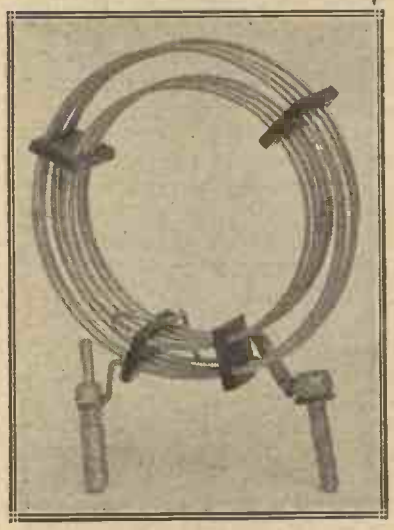
IN the reception of signals over long distances it is admitted that the super-heterodyne or multi-valve set will, with proper handling, be capable of producing more or better results than a less complicated arrangement of apparatus. But distant stations can be received with considerable consistency at readable strength with a straightforward single valve set using reaction. It is not suggested that good results are likely to be obtained in the reception of telephony; this would be asking too much of the apparatus. But the reception of Morse signals makes much less exacting demands on the set, and it is with this type of reception that the writer is mainly concerned here.

800 Stations

As some indication of the results that may be anticipated, the writer, using a single-valve set with the "Reinartz" type of reaction coupling, on an indoor aerial and counterpoise, during the six months from October, 1924, to March, 1925, has logged a total of well over 800 stations. This total includes transmissions from most of the European countries, Mesopotamia, North Africa, and all the U.S.A. districts except the sixth and seventh. Cards confirming reception have also been received from Buenos Aires (6,500 miles) and Java (7,150 miles), while a letter is due from Hanoi, in French Indo China. For various reasons, listening was rarely prolonged for more than an hour or two after midnight, so that the best part of the 24 hours from the point of view of reception was not available.

Wavelength Band

All this work was carried out on wavelengths between 130 and about 40 metres, the band most commonly searched being that between 100 and 50 metres, this being the range covered by the grid coil most commonly in use. Great care had to be taken in the construction and operation of the receiver to eliminate unwanted local noises, in order not to lose faint signals. The tuning controls of the receiver comprised a main tuning condenser, with a separate single-plate vernier in parallel. Rough control over oscillation for each band of 10 metres or so was obtained by suitable adjustment of the coupling between the aperiodic aerial coil and the grid coil. The reaction condenser then provided the necessary fine control over oscillation.



The low loss aerial coil used by the author in his short wave receiver.

Searching

A systematic method of searching was adopted, and a description of this method may be of interest. First of all, it is desirable to ascertain by trial to how many degrees of the main tuning condenser a complete turn of the vernier corresponds. To accomplish this, with the vernier at 0 deg., adjust the main condenser till a continuous wave signal is picked up, and, with the set just oscillating, tune as near as possible to the silent point of the signal without touching the vernier. Then *decrease* the reading on the main condenser by about a degree, and *increase* the setting of the vernier till the silent point of the same signal is again reached. If this point is reached when the vernier is set at 180 deg., then it is obvious that a complete turn of the vernier corresponds to about 1 deg. on the main condenser scale. This completes the preliminary determinations necessary.

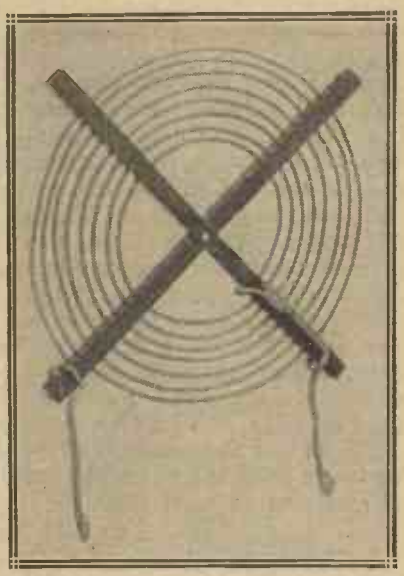
Members of the Hounslow Radio Society and some of their apparatus on the occasion of their combined meeting with the Golders Green and Inland Revenue Societies.

Delicate Tuning

Now, in searching for signals, it is assumed all through that the necessary reaction adjustments are made to keep the set just oscillating. To ensure that no signals are missed, the main condenser is moved only a degree or more at a time, the actual number of degrees for any set depending, of course, on the relationship between the main and vernier condensers determined as described above. For each step of the main condenser the vernier is swung slowly over its whole scale and back again before pressing on to the next position. As soon as a signal is heard, it is finally tuned in by careful setting of the vernier and the reaction adjustment. In practice it will be found best to turn the main condenser less than that number of degrees covered by the vernier. This provides a certain amount of overlap between the two condensers, and ensures that no part of the wavelength band is missed out.

In the first receiver that was constructed by the writer for reception below 150 metres the valve used was a Marconi D.E.3. This gave very satisfactory results down to about 50 metres, the minimum for which the set was constructed.

Subsequently, when this valve began to show signs of becoming worn out, an ex-W.D. "B" transmitting valve, which had previously proved its value as a detector, was substituted for it. The results obtained with this valve were distinctly better. It made slightly greater demands on reaction, 14 turns on the reaction coil being required with a 7½-turn grid coil, but appeared to be much more stable in operation, especially at the higher frequencies. This valve is one of the ordinary four-pin type; the correct filament voltage is 5 to 6, and the filament current of this particular valve .75 amps. at 6 volts. For this work it functioned best at a fairly low-filament temperature, about .4 volts being sufficient for the filament, with an anode potential of 45 volts.



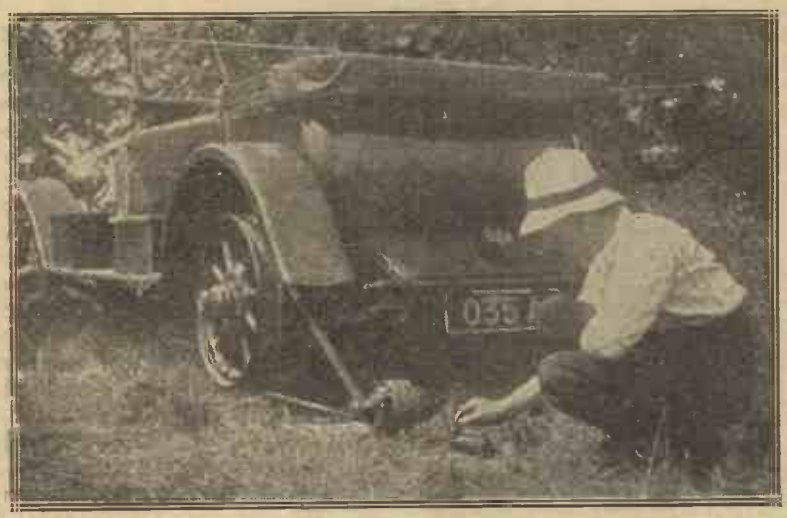
Another type of low loss coil used in conjunction with the coil illustrated on the previous page.

Power Valves

Though this valve was quite satisfactory in operation, it was desired to find a valve that would be more economical in filament-current consumption. A B.T.H. B4 proving quite satisfactory on a brief test, of which the writer has no figures available, a Mullard D.F.A.4 was then obtained, and is now giving eminently satisfactory service. The filament of this valve was fed from the usual 6-volt accumulator, the actual voltage applied being rather less than 5 volts; 60 volts H.T. was found to be quite satisfactory, higher values giving no useful increase in signal strength. Complete stability was obtained over the whole range of wavelengths from 130 metres down to about 20 metres, while much smaller sizes of reaction coils than those used with the "B" valve described above were quite sufficient. With a 7½-turn flat spiral grid coil eight turns on the reaction coil sufficed, from the minimum to which the grid coil would tune, up to the maximum wavelength obtainable with a .0005 μF condenser in parallel. With the next smaller size of coil in the grid circuit, covering a band of wavelengths from a minimum of 35 metres up to about 80 metres, the same reaction coil was used, but it was set at an angle of 45 deg. to the grid coil, instead of being closely coupled. For the lowest band, down to approximately 20 metres, a 4-turn coil was quite sufficient. Even at these high frequencies the valve proved stable enough in operation to enable signals to be tuned-in sharply without undue difficulty. The variable grid-leak did not have such a pronounced effect on the operation of the valve as had been found to be the case with the D.E.3 described above. Generally speaking, a value rather above the normal, in the neighbourhood of 3 or 4 megohms, was found to give the best results.

Other Valves

Occasional trials with ordinary 4-pin bright-emitter valves of



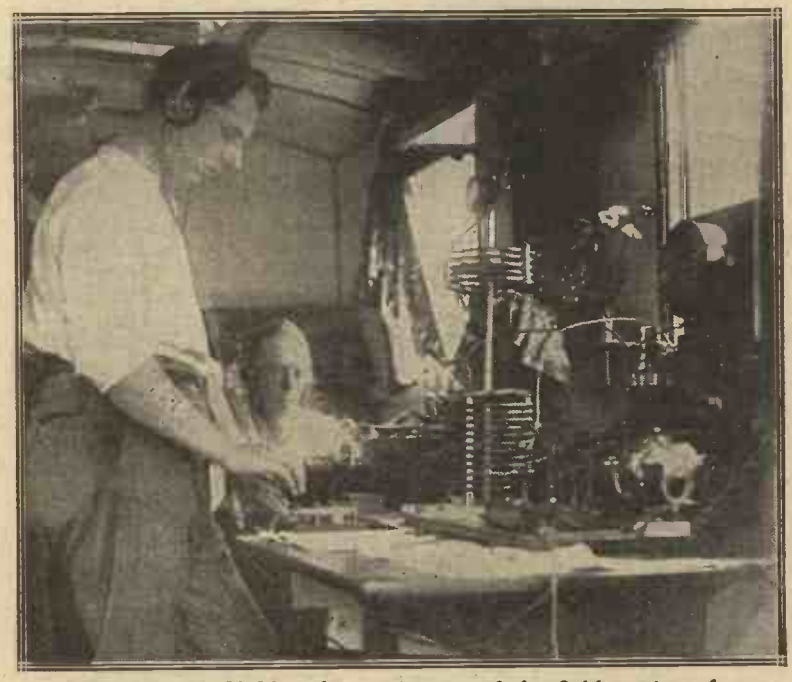
The combined societies, Golders Green and Hendon, Hounslow and Inland Revenue, held a field day on June 7th, transmitting and receiving between Mill Hill, Hounslow, and Higham Park. The power for the field set was supplied by a generator driven in the manner shown above.

well-known makes showed that they would all function fairly satisfactorily in the receiver; but none of them gave such consistently good strength of signals, nor did they prove so stable over the whole band of frequencies used as the power valve. It is not suggested that the power valves quoted here are the only ones which are likely to be satisfactory for this class of circuit. Indeed, it is to be expected that any of the power valves now available should give equally good results, provided that they are supplied with the correct operating voltages and values of components.

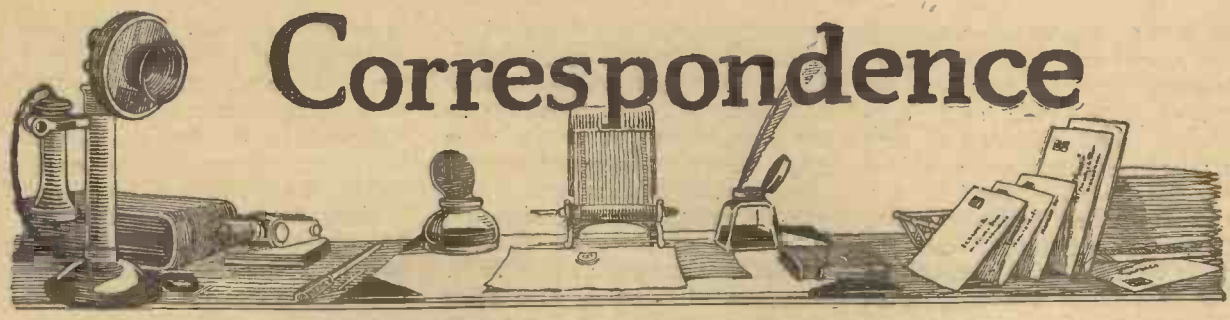
Aerials and Earths

A few notes on aerial and earth systems employed may be of interest. Almost all the stations recorded in the writer's log-book were received on an indoor aerial. The first receiver, using the D.E.3 valve mentioned, was installed in a ground-floor room in a house on high ground above Sherborne, Dorset. The house was in the middle of a row of similar houses, with gas laid on and electric bells in use. A certain amount of loss from absorption was therefore possible. The aerial consisted of a single strand of 22 S.W.G. bare wire, 30 ft. long, passing completely round the room about 2 ft. below the ceiling, the height above the floor being 7 ft. This wire was supported from the picture rail by small ebonite strips. At first one end was connected to the receiver and the other left free, but later it was found that by joining the ends together at the aerial terminal the set would oscillate over two bands of a few metres each which had previously been dead. The "earth" consisted of the large metal fender and all the metal parts of the fireplace, these acting as a rather poor counterpoise. With this arrangement over 200 U.S.A. stations were logged with ease, the best night being one on which 60 U.S.A. stations were recorded in about three hours, from 11 p.m. onwards.

Later, when the receiver had been rebuilt and the D.F.A.4 valve was in use, it was used on a new aerial-earth system. In this case the aerial consisted of 50 ft. of stranded rubber-covered cable, passing from the set out of a window, up the wall of the house, which was situated at the bottom of a valley in the same locality as the previous one, in at a window 30 ft. above, and across the room above to the opposite wall. The earth was again a counterpoise, consisting of three 22 S.W.G. insulated wires each about 10 ft. long, joined together at a point on the floor close to the set at one end of the room. They were laid under the carpet and spread out fan-wise across the room. This system proved excellent; it was found that hand-capacity in tuning, which had been somewhat troublesome with the previous arrangement, was completely eliminated anywhere above about 40 metres, and that even below that wavelength the effect was negligible. This was due, in the writer's opinion, to the fact that in working the set, his feet were placed in close proximity to the three wires under the carpet, the operator being thus quite sufficiently connected to the earth terminal of the set. Previously it had not been possible to make any movement in the neighbourhood of the 'phone leads without upsetting the tuning. Now it was possible to move almost anywhere in the vicinity of the set without a recurrence of this trouble. With this system the best long-distance reception, as described above, was achieved. Results, too, were quite consistent, with no suggestion of freak effects. RCB8 of Buenos Aires could be heard any night, although, of course, at varying strength. The Dutch Government Laboratory at Bandoeng, in Java, was heard quite clearly on more than one occasion. One great advantage of the indoor aerial-earth system was found to be that the interference caused by atmospheric disturbances was much reduced; subsequent trials of the set on outdoor aerials with counterpoise and waterpipe earths has proved this sufficiently to the writer's satisfaction. It appears that there is not a proportionate loss of signal strength from transmitting stations by using an indoor instead of an outdoor system at these high frequencies. The writer has made tests with both systems on nights when atmospherics were moderate or bad, using a change-over switch to change quickly from one system to the other while listening to the same signals, and any loss in signal strength noticeable on the indoor as compared with the outdoor system was always compensated for by the decrease in the interference caused by atmospherics.



Mr. Maurice Child at the transmitter of the field station of the combined societies' meeting held recently.



Correspondence

THE FOUR-VALVE T.A.T. RECEIVER

SIR,—The enclosed photograph depicts a four-valve T.A.T. receiver (Mr. John Scott-Taggart, *Modern Wireless* for December, 1924), which has been in use with the utmost satisfaction for some months.

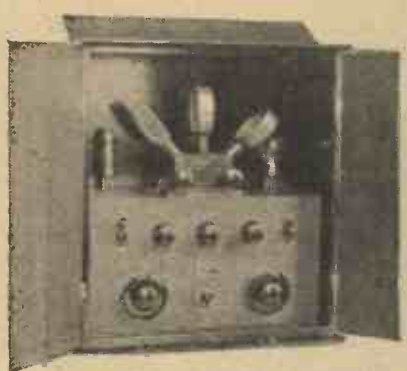
As will be apparent from the photograph, no plug-in type of coil is used as the aperiodic anode inductance, this being a tapped inductance contained internally and brought out to a switch and studs. The last stud cuts out the coil and brings into circuit a resistance.

Results indicate that your test reports are very conservative, and Mr. J. Scott-Taggart is deserving of all praise for this excellent circuit.

I hope to alter the set to include a wave-trap, but I find difficulty in keeping pace with your multifarious improvements.—Yours faithfully,

W. WATSON.

Harlesden.



A 4-valve T.A.T. Receiver built by Mr. W. Watson.

THE FOUR-VALVE FAMILY RECEIVER

SIR,—Enclosed is a photograph of my Four-valve Family Receiver (by Mr. Percy W. Harris, Radio Press Envelope No. 2), which I have made.

There are many of my wireless friends who have heard this receiver, and consider it the finest they have heard.

As an instance of its simplicity, my son, who is less than five years old, can tune in the local station, and on a recent Sunday, with my aid by instructing him as to which valves to switch on, he tuned in 5NO faintly and then brought the

Master Sullivan and the 4-valve Family Receiver.

reaction closer and switched on the loud-speaker.

I have logged all the B.B.C. main and relay stations, also many amateurs and WGY (New York), all on the loud-speaker.

My aerial is of the Vertex type, about 40 ft. high with 65 ft. of No. 12 S.W.G. copper wire on an iron frame and with 30 ft. lead in.

The earth is a brass tube 2 ft. 6 in. by 1 in., with a length of heavy cable brazed to the bottom and with the combination of this aerial and earth an Amplion connected to any ordinary crystal set can be heard faintly at a distance of 20 ft.

I have added extra H.T. to the last two valves, and also grid bias.

Wishing your periodicals every success.—Yours faithfully,

H. V. SULLIVAN.

Mosten, Manchester.

A NEW VALVE-CRYSTAL CIRCUIT

SIR,—Just a slight appreciation of a good circuit, certainly one of extreme interest. I refer to the "Valve-Crystal Circuit" described by Mr. J. Scott-Taggart in the March issue of *The Wireless Constructor*. I made up a receiver, after seeing the circuit, and the result is really surprising. I am one mile from 2LS, aerial and earth systems are good, aerial 60 ft. long, 40 ft. high. Full loud-speaking is received from the local station, heard distinctly all over the house. Manchester (40 miles) is at medium loud-speaking, much too loud for 'phones. I have received all main stations on 'phones, excepting Cardiff and Bournemouth. Of the relays, Hull and Sheffield come in well. Nottingham is just readable. Several foreign stations, origin not known, are at medium 'phone strength.—Yours faithfully,

F. MARTIN.

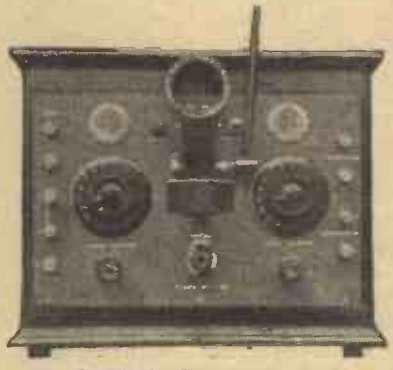
Bradford.

A READER'S ST100

SIR,—I understand that you are interested in the results obtained by your readers, so am enclosing photographs of the ST100 I have made up. Not being satisfied with the appearance of an ST100 set I had previously constructed, I decided to make this design.

The reception is quite as good from 2LO, and I get Radio-Paris easily now with Nos. 150 and 250 coils. You will notice I have a Lissen switch to cut out one valve, when I get London at quite good volume for a small room.

I have tried numerous other cir-



Mr. Quilley's ST100 Receiver is extremely neat.

cuits, but I have to admit that the ST100 is the best for purity of tone for local broadcasting reception.—Yours faithfully,

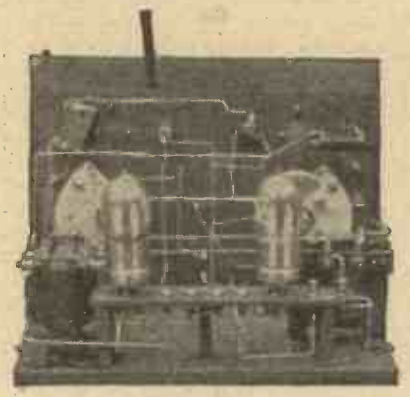
E. J. QUILLEY.

Stockwell, S.W.9.

A READER'S PRAISE OF RADIO PRESS REFLEX CIRCUITS

SIR,—Being a regular reader of Radio Press publications, I am very

interested in readers' results obtained with sets made from instructions given in your excellent publications, and think it might interest other readers to hear of results I have obtained with three reflex sets I have made during the past three months. The first I made was the One-Valve Reflex described by Mr. Percy W. Harris in the February issue of *The Wireless Constructor*, and which brings in all the B.B.C. and plenty of Continental stations on the 'phones, the local station (Leeds) at 10 miles distance being comfortable on the loud-speaker. I might mention here that previous to this I had made 11 single valve sets, but the volume was not to be compared with results of the reflex. I have also had Pittsburg KDKA with this set, which I think you will agree is a good performance. I decided later to go farther ahead with reflex receivers, so looking up some Radio Press back numbers, I came across the "Twin Valve Receiver," by Mr. Scott-Taggart in the January issue of *The Wireless Constructor*, and reading the account of the results obtained with same (which I find is nearly always on the modest side), I decided to build it, and was astonished at the number of stations that came through well on the loud-speaker. Leeds-Bradford, very loud; Manchester, 40 miles, nearly as loud as Leeds; Bournemouth a trifle weaker, obtained while Manchester was not working and after dark (I have received Bournemouth here on a crystal set; distance is, I believe, 260 miles). Newcastle also came in on the loud-speaker at moderate



A back-of-panel view of Mr. Quilley's receiver

strength, and also one German station during daylight. On a subsequent occasion, looking at *Modern Wireless*, March issue this year, I found the "Three-Valve Dual Receiver" designed by Mr. Scott-Taggart, and made this set up. I arranged the components a little differently to the instructions given; in fact, nearly the same as shown for the twin-valver, with the extra valve, of course. The results obtainable with this receiver are quite equal to any four-valve set I have heard and better than many. I think this is sufficient praise.

Wishing Radio Press still further success.—Yours faithfully,

G. BARRETT.

Wakefield

COMMUNICATION WITH AUSTRALIA

SIR,—With reference to the recent short wave transmissions to Australia, I have just received confirmation by the first mail of the reception of my signals on 18 metres at 4.45 p.m. Melbourne time on April 26, strength 6. This, you will note, precedes Mr. Simmonds' transmission, which was taken to be the first to Australia in daylight, by one day, and also it was on a much shorter wavelength, as you will observe.

The reception was carried out by the Senior Engineer on the staff of *Amalgamated Wireless*, whose name, by the way, is B. Pringle.

It was absolutely impossible for me to know previous to this, as, unfortunately, Mr. Pringle did not cable me, but simply wrote first mail. The time checks exactly with my log, and both the letter and my log are open for examination at any time should they be required, in view of the circumstances.

The equipment in use at 5NN was a somewhat unusual circuit,

which I shall be pleased to describe should you require any further details at a later date. The valve in use was a Mullard O250, while the aerial is 37 ft. long, 30 ft. high, counterpoise 40 ft. long, 10 ft. above the ground. The aerial, as a matter of fact, is the lead-in of my old 90-metre aerial, and falls right in between two houses, and is totally shielded except in one position; the top of the aerial does not come to the top of the house, but about 3 ft. or 4 ft. below.

The receiver in use when the signals were picked up in Melbourne was, according to the information received, a low-loss two-valve tuner, detector and one stage of note magnification.

I trust that you will give notice to this achievement, as instead of making me second across, it gives me the privilege of being first across on ultra-short waves in daylight, and also with the shortest wavelength that has ever been used for long-distance transmission in any part of the world.—Yours faithfully,

J. H. D. Ridley (5NN).

S. Norwood, S.E.25.

ST100 WITH EXTRA H.F. VALVE

Sir,—Am enclosing a photograph* of a set made up from instructions by Mr. John Scott-Taggart in the June, 1924, number of *Modern Wireless;* it is the ST100 with high-frequency valve. I have made slight alterations, which include a switch for both high- and low-tension, a switch to change over from 'phones to loud-speaker, and a separate lead for H.T. to the H.F. valve.

I get very good results with the set, but cannot cut out 2LO. I have had Radiola, Petit-Parisien and Madrid on the loud-speaker, loud enough to be heard in a small room, and have also had Bournemouth, Manchester, Cardiff, Glasgow, and one or two amateurs on the 'phones. When I have made one or two minor alterations to the aerial I hope to get even better results.—Yours faithfully,

W. E. Newton.

Denmark Hill, S.E.5.

A TRANSFORMER-COUPLED THREE VALVE RECEIVER

Sir,—While looking round for a set that I could make up as a portable one I tried out the above-named, by Mr. Stanley G. Rattee, M.I.R.E., Vol. 5, No. 4, *Wireless Weekly,* and found it a great success. I then decided to fix it up in as small a space as possible in an attaché case 17 in. × 10 in. × 5 in. deep, panel 10 in. × 9¼ (I had a piece of ebonite that size), and find it works splendidly, too loud for 'phones on London, but just right for loud-speaker. The enclosed photographs* will give you an idea what it looks like; both coils fold down level with panel and there is plenty of room for H.T. battery and L.T. accumulator, also 'phones and a length of flex. I am a regular reader of *Wireless Weekly, Modern Wireless* and *The Wireless Constructor,* from which I find most valuable information.—Yours faithfully,

J. Stuart.

Mayfair, W.

[* The Editor regrets that the photographs submitted would not stand reproduction.]

* * *

"LOW-LOSS"

Continued from page 311

facturer will provide him with one, even if only in the obvious application of the neutrodyne receiver. This one example will suffice to illustrate our point, and we must content ourselves with the observation that the high-frequency transformer is merely one of a host of components in whose design and production the low-loss idea can, and should, act as a most valuable stimulant to all-round improvement.

Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

M.H. Fixed Condensers

From Messrs. L. McMichael, Ltd., come samples of their well-known flat interchangeable unit type of fixed condenser, in a new and improved pattern. These are of the same general design as heretofore, being about 2½ in. by 1⅜ in. in size and adapted for mounting in spring clips secured to the panel by a single bolt at each end, clips for this purpose being provided with each condenser. The general finish and appearance are up to the standard associated with Messrs. L. McMichael, Ltd.; the actual capacities of the units tested, the .01 μF size and the .0003 μF (grid condenser) size were within close limits of the nominal value, and in each case a valve was found to oscillate with ease with this as the main tuning capacity. The static insulation test showed high insulation resistance in the case of the smaller one; with the larger condenser the insulation was adequate for any ordinary purpose, and it operated well as a grid-blocking condenser in a resistance-capacity L.F. amplifier. The great convenience of this interchangeable type of fixed condenser, together with the improvements introduced in this new pattern, should certainly maintain its popularity.

"Decko" Back-of-Panel Valve-Holders

A one-hole-fixing valve-holder of neat design is that marketed by Messrs. A. F. Bulgin & Co., the new pattern "Decko." This is affixed behind the panel by a single large screw with a plated hexagonal head; the valve is mounted in a vertical position behind the panel in sockets which are sunk in the ebonite block for greater security against accidental short circuits when inserting it. Large soldering tags, double in the case of the grid and anode connections, are provided at the sides of the holder, one filament connection underneath being supplied with an extra long tag and a terminal-nut in addition.

The insulation resistance proved, on trial, to be excellent, and the fitting was easy to apply in making up an American type of set with vertical panel and concealed valves. It can be recommended for this purpose; the workmanship is good

and the finish adequate, whilst there is nothing flimsy about the device.

Ediswan Valve-Holder

Messrs. Edison Swan Electric Co., Ltd., have brought to our notice the Ediswan W.L.539 Ebonite Valve-holder, which they are marketing at a moderate price. This is of the cylindrical solid type, and has the sockets deeply recessed as a measure of precaution against shorting the filament of the valve across the H.T. supply by mistake, since no connections can be made until the valve-legs are inserted well in. The pins are each provided with a pair of nuts. The insulation-resistance proved excellent on test, and the fitting appeared to be well made and highly finished.

Lisenin Positive Grip Plug and Socket

A plug-and-socket terminal connector of neat appearance and thoughtful design has been submitted for our trial by Messrs. Lisenin Wireless Co. The sockets are mounted in the panel in the usual manner with back-nuts, and are provided with a cross slot to take the end of a screwdriver when inserting them. Incidentally, they are of the correct size to take a valve-leg, and hence can be used as valve sockets for anticapacity mounting. The plugs have a long conical end which fits securely in the socket; at the upper end a conical chuck is provided made up of an inner brass cone-piece and an insulating sleeve which, screwing on the main portion of the plug, jams the upturned ends of the flexible connector between this cone-piece and an internal cone in the main part of the plug. The cone-piece is recessed and the insulating sleeve is of large diameter inside, so that the insulated portion of the wire fits close up, giving a strong connection here.

On trial, this device was found to give a secure hold on flexible connections and single wires of varying sizes. The insulating sleeve is supplied in two colours, black and red. The general appearance of the fitting, together with the finish and workmanship, were matters of favourable comment, whilst the price is moderate for a well-finished article.

Combined Earth Switch and Lead-in Tube

A simple and effective type of combined safety earthing device for protection from lightning and lead-in tube for aerial connection is that from Messrs. E. Shipton & Co., Ltd. a sample of which has reached us. This has the usual insulating tube about 6 in. long and ½ in. diameter for insertion in the window-frame, etc., through which passes a square plated rod, with a sliding movement of a little over 1 in. A knob at the inner end controls this; at the outer end it is fitted with a large and convenient winged nut for securing the end of the aerial lead. Two metal collars on the insulating tube are each provided with a substantial terminal; the external one is to be connected straight to earth, the inner one to the aerial terminal of the set. Contact springs on the moving rod engaged with these collars, and complete connection either direct to the set within or to the earth, thereby isolating the set during thunderstorms, etc., according to the position of the control knob. Whilst there is always present the relatively small capacity across the collar and the rod inside it, via the insulating dielectric at each end, the effect of this will be but slight for reception on the ordinary frequencies. The insulation resistance, when dry, proved to be satisfactory. The outer end should not be exposed unprotected from rain, if insulation is to be preserved. The compactness, simplicity and certainty of this device should appeal strongly to many listeners. The price is also quite moderate.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

T.O.L. (EXETER) has submitted two circuit diagrams for our examination and comments. One consists of two high-frequency stages, tuned anode coupled, using ordinary plug-in coils, tuned by a dual condenser. Reaction is shown from the plate circuit of the detector valve on to the first anode coil. The second diagram consists of a detector valve and one stage of transformer coupled low-frequency amplification.

We have carefully examined the proposed wiring diagrams and lay-out, and would state that the circuit as given is substantially correct, excepting for one or two small mistakes. We would, however, emphatically advise our correspondent not to try and construct the arrangement as set out in his diagrams. Dealing first with the high-frequency part of the circuit, it is very doubtful if a dual condenser could be successfully used to tune two tuned anode stages using ordinary commercial plug-in coils, which are usually far from matched. Again, if these coils were obtained perfectly matched, when reaction was used on to the first anode coil, this would unbalance matters so that the two circuits would not be brought into resonance by the dual condenser. The layout also is by no means good; the two anode coils are shown on the centre line of the panel and separated only by a distance of 4½ ins. We would advise that the coils be further separated if possible and arranged with their axes at right-angles. The potentiometer connections as shown are correct, but the grid-leak which is joined to the grid of the second valve should be taken to L.T. *minus* and not L.T. *plus*, since it is desirable that a negative potential be applied to the grid of amplifying valves.

Dealing with the low-frequency portion of the set, we notice that provision is made for separate high-tension on the low-frequency valve. This is a very wise arrangement, but where a fairly high value of high-tension is used we would advise that provision is also made for applying grid bias. This is readily carried out by bringing the side of the secondary of the L.F. transformer which goes to L.T. negative out to a terminal which

becomes grid-bias *minus*. The grid-bias *plus* terminal will be coincident with L.T. *minus*. By employing a suitable value of grid bias for the high-tension applied to the plate of the last valve, the drain on the high-tension battery will be less and the valve may be worked on the correct part of its characteristic curve for pure reproduction.

A.C. (WRITTLE) is using a crystal set in conjunction with a 2-valve power amplifier for loud-speaker reception from Chelmsford. He is using two D.E.5 type power valves with 100 volts high tension, and states that his high-tension batteries have to be renewed after four or five weeks' service. He mentions that his loud-speaker reproduction is lacking in purity, submits a circuit diagram and asks our advice.

On examining our correspondent's diagram, we are by no means surprised that the life of his high-tension batteries is exceedingly short. With D.E.5 type valves and no grid bias when 100 volts is applied to the plate, roughly a value of 18 milliamperes is taken by the two valves. This is much too heavy a load for the ordinary small type of high-tension battery, which will soon loose its voltage and tend to become extremely noisy. We would suggest that the connections from the filament side of the two secondaries of the L.F. transformers be broken and that these two points be joined together and taken out to a terminal which will become the negative terminal for a common grid-bias battery. The grid-bias positive will be coincident with L.T. negative. Using 100 volts high-tension, 4½ or 6 volts would be a suitable grid-bias voltage to use. We would suggest that a 9-volt grid battery be obtained tapped at 1½-volt steps. Using 6 volts negative grid bias, the plate current for the two valves will be reduced to the order of eight milliamperes and the life of the high-tension battery considerably prolonged.

W.F. (PEMBURY) has a valve receiver, employing a detector and two transformer-coupled low-frequency stages, which continually howls. He submits a circuit diagram, and asks if we think the values of the condensers are unsuitable and if so, whether this would cause the set to howl.

In reply to our correspondent, we do not think that the trouble is likely to be due to unsuitable condensers, but rather that it is due to obscure reaction effects at either high or low frequency. If oscillation is taking place at low frequency it may often be cured by reversing the connections to one or other of the inter-valve transformer primary windings. Whether the trouble is due to high- or low-frequency oscillation can readily be determined by varying the tuning controls when the set howls. If this alters the note, the oscillation is occurring at high frequency, and the remedy is to weaken the reaction coupling and try the effect of varying the value of grid-leak used. If, however, the howling is at low frequency, altering the filament resistances of the low-frequency valves should alter the note. Should the trouble not be cured by reversing the primary connections to one of the transformers, we would suggest that the effect of placing a resistance of ½ megohm across the secondary of one of the transformers be tried. In cases where the howl does not disappear with the ½ megohm leak across the secondary we would suggest that the effect of a variable anode resistance be tried. If the cores of the transformers are not earthed, we would suggest that these be joined to L.T. negative.

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Does it just light your valves or does it help tuning?

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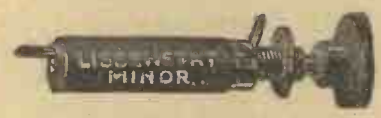
When the condensers and reaction coupling have been adjusted to their finest degree, it is then that the final minute adjustment possible with a LISSENSTAT will resolve the carrier wave into clear speech and music.

There are three models of the LISSENSTAT—the MINOR, MAJOR and UNIVERSAL. The LISSENSTAT MAJOR is the standard model; the LISSENSTAT MINOR provides much of the beautiful Lissenstat Control at a popular price; the LISSENSTAT UNIVERSAL incorporates a safety device for the protection of dull emitter valves.



Price 3/6

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LISSENSTAT RESISTOR.—Every rheostat which is capable of a zero minimum has an element of danger for dull emitter valves. This handy little LISSEN device can be fitted easily and quickly. It provides any type of rheostat with a predetermined safety minimum resistance for dull emitters. Price **1/3**

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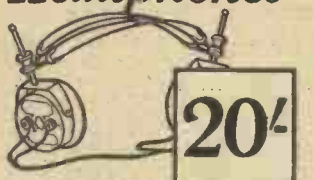

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All Brandes products carry our official money-back guarantee, enabling you to return them within 10 days if dissatisfied. This really means a free trial.

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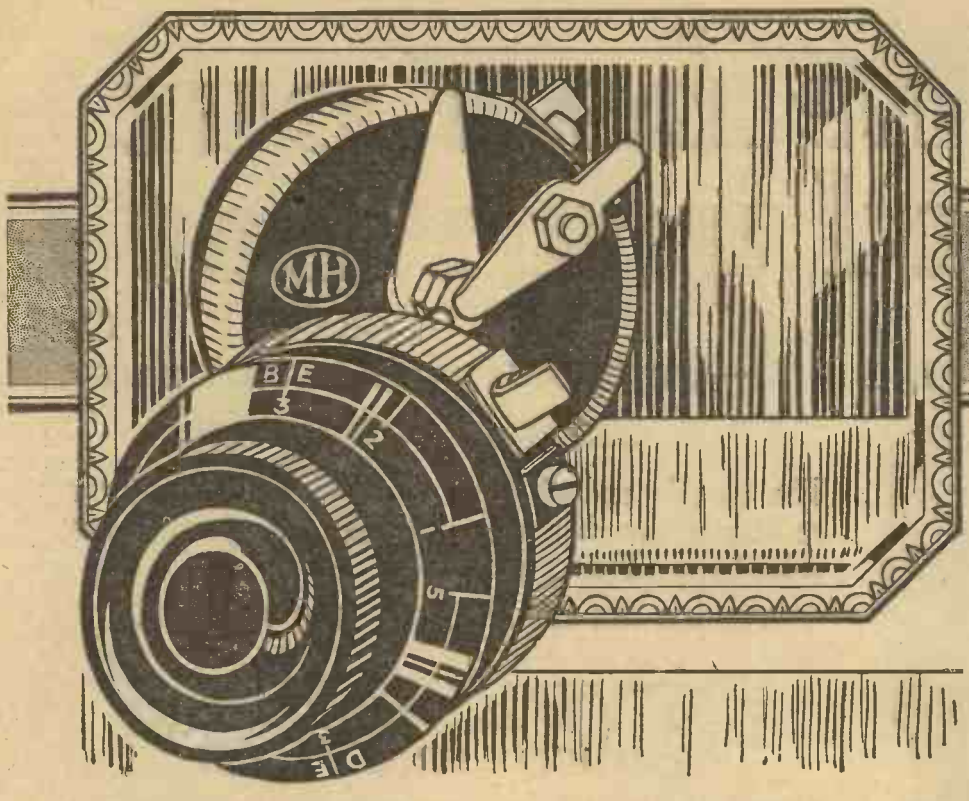

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YOU examine a (MH) Filament Rheostat, and however long you may reflect on the question, you will always come to the same conclusion—that in every way the (MH) Filament Rheostat is the ideal component you are seeking.

Every detail in design and construction has been carefully considered.

Note the lipped edge to the moving contact. This ensures smooth action and positive control. See how the wire is wound on the former.

The gauge of wire employed will safely carry the necessary current without overheating.

The metal bridge piece separating the two windings of the dual type provides warning to the touch that the slider is at the end of the high resistance winding. The red and white engraved dial also tells the eye of this fact.

Both knob and dial are metal bushed.

These are a few of the salient features which make (MH) Rheostats instruments of precision that stand out from all others.

The (MH) Potentiometer

IS similar in build and design to the (MH) Rheostat. Its use enables you accurately to adjust the grid potential of a valve while its resistance of 300 ohms ensures that the current taken is negligible. It can always be relied upon to give satisfactory service

PRICES.

Bright Emitter Filament Rheostat	**5/-** each
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Dual Type (for either Bright or Dull Emitters)	**7/6** each
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Get the *best* out of your set!

—*and solve your accumulator charging difficulties*

The trouble and expense of continual accumulator recharging are the chief sources of annoyance to the valve user. You can change all this.

TO ENSURE EFFICIENCY WITH ECONOMY
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TYPE D.E.3

REDUCED PRICE — 16/6

If you have a multi-valve set—Bright emitter valves mean heavy, bulky accumulators and constant recharging. Even dull emitters of the ·3 amp. class may constitute a heavy drain if several are used. The D.E.3 will make your accumulator last from 5 to 10 times as long on one charge.

If you have a single or two-valve set—With the D.E.3 you can use a 4-volt accumulator of half the usual size; or it may be dispensed with altogether, and dry cells substituted.

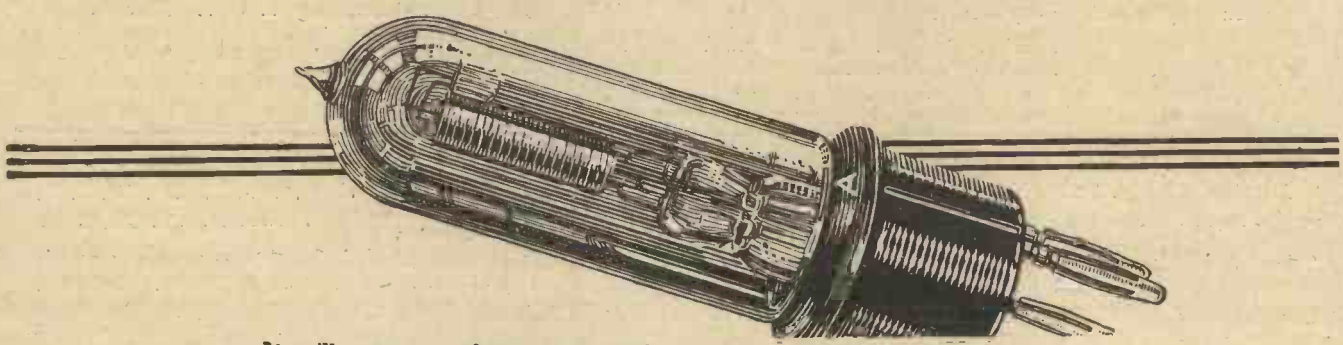
If you have a crystal set—By adding a D.E.3 valve as amplifier you may enjoy all the advantages of pure loudspeaker reproduction without the trouble and worry of accumulator charging.

FIGURES SPEAK FOR THEMSELVES

CAPACITY OF ACCUMULATOR	HOURS ORDINARY DULL EMITTER 0.3 AMPS.					HOURS D.E.3 DULL EMITTER 0.06 AMPS.				
	Number of valves									
	1	2	3	4	5	1	2	3	4	5
20 ampere hours	66	33	22	16	13	330	166	110	82	66
40 ampere hours	132	66	44	32	26	—	332	220	164	132
60 ampere hours	198	99	66	48	39	—	—	330	246	200

BUY THE VALVES BACKED BY THE NAMES

MARCONI & OSRAM



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B 500

INTERVALVE TRANSFORMER

Guaranteed for 12 months.

This transformer has been adopted by leading Manufacturers of Wireless Receiving Sets and discriminating amateurs in all parts of the world. High amplification without distortion and complete freedom from internal noises. Correct design, high-class finish. Excellent results have been obtained on tests carried out by the National Physical Laboratory. Copy of the curve can be had on application.

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(For Panel mounting).

Strongly constructed. Moving vanes are shaped to give low minimum capacity. Fitted with a stop to allow of a movement of 180° only. From 5/6 each.

POTENTIOMETERS.

(For panel mounting).

On rectangular ebonite former, complete with knob and pointer, Former mounted on cast brass frame. Resistance approximately 400 ohms. 7/6 each. *Makers:*

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The Battery for your PORTABLE SET

The "Ever-Ready" L T 3 Dry Battery.

For Filament heating of Dull Emitter (.06 amp. type) Valves.

EFFICIENT AND ECONOMICAL.

A thoroughly reliable battery which, by reason of its shape and size, is particularly suitable for use with Portable Receiving Sets. Batteries are fitted with three insulated terminals at 0 (positive), 3, and 4.5 volts (negatives). When the voltage of the initial circuit at 0 and 3 has fallen too low to efficiently operate the valve, a further period of useful life is obtained by changing the negative lead to the 4.5 terminal.

No.	Type.	Volts.	Each.
RB54/8	LT3	4.5 volts	7/6

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Any size cut.
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18	1/11	2/11	3/5
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2 VALVE Amplifier, 35/-, use one or two valves; also 1 Valve Amplifier, 20/-, both perfect as new. 3 good Valves, 6/- each. 3 pairs smart 20/- Headphones, as new, 9/- each, 26/- the lot. New 4-volt Accumulator, celluloid case, 13/-. New Dura 60-volt H.T. Battery, guaranteed, 6/-. 2-Valve All-Station Set, works speaker, £4. Approval willingly. — W. TAYLOR, 57, Studley Road, Stockwell, London.

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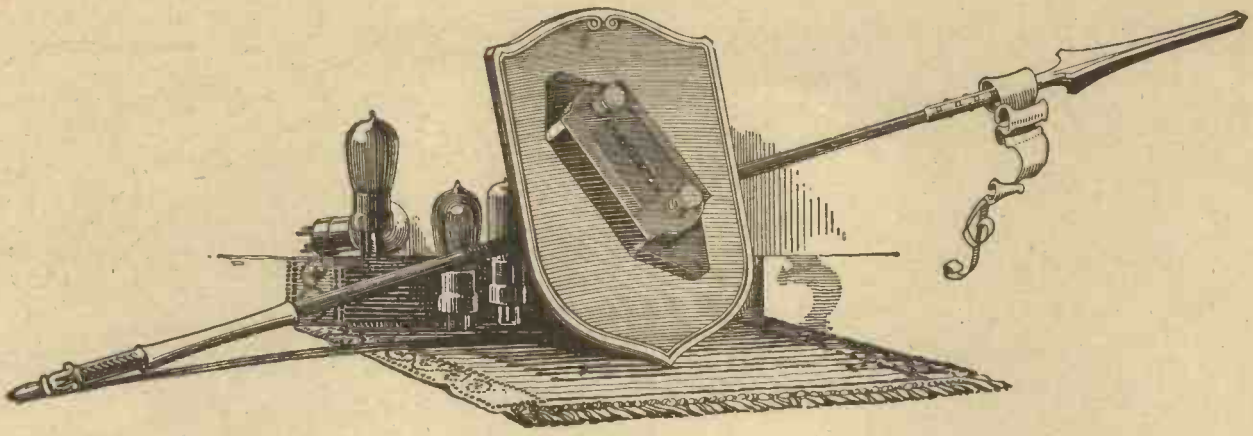
FOR SALE, Burndept Experimental Ultra IV Panel, with Mark III Tuner and Extra H.F. Panel. Offers to Box No. A. 33, "Wireless Weekly," Barclays, Bush House, Strand, W.C.2.



PROTECT YOUR VALVES
with the
"DUBRESCON"

THE disconcerting flash that occurs when the filament terminals of a valve are accidentally touched across the anode and grid sockets of the valve-holder is one of the expensive kind—say 8/- or more. Every amateur probably flashes away quite a lot of money this way every year. There is also a similar effect when the H.T. leads are mistakenly connected to the L.T. terminals, and the valves switched on.

These mistakes are like all others — expensive.

Valve immunity, however, can now be purchased for SIX SHILLINGS. That is the price of the new Dubilier Dubrescon, which makes it impossible for valves to be burnt out by accidental short-circuiting or similar causes.

The Dubrescon must be inserted in series in one of the H.T. leads—quite a simple operation. The H.T. current can then never exceed the usual filament current, and your valves are secure for ever. The Dubrescon does not interfere with the passage of the H.F. currents.

It is advisable to buy one now, ready for next time. And in doing so, be sure that you

Specify Dubilier

THE DUBRESCON
Insert in series in one of the H.T. leads for protection of valves.

DUBILIER CONDENSER CO. LTD

6/-

Twelve months from now his Wuncells will still be giving him the same good service.

APART from sensitiveness, low current consumption, and tonal purity, there is still one vital requirement which every wireless enthusiast must consider carefully before he chooses his Dull Emitter Valve. And that is its probable length of life. Obviously no improvement in valve design is of much value if the valve itself will not stand up to the rigours of daily use.

The weakest part of any valve is naturally its filament—given ordinary care the grid and anode are everlasting. Improve the filament, therefore, by making it more robust or by reducing the strain to which it is subjected, and automatically the valve gains in longevity. In the Wuncell we have done both. We have reduced the strain under which Dull Emitters usually operate by designing a valve of moderate current consumption (.3 amps at 1.8 volts). Wireless enthusiasts long ago realised that an unnecessarily low current consumption resulted only in an excessively fine filament incapable of withstanding the shocks of everyday use.

The Wuncell filament—due to an entirely new process—is actually as stout as that used in the standard bright emitter. The same exclusive process permits the valve working at a temperature of only 800 degrees. In daylight its glow is practically invisible. At night it can be compared to the embers of a dying match. Certainly it is the nearest approach to the cold valve yet achieved.

The man who looks to his valves to give him many, many months of enjoyment must standardise on the Wuncell—no other can approach it for length of life.

Wuncell Dull Emitters

Made in two series: Types W.1 and W.2 for 2-volt accumulators. Types W.R.1 and W.R.2 with additional resistance incorporated within the base so that valves can be used with either 2-, 4- or 6-volt accumulators.

W.1 and W.R.1 are for use as Detectors or L.F. Amplifiers. W.2 and W.R.2 are specially designed for high frequency amplification.

Technical Data:
Filament voltage, 1·6 to 1·8
Fil. consumption, ·3 amps.
Plate voltage, 20 to 80

W.1 14/- W.R.1 16/-
W.2 14/- W.R.2 16/-

The New W.3

The Cossor Loud Speaker Valve

When used with a good low frequency Transformer this new W.3 valve gives an immense volume of pure and undistorted sound. Its use renders a second stage of L.F. amplification practically superfluous. The design embodies all the well-known Cossor principles and the valve is therefore quite free from microphonic noises. Filament voltage, 1.8 volts; filament consumption, .3 amps. plate voltage, 80-120 volts.

18/6

— the long life Dull Emitter

Cossor Wuncell

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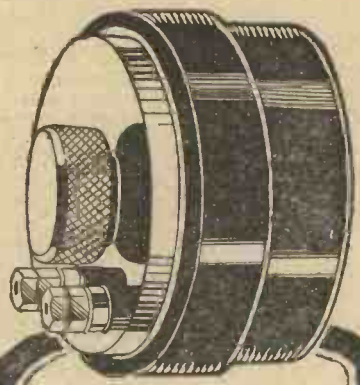

Build Your Own Loud Speaker

THERE is lots of pleasure and satisfaction to be obtained from building your own Loud Speaker. Almost every Wireless Magazine has published detailed constructional articles showing, for instance, how to build Loud Speakers of the paper diaphragm type.

Without exception, they stipulate that the famous Brown A-type Earpiece shall be used. The reason for this lies in the fact that no other earpiece has the essential reed type mechanism.

A Loud Speaker of this type, requiring no horn or cabinet, is not beyond the ability of any wireless amateur. Why not make up your mind to build one right away?

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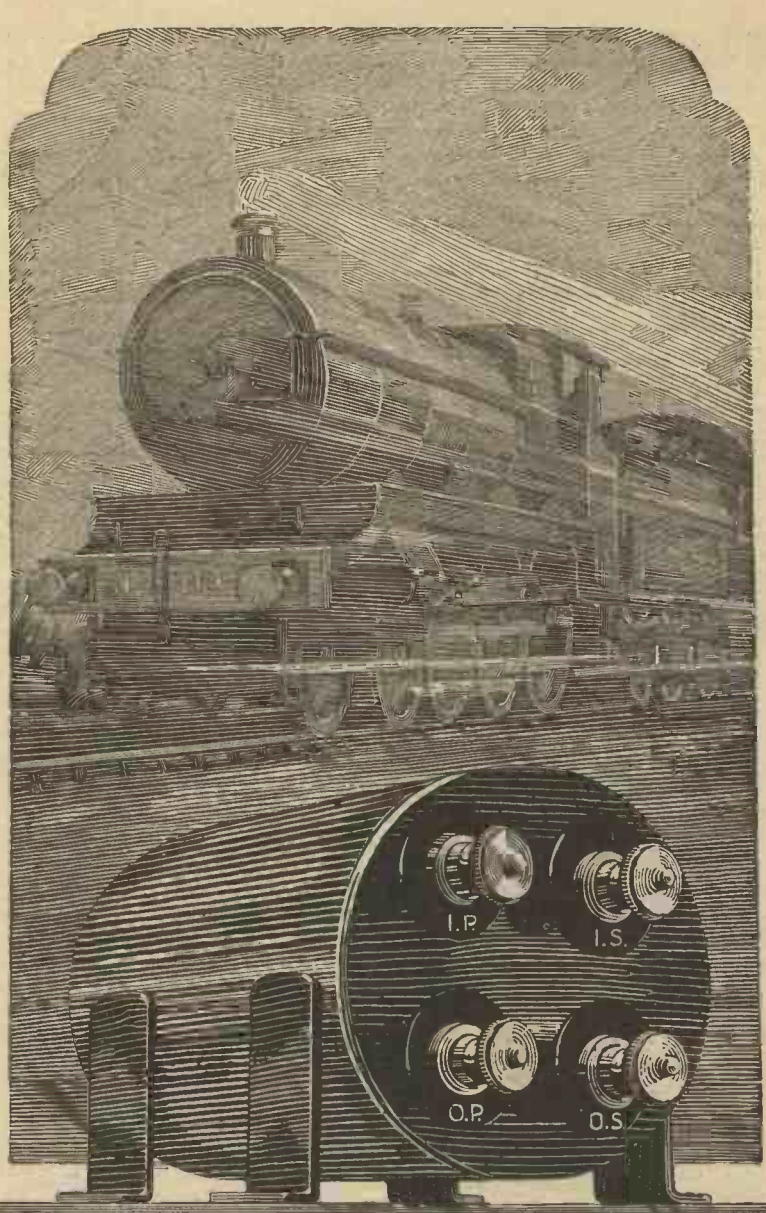

Power!

SPEED, and yet more speed, clamours the user of the railways. And so Science and Industry work hand in hand to evolve a locomotive capable of delivering that extra power which means more miles added to the daily run.

Volume and yet more volume is the insistent demand of the wireless enthusiast. First a sufficiency of sound to fill a small room. Then a fullness that could be heard through closed doors. And now to-day everyone wants a mighty volume of sound, readily controllable, suitable even for outdoor recreation.

Of all the transformers on the market, there is none enjoying a greater reputation for volume and clarity of tone than the Eureka. Its colossal sales testify to its correct design and sterling workmanship. When you choose the Eureka you are endorsing the choice of Britain's leading technical experts.

Concert Grand, 30/- *No. 2 (for 2nd stage) 22/6*

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52A **£3 10s.**

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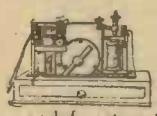

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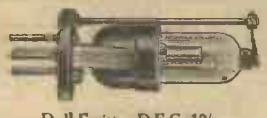

Dull Emitter D.E.C. 12/-.

New Osram "C" Valves, Low Loss Type, 4/-.
22/- for six.
Adapters, 4-pin. 1/-.

Rubber Battery Leads, 1/- pair.

D.C. DYNAMOS.

12v. 8a	60/-	M.G., H.T. 750v. 80w.	£12
H.T., M.G. 350v. ..	£4	,, ,, 1,200v. 80w.	£22
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VALVE RECEIVERS AND AMPLIFIERS

H.F., L.F. and Super-Heterodyne.

2-Valve T.B. in case (Valves extra)	£2	0	0	6 v. H.F. and L.F. (Valves extra)	£5	10	0
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6-Valve T.M. L.F. ..	£6	0	0	7 v. H.F. and L.F. ..	£5	17	0
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AERIAL WIRE. 7/23 copper, 50 ft., 10d. 100 ft, 1/8; 110 ft. cartridge aerial, 1/3. Morse practice outfits, 5/6. 25,000 pairs zincite-bornite crystals in Perikon cups, 6d. pair. Folding frame aerials, 21/6. Copper strip aerials, 2/6 per 100 ft. 7/22 enamelled, 3/- per 100 ft.
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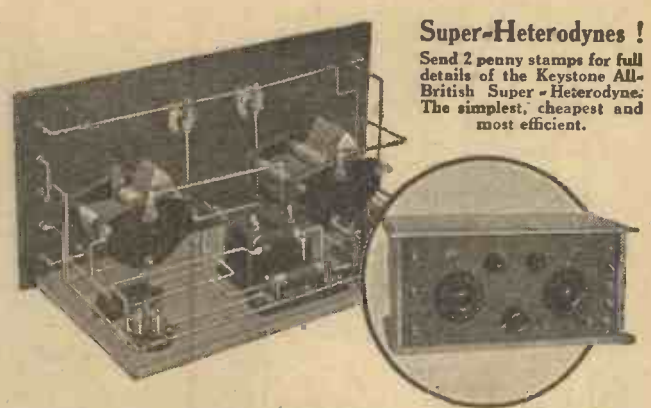

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Send 2 penny stamps for full details of the Keystone All-British Super-Heterodyne. The simplest, cheapest and most efficient.

64/- buys all the parts for this 2-Valve Set

NO need to spend a lot of money on a ready-built Receiver when you can build the splendid 2-valve Set shown above for just over £3. This is the Popular Wireless Continental Receiver—a splendid Set for long distance reception. Now that valves have been reduced in price no one can say that a Valve Receiver is costly to build or expensive to run. Send for the parts you need to-day—wiring diagram giving full instructions is supplied free of charge to all customers. Our 32-page Pilot Chart (post free, 3d.) shows many other Receivers just as cheap and easy to build. Catalogue of Components, 48 pages; scores of Illustrations, post free, 3d. Peto-Scott's Wireless Book, containing over 80 circuit diagrams, post free, 1/6.

		£	s.	d.
1	Peto-Scott Square Law Condenser, ·0005		8	
1	Peto-Scott Square Law Condenser, ·0003		6	9
2	Microstats		5	6
1	Two-Coil Holder, Board Mounting		5	6
2	Anti-capacity Valve Holders		2	6
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6	2 ft. Lengths 1/16 Bus Bar			
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		£1	18	0
	Plain Panel "Red Triangle," 13" × 6½" × ¼"		5	0
	Panel drilled, extra		2	0
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	CABINET, 13" × 6½" × 6½", with Baseboard Mahogany ..	1	1	0
	Ditto, in Oak		19	6
		P.S.3057.		

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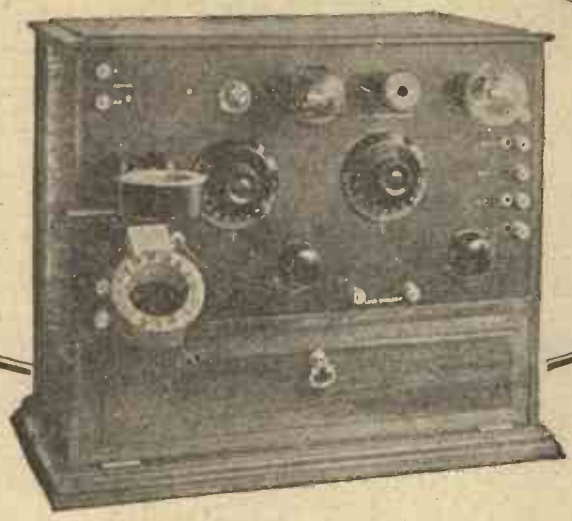

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in which no crystal is employed

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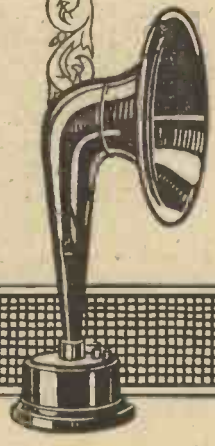

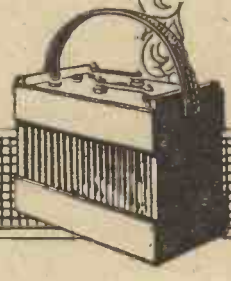

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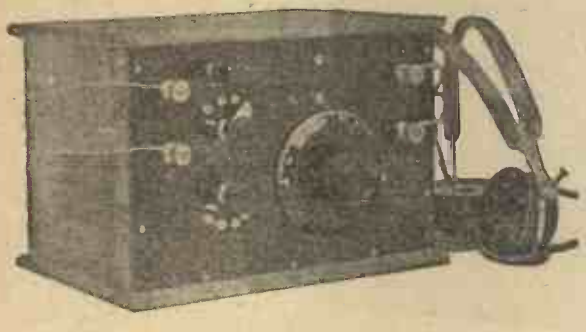

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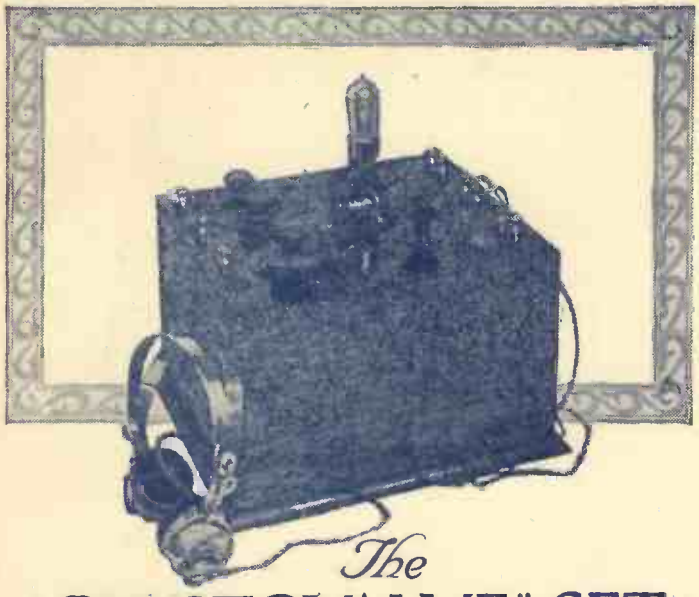

The

"CRYSTOVALVE" SET

THE "Crystovalve" set, illustrated above, is described fully in the current issue of "The Wireless Constructor" by the Editor, Mr. Percy W. Harris, M.I.R.E.

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WE GIVE BELOW A SELECTION FROM THE CONTENTS OF THE SPLENDID CURRENT NUMBER.

A very adaptable receiver described in this issue is the "Double-Purpose" 2-Valve Receiver, by D. J. S. Hartt, B.Sc. This set can be used as H.F. and Detector, or Detector and 1-note magnifier by a turn of a switch. Full constructional details and a FREE BLUE PRINT are given.

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"Faults in H.F. Transformers," by G. P. Kendall, B.Sc.

"How to connect your separate High-Tension and Grid-Bias Terminals," by Percy W. Harris, M.I.R.E.
(It is the practice in many "Wireless Constructor" valve sets to allow provision for GRID-BIAS, and in the case of multi-valve sets, separate H.T. Terminals.) How the maximum efficiency from this refinement can be attained is the subject of the above interesting article.

"A Low-Loss Crystal Receiver," by W. H. Fuller, a unique design of Crystal Set for Broadcast Reception. For the new Constructor, "What tools to buy."

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The Wireless Constructor

Edited by PERCY W. HARRIS, M.I.R.E.

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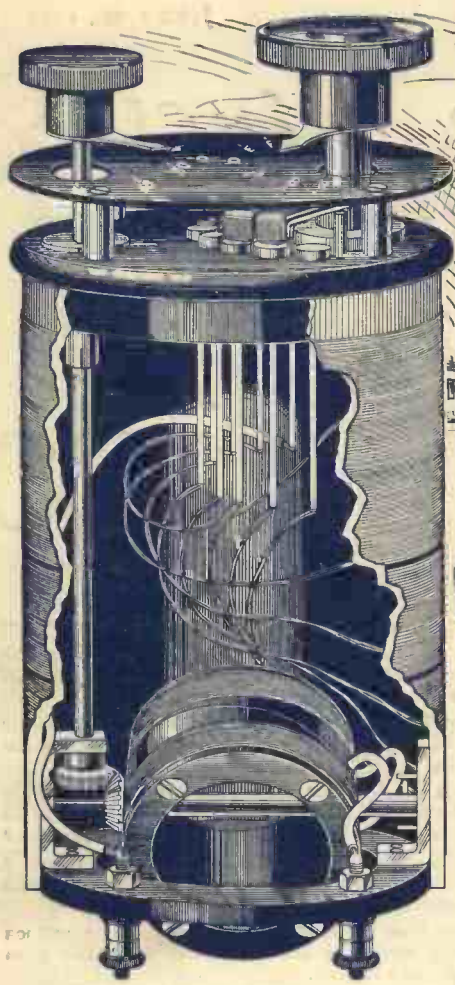

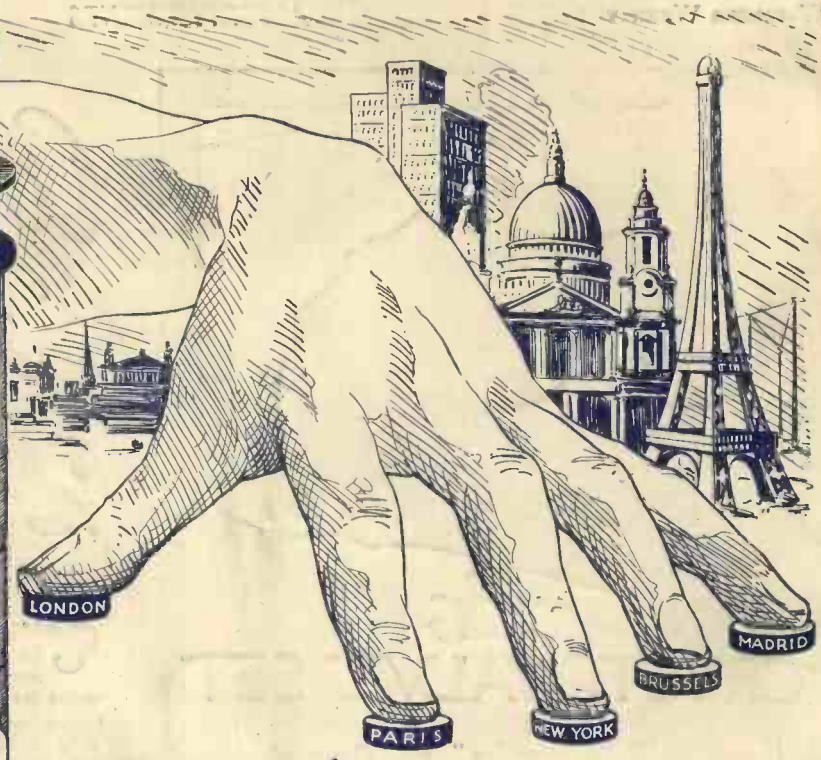

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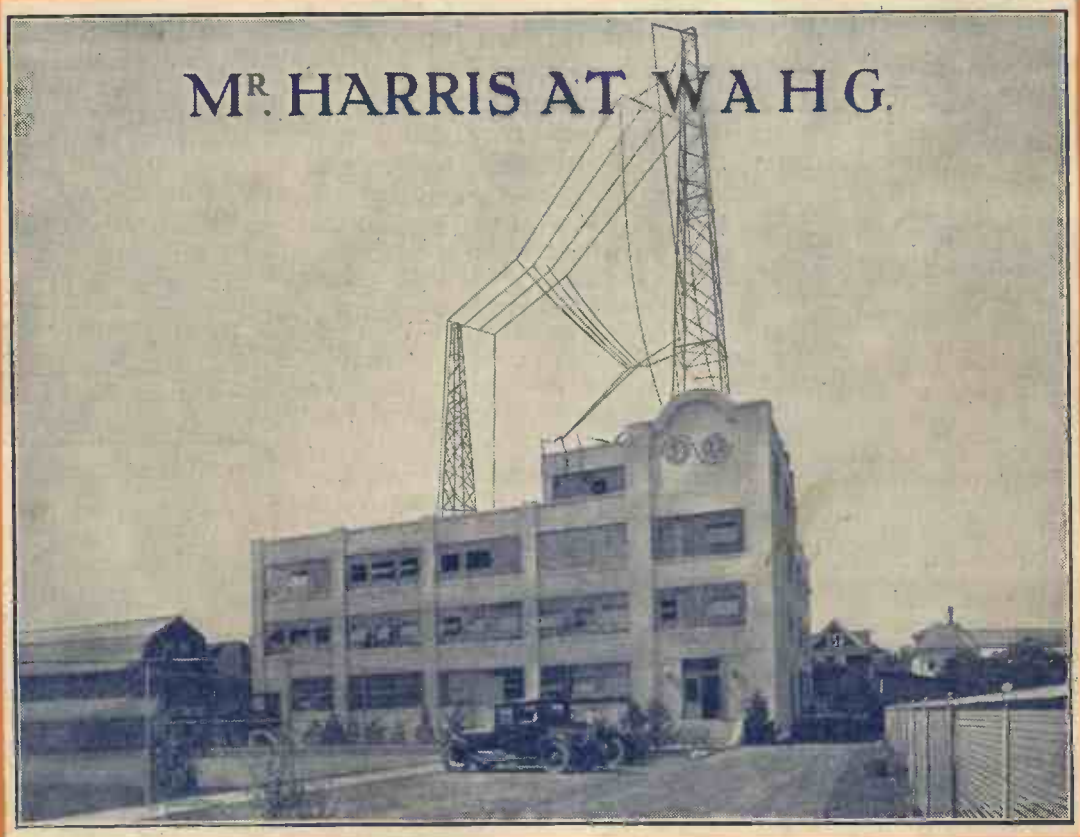
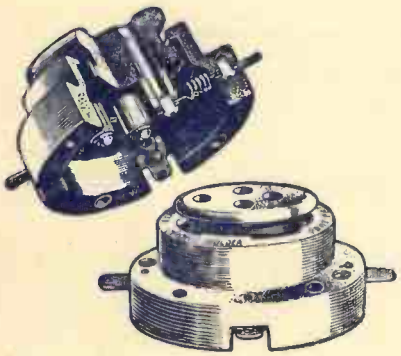
Wireless Weekly

Vol. 6. No. 12.

MR. HARRIS AT W A H G.



Prevent microphonic valve noises by using Burndept Anti-Phonic Valve Holders



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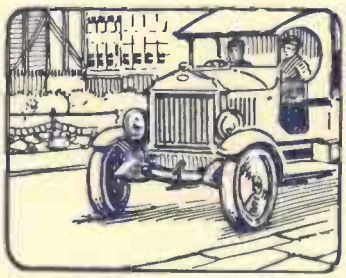
Someone slams a door—



—a heavy lorry passes by—

—someone races upstairs—

—the children jump about in their playroom—these are common causes of microphonic valve noises.

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

An Opportunity for the Experimenter

A CABLE has just been received from Mr. Harris in Washington, in which he reports the result of his interview with Dr. Taylor, the Chief of the United States Naval Radio Laboratory, who is perhaps best known to British experimenters as the controller of the station NKF. In the course of conversation with Mr. Harris, Dr. Taylor laid special stress upon the great importance and possibilities of the work which can be done with the co-operation of the private experimenter in investigating the peculiarities of short wave transmission phenomena.

Station NKF is now working regularly upon a wavelength of 71.35 metres, a transmission which has already been found of great value by many British experimenters in calibrating their short wave receivers, since it gives a guide to one of the bands upon which so much communication is done by the American transmitters. The station is also working frequently upon two other shorter wavelengths, one of 41.7 metres and the other of 20.8 metres, but no reports have as yet been received of these transmissions being heard in this country.

For these experimental transmissions powers up to 15 kilowatts are being used, and there should be no difficulty in receiving them, given a convenient schedule of working hours. Dr. Taylor has especially invited the co-operation of British experimenters in reception work upon these wavelengths, expressing particular anxiety to receive reports upon the two transmissions upon the shorter waves.

Dr. Taylor states that he will willingly arrange for a schedule of transmissions upon these various wavelengths to suit British experimenters; a very valuable opportunity is thus afforded to every British experimenter who possesses a short wave receiver of taking part in researches of undoubted importance and assisting in the development of the shorter wavelengths which offer so promising a field. This work should prove of particular value and interest at the present time of the year, when reception of the ordinary amateur transmissions from distant countries is becoming more and more difficult, as a result of the lengthening of the hours of daylight, when it is remembered that much of the important experimental work on 20 metres has been done in daylight. It is being suggested that ere long a change from winter to summer conditions will merely involve a change in the order of wavelengths used, to maintain all-the-year-round communication between British and American transmitters, and we have already seen daylight communication established between Great Britain and the Antipodes and between Great Britain and the United States, using the 20-metre wave.

Difficulties in obtaining additional licensing facilities for the use of the various shorter wavebands at present limit the activities of our transmitters, but much valuable investigation can yet be done by the purely receiving experimenter, in co-operation with such experimental transmissions as that of NKF, and we cannot but feel that the invitation extended by Dr. Taylor represents a very valuable opportunity to everyone who is prepared to make up a simple one- or two-valve receiver to take part in this development work.

There remains the question of the arrangement of suitable schedules of transmission upon the part of NKF, and this matter is now under consideration, and announcements regarding the arrangement of these tests through the medium of *Wireless Weekly* will be appearing in an early issue.

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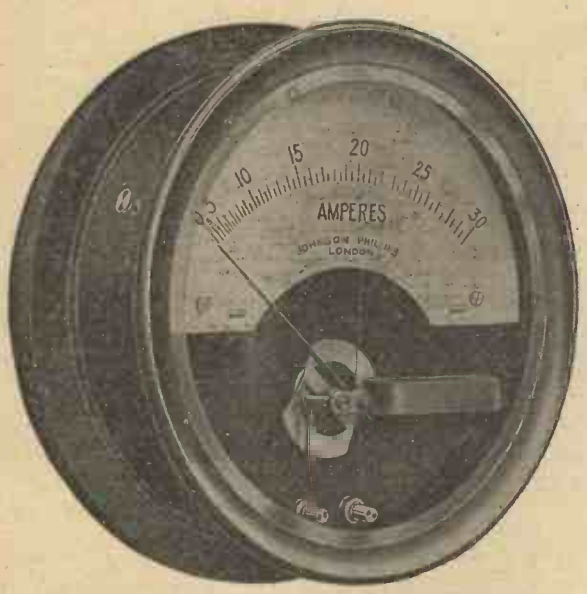
Wireless Measuring Instruments and their Uses

By A. JOHNSON-RANDALL, Staff Editor.



A well-known form of hot wire ammeter.

OF the many hundreds of enthusiasts who boast of being true experimenters, curiously enough there are but few who have any real knowledge of electrical measuring instruments, and in particular of their many applications to radio telegraphy and telephony. To take a simple example, not one amateur in fifty could give the value of the steady anode current taken by his valves, and yet the size and life of his H.T. battery depend upon the average load imposed upon it. It is for this reason that I intend to give a brief outline of the principles and uses of electrical measuring instruments as applied to wireless.

Classification

What constitutes an electrical measuring instrument? The answer is: any apparatus which will enable us to make accurate quantitative measurements in an electrical circuit.

We may therefore divide our instruments into groups as follows:—

Apparatus for the measurement of:—

(1) Current.
(2) Potential differences.
(3) Resistance.
(4) Inductance.
(5) Capacity.
(6) Frequency.

These may again be subdivided according to the magnitude of the values we wish to determine, as if we are dealing with very small values then our method of measurement may be entirely different from what it would be in the case of very large values. For example, the treatment in the case of the determination of the resistance of a few turns of copper wire would not be the same as that for a grid leak or resistance of similar magnitude. I am, of course, assuming D.C. (direct current) resistance in each case.

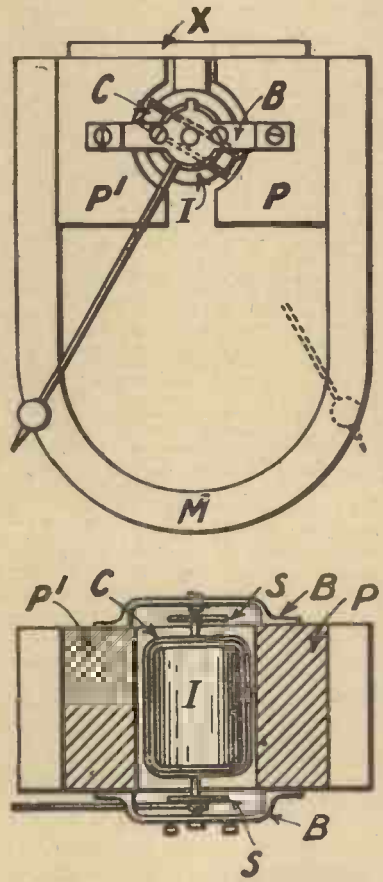


Fig. 1.—Illustrating the principle of a moving-coil instrument.

Under (1) and (2) we have to consider whether the current is alternating or direct and whether its magnitude is large or small.

Current, Potential and Resistance

The types of instruments commonly used in wireless in these two groups are

(*a*) Moving coil permanent magnet.

(*b*) Moving iron, attraction and repulsion types.

(*c*) Thermal expansion or hot wire, and thermo-coupled.

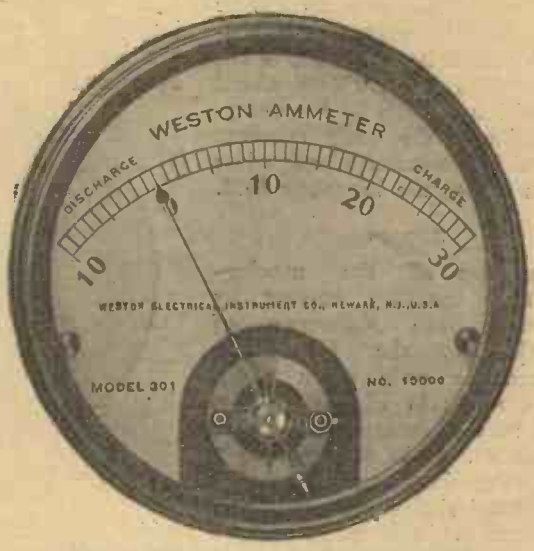
(*d*) Electrostatic. (This type is perhaps not very largely used.)

In group (3) we have really to consider, so far as the amateur is concerned, only the measurement of D.C. resistance, as the determination of resistance in the case of high-frequency oscillating currents is complicated and outside the scope of the ordinary experimenter. The type of instrument to employ is here again decided by the magnitude of the value to be determined. For very low values we have the Thompson double bridge and Wheatstone bridge methods, and for very high resistances, such as insulation resistance, the ohmmeter and generator method. The latter method gives a direct reading, but high resistances may also be determined by substituting values in a formula and by subsequent calculation.

Inductance

The determination of inductance usually presupposes some considerable mathematical know-

This article treats of a subject too often neglected by the experimenter. Measuring instruments of the types commonly used in wireless are described in detail, and their practical application is indicated.



A type of ammeter used for accumulator charging purposes

ledge, and if only for this reason alone is outside the scope of many enthusiasts. It is certainly possible for the amateur roughly to *compare* inductances as applied to wireless circuits, particularly in regard to wavelength ranges covered when connected in circuit with a given condenser. Unfortunately, however, in this case we have to consider not only inductance but self-capacity as well.

Capacity

The measurements under group (5) are chiefly the determination of small capacities such as small condensers, and the determination of the capacities of aerials.

Here again it will only be possible for the average amateur to make rough measurements, owing to the cost of the apparatus and the complexity of the methods employed being outside his scope. As a matter of general interest, I shall deal with the measurement of aerial capacity by means of the Fleming commutator and with rough methods for the comparison of small capacities with a standard.

Frequency Measurement

In the last group (6) we have to consider the measurement of high frequencies or wavelength and that of low-frequencies such as the frequency of an alternator. The determination of wavelength will probably be the most interesting to the vast majority of enthusiasts, the measurement of low frequencies being more interesting to holders of transmitting licences.

In this article and subsequently I shall endeavour to explain in an elementary manner the principles of various measuring instruments and to describe some of the more common measurements of general interest to amateurs.

Perhaps the most useful of all instruments are voltmeters and ammeters suitable for measurements in D.C. circuits. In a valve receiving circuit the most common measurements are: The anode and filament current, the H.T. voltage, the voltage across the terminals of the L.T. battery, and the actual filament voltage. In all these cases I strongly advise the use of a first-class moving-coil instrument. The principle of

Fig. 2.—For measuring the voltage of a battery the volt-meter is connected across the battery terminals.

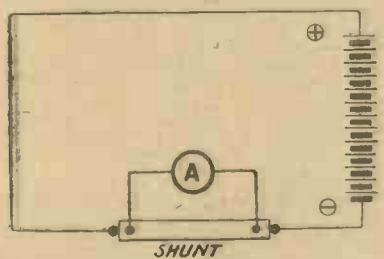


Fig. 3. — In the case of small ammeters the shunt is incorporated in the instrument itself.

moving-coil instruments is quite simple. Referring to Fig. 1, M is a permanent magnet of constant strength, and P'P are two pole pieces, usually of mild steel. A soft-iron core or cylinder I is placed concentrically with the pole pieces and is screwed to a brass bridge piece X. This core serves to concentrate the field. Pivoted between two brackets B and capable of rotating in the air gap between the soft iron core and the pole pieces is a rectangular-shaped coil C. This coil is wound upon a former of aluminium or copper and is, in fact, the moving coil to which the pointer is pivoted. The pivots upon which the moving coil is suspended are insulated from the frame, and current is led into and out of the coil by means of two controlling springs S. To nullify the effects of temperature variation, the two springs may be set so that when one coils up the other uncoils. The two pivots upon which the former rotates run in jewelled bearings.

Action of Moving Coil

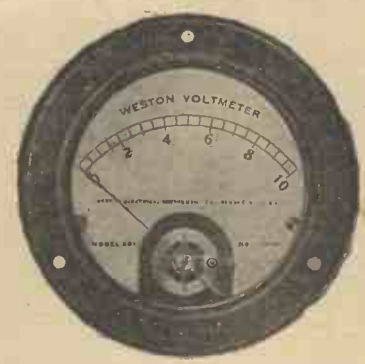
When a current passes through the moving coil, the coil experiences a couple owing to its lines of force tending to set themselves parallel to the lines of force from the permanent magnet. It therefore rotates against the spiral springs S and reaches a state of rest when the controlling force due to the springs balances the rotative force. If the instru-

ment is properly designed the deflection will be proportional to the current and the scale will be linear. The instrument is rendered "dead beat" (that is the pointer does not oscillate about its position of rest) by the damping action of the eddy currents induced in the metal former when it cuts across the magnetic field.

Shunts

Ammeters of the moving-coil type measure current by indicating the difference of potential (or the IR drop) between the ends of a shunt connected as in Fig. 3. This shunt may be incorporated in the instrument, or in the case of a multi-range instrument a number of external shunts may be used. The ammeter is therefore really a voltmeter, as it is simply measuring the drop in volts across the shunt. The size of wire used for the coil depends upon the particular purpose for which the instrument is intended.

In the case of instruments intended for use as voltmeters, the moving coil has a resistance connected in series with it,



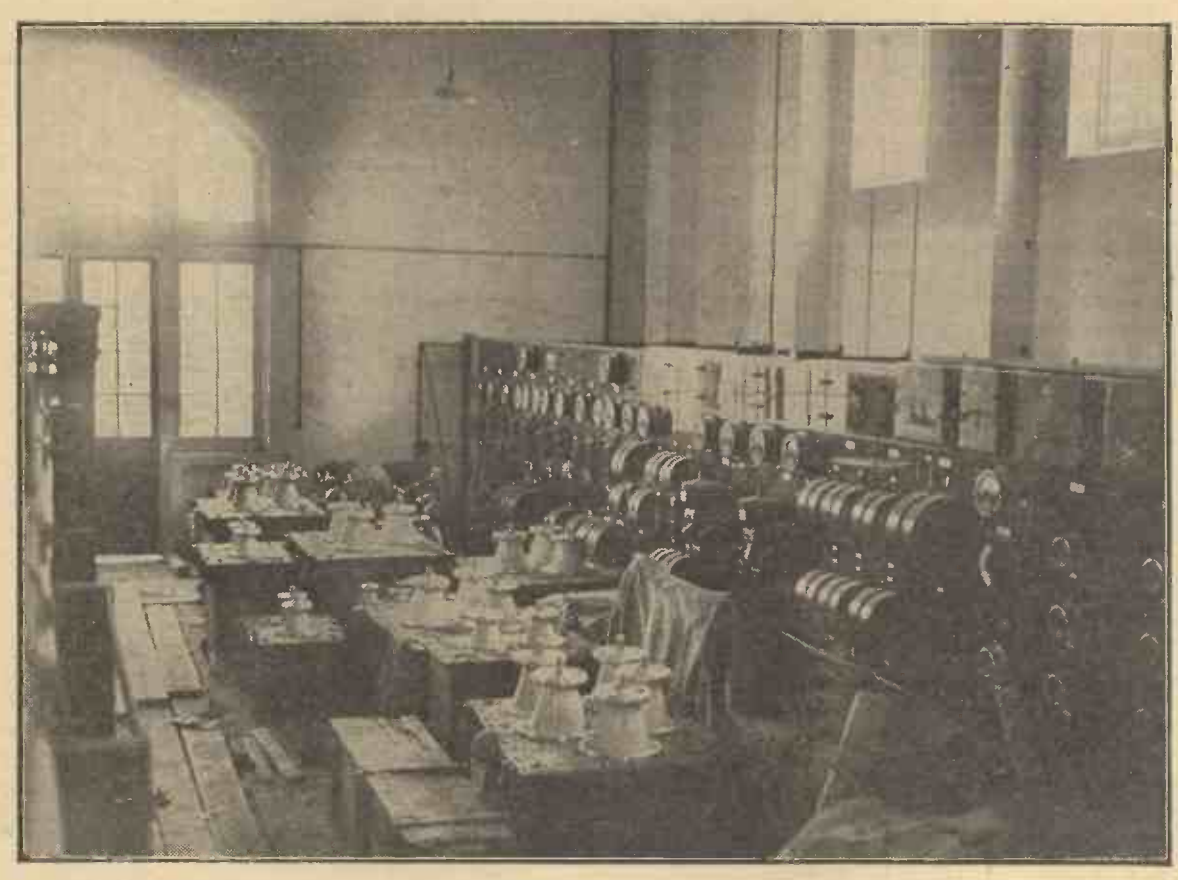
A popular form of moving-coil voltmeter.

which in practice may have a value of many thousands of ohms; this resistance has a negligible temperature coefficient, so that any error due to temperature variation is very small indeed. Moving-coil voltmeters of this type are specially suitable for measuring the voltage of H.T. batteries, as the load imposed upon the battery is not sufficient to harm it appreciably in any way.

The resistance of my own instrument on the 150-volt range is 15,000 ohms, and the current passing through it when giving full-scale deflection is therefore 10 milli-amps.

(To be continued)

THE RUGBY STATION



The building of the high-power station at Hillmorton is nearing completion, and the photograph reproduced above shows the condenser banks ready for installing. The switchboards which will be used at the station are also seen.

Some Common Faults in a Popular Circuit

By JOHN UNDERDOWN.

An article of immense value to the wireless constructor who is not yet getting the most from his set. Though a four-valve circuit is discussed by the author, many of the faults referred to may also be found in circuits using fewer valves.

THE subject of locating and dealing with common faults is one of great interest to all readers, since at any moment they may be confronted with certain difficulties which are readily overcome, providing one has sufficient idea of the symptoms to recognise the cause. In the course of this short article it is proposed to deal with a number of the most prevalent troubles as gathered from readers' letters.

A Popular Circuit

A very popular type of four-valve circuit consisting of one high-frequency valve, using tuned anode coupling, followed by a detector with reaction and two stages of transformer coupled low-frequency amplification, is shown in Fig. 1. This is a good all-round circuit for average reception purposes, using a loud-speaker. We will consider the circuit in detail, indicating the most common faults and how to locate them, assuming all through that an average P.M.G. aerial is used.

Flat Tuning

Dealing with the circuit logically, the first trouble sometimes met with is that of flat tuning of the aerial circuit—that is, the condenser shown as C1 in the diagram has very little effect on tuning. This trouble is generally not located in the set, but in the aerial and earth system. Generally speaking, a fault in this system, giving very flat tuning, will be located in the earth connection, and for a comparative test the normal earth should be removed and the effect of a temporary counterpoise earth should be tried. This may

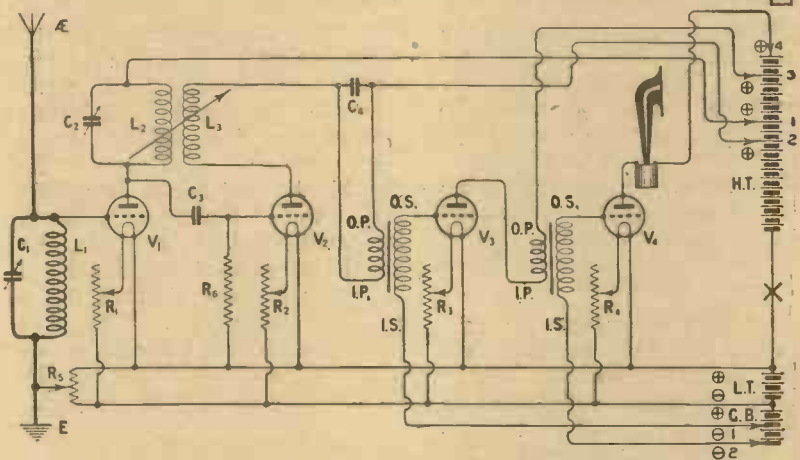


Fig. 1.—A popular form of four-valve circuit for all-round average reception purposes, using a loud speaker.

readily be carried out by connecting in place of the normal earth a long length of insulated wire, which should preferably be stretched underneath the aerial to its full length, well insulated and 6 ft. or so above the ground. If with such an arrangement tuning is very much sharpened, reaction demands greatly lessened *and* signal strength improved, the set now becoming "live," whereas previously it was lifeless, the trouble is undoubtedly located in the earth connection, and alternative earths should be tried or the counterpoise arrangement adhered to. Where it is impossible to try the effect of an outdoor counterpoise underneath the aerial, as indicated, a very effective arrangement is to take the insulated wire through the house on the floor.

Earth Trouble

Where the trouble is thus definitely located in the earth connection, and this is of the buried plate or tube type, the earth connection should be examined and re-soldered if necessary, whilst means should be taken to keep the soil round the buried earth in a moist condition.

Should the trouble not be located in the earth connection, the next offender to suspect is the potentiometer shown as R5 in the diagram. If this were broken between the negative end and the slider it would result in a definite positive bias being applied to the grid of V1. Perhaps the easiest method definitely to locate whether the trouble is in this component is to disconnect the two leads to the winding of the potentiometer and to connect the lead which goes to the slider directly to L.T. negative. If with the earth connection made direct to L.T. negative, with the potentiometer out of circuit, tuning is considerably sharpened, it is almost certain that the trouble is due to a break in the winding. To ascertain whether the winding of this instrument is defective a very simple test may be made with a pair of telephones and a small dry cell.

Testing

One tag of the telephones should be connected to one side of the dry cell, and the free side of the dry cell to one end of the potentiometer winding. The other end of the potentiometer winding should now be tapped with the free telephone tag, and if the telephones are placed on the head, loud "plonks" will be heard if the winding is continuous. If no click or only a very slight click is heard, the winding is broken. Tapping with the free telephone tag along the bared portion of the winding will soon locate the break.

The Aerial Condenser

The aerial condenser C1 may also be responsible for flat

tuning of the aerial circuit, and if another condenser known to be working well is available, the effect of substituting this temporarily, externally to the set by connecting across aerial and earth terminals may be tried, the normal leads to C1 being removed. When the aerial condenser is found to make no difference to tuning, this is often due to the fact that the pivot which should make connection with the moving vanes is not actually making contact.

Instability

The effect of a broken potentiometer winding as explained above is by no means always one of flattened tuning, but is often known to produce instability when the break occurs between the slider and the positive end of the winding. Full negative potential is thus applied to the grid of the high-frequency valve. Where, therefore, the set tends to be very unstable, the potentiometer should be examined as previously indicated, as should the earth connection, since if this latter is broken, difficulty is usually experienced in controlling the set.

The Anode Circuit

In cases where the high-frequency valve seems to make no difference in signal strength on distant stations, whether this valve is functioning correctly or not, can readily be established if the reaction coil L_3 is short-circuited and a weak signal tuned in in the normal manner, using four valves. The anode coil L_2 and the valve V1 should then be removed and the grid socket of this valve-holder shorted to the plate socket. If on retuning signals are received at equal strength, the trouble is definitely located in the H.F. stage. The anode condenser C_2 should be examined carefully for the faults previously indicated, and, if possible, L_2 should be replaced by another coil of the same size, known to be working effectively. By this means, and the substitution of another valve if possible, the trouble may usually be located.

Continuity Test.

It is but little use applying the telephone and dry cell test to an anode coil, except in cases where no signals are obtained, since it is impossible by this method to discover if the coil is short-circuited, as no difference in the loudness of clicks will be obtained with a normal or a short-circuited coil. This test will, however, locate a break.

The Detector

When on switching on a set with reaction a ticking noise only is heard and no signals, the trouble is generally located in the detector circuit, and usually in the grid-leak shown as R_6. If the grid condenser C_3 has insulation of a satisfactory order and the grid-leak breaks down, the grid will become charged up negatively and prevent any flow of electrons through the detector valve, whereupon the set will cease to oscillate and the charge will leak away gradually. When the accumulation has been sufficiently reduced, self-oscillation will begin again, to be again stopped by the re-accumulation of a negative charge, and the result will be a continuous ticking noise. The substitution of a fresh grid-leak almost invariably cures this fault.

No Reaction

Where no reaction is obtainable, the first experiment to try is the effect of using a coil one size larger, and, if still unobtainable, that of reversing the leads to L_3. Should this not overcome the difficulty, the coil L_3 should be removed and the coil-block taking the reaction coil should be tested for a short-circuit by the telephones and dry cell method with the detector H.T. supply removed. No clicks should be heard on testing between plug and socket with the 'phones as previously indicated, and should these be heard, it indicates that the insulation is poor in this part of the circuit, but not necessarily in the actual coil-holder. The coil-holder should be examined, as should the panel and the valve socket taking the detector valve. If any flux is present between the valve legs, this should be very carefully removed, since it is possible to obtain sufficient leakage to make the grid of the detector so positive that satisfactory reaction effects are not obtainable.

The L.F. Circuit

The most common cause of trouble in the low-frequency portion of such a set as indicated in Fig. 1 is low-frequency oscillation, which may announce itself by a continual howl when both low-frequency valves are used or by very poor quality when the low-frequency side is oscillating above audible frequency. The first experiment to try in such a case is the effect of reversing the primary leads to the second transformer. If this does not cure the trouble, the effect of placing a resistance across the

THE BARCELONA STATION

The studio at the Barcelona station bears very considerable resemblance to the studios of our own broadcasting stations.

secondary of one or both should next be reverted to. First a resistance of ½ or 1 megohm should be tried, but in extreme cases a much lower order, such as that of a variable anode resistance, will be necessary. This latter type of resistance will give an appreciable loss in signal strength, perhaps compensated for by the gain in purity. The effect of earthing both of the cores of the L.F. transformers to L.T. negative should also be tried. With many transformers a special tag is provided for this purpose, and with some others earthing the metal feet will have the desired result. Another method, advocated by Mr. A. D. Cowper, is that of placing a variable anode resistance across the plate connection and grid connection of the first or second low-frequency amplifying valves. For this experiment it is vital that a really reliable anode resistance be used, or frying and sizzling noises may be produced. These expedients will usually cure cases of instability or buzzing in low-frequency circuits of the type indicated, although in extreme cases it may be necessary to change one of the transformers. A broken potentiometer is in some cases responsible for trouble of this kind.

Transformer Ratios

Where readers experience trouble due to low-frequency oscillation, it is almost invariably asked whether they are using the correct ratios. It is sometimes seen advocated that a high ratio transformer should be used after the detector valve, followed by one of lower ratio between the first and second low-frequency amplifiers. This is an entirely erroneous idea; the consideration to be borne in mind is the fact that to secure high quality reproduction the impedance of the primary of the low-frequency transformer should be two or three times that of the valve. Usually for the detector valve a general-purpose type is used which has a fairly high impedance and hence a high value of primary impedance for the first L.F. transformer is indicated. Thus a very large number of turns is required for the primary of the first L.F. transformer, and since, if a high ratio is still preserved, the secondary number of turns will be extremely high and the transformer very bulky and of high capacity, it is advisable that a low ratio type be used in this position. A good type of transformer, and not a cheap type, should be chosen, since it by no means necessarily follows that a low ratio indicates high primary impedance in all cases. Where the detector valve is followed by the small types of power valve now so popular, with a lower impedance, it is unnecessary to have such a high value of primary impedance for the second stage transformer, and a higher step-up ratio type may be used here.

No Signals

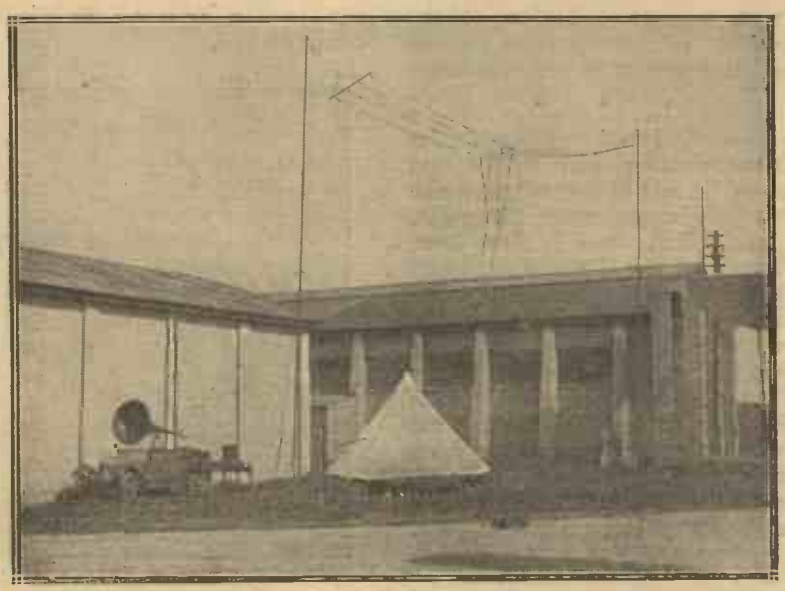
Where a set has been working satisfactorily and suddenly develops a fault, so that no signals are obtained, despite the fact that the valves all appear to light correctly, these latter should be carefully examined, since it is always possible for the filament to short to the grid, the valve still lighting, but no signals being obtained.

If it is definitely established that such a fault is not responsible, the set should be gone over systematically. Where a milliammeter is available, this serves a valuable means of locating the fault to a particular valve. When the circuit is working in a normal manner it should be connected at the point X, and an idea of the total consumption of all the valves is obtained. When a fault occurs, a decrease in the reading of this instrument indicates that the supply to one or more valves may be cut off.

Stopping of Signals

The effect should then be tried of inserting it in the plate circuit of the various valves by connecting it between the actual tappings from the valves and the H.T. battery. No reading indicates that the circuit is broken, and the usual tests can then be applied. Breaks in the primaries of L.F. transformers are often the cause of the sudden cessation of signals, and the telephone and dry cell test applied across the primary winding, with the normal connections broken, will usually locate a fault of this type. No clicks or very faint clicks usually indicate that this winding is broken.

THE AIR FORCE PAGEANT



The outfit which will be used at the Royal Air Force pageant for transmitting orders by wireless to the squadron while flying.

WIRELESS NEWS IN BRIEF

A large map of London, dotted all over with small coloured flags, forms part of the scheme at Savoy Hill to keep the officials of the B.B.C. informed concerning the qualities of broadcasting from the London station from day to day. A similar map may be found in each of the provincial stations.

At frequent intervals the broadcasting is thoroughly tested. Shortly before a test is to be carried out listeners in various parts of the district served, including a number of serious students of wireless, receive warning of what is going to be done. On the appointed day experimental transmissions are made, and reports are submitted to the broadcasting station by the listeners. On recent occasions a single test has produced 5,000 letters. This bulky report is very carefully examined and arranged on a regional basis. It is then translated into terms of flags on the map, and a glance at these immediately discloses how reception may vary in different places. Thus the changing complexion of the map is a constant, accurate indication of the quality of the service which listeners generally are receiving.

* * *

The wireless beam station for communication with India and Australia will be erected on a site at Winthorpe, near Skegness, Lincolnshire, which has been chosen by the Post Office and approved by the Marconi Company, and negotiations for the purchase of which are being rapidly pushed forward. Under the terms of the agreement with the Government the work must be completed in nine months from the date of handing over the site, so that the new station should be ready for service early next year.

* * *

In reply to an inquiry in the House of Commons concerning the possibility of securing the broadcasting of a weather forecast at 7 a.m. daily during haymaking and harvest time, Mr. E. F. L. Wood said that he had already taken this up with the Air Ministry and the British Broadcasting Company. There seemed, however, to be no prospect of obtaining so early a forecast, as, under the present organisation, it would require a special shift of engineers and operating staff to put it out. He hoped, however, it would be possible to arrange for a broadcast about 10 a.m. each day, to start as early as possible in July.

* * *

What is believed to be the first private two-way wireless telephone installation in this country is now being operated by the Powell Duffryn Steam Coal Company between their collieries at Llantrisant and Bargoed, Glamorgan, over a distance of 35 miles.

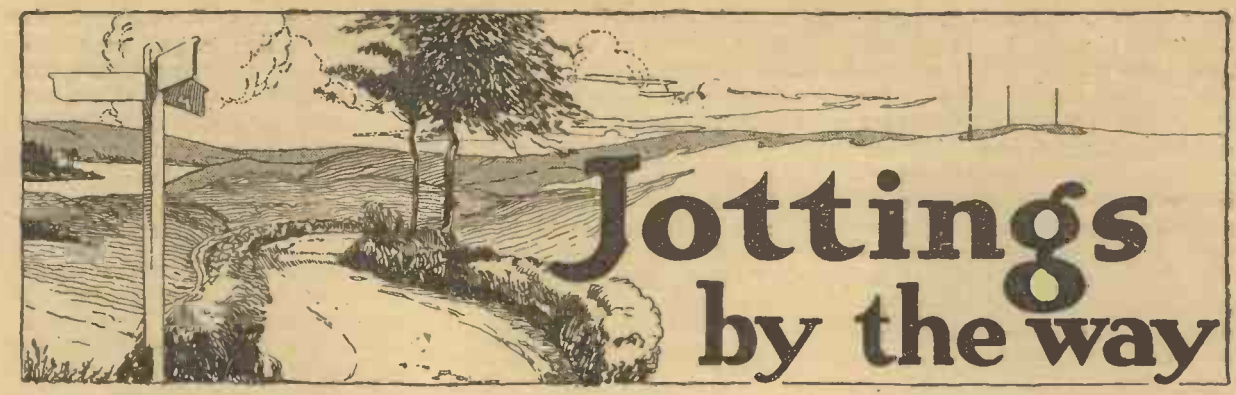
Each station has apparatus for both reception and transmission, and the company propose to link up another colliery at Aberaman, so successful has the installation proved.

Although formal symphony concerts have been abandoned at Manchester during the summer months, a light symphony concert has been arranged for the afternoon of Sunday, July 5, the artists being Miss Helen Anderton (contralto), Mr. Victor Helliwell (bass), and the 2ZY Augmented Orchestra, conducted by Mr. T. H. Morrison. Requests are continually being received for Tschaikowsky's "Casse Noisette" Suite, and accordingly this piece has been included in the programme.

* * *

The weekly Chamber Music Concert at the Manchester Station will on Friday, July 10, include solos and sonatas by Mr. William Primrose and Mr. Gordon Bryan. Among the pieces they are to play are Brahms' sonata for violin and piano in D minor, and the Prelude, Minuet and Gavotte from Suite in E for violin alone by Bach. Modern composers are well represented by a sonata for violin and piano by Alexander Tscherepnin, and a group of Three London Fantasies by Percival Garratt, to be played by Mr. Gordon Bryan.

The famous Sheffield choir in the London studio on the occasion of the broadcasting of "The Song of Hiawatha." The conductor, Dr. Henry Coward, is seen on the extreme right.



Jottings by the way

Conversion

"PODDLEBY," I cried, bursting into his study the other day, "Poddleby, my friend, I have made a most important resolution. In future . . ." "Was your resolution to give up using door-mats?" inquired Poddleby in an ill-mannered way, pointing to my footgear, which I must admit was a little muddy, since my inspiration had come to me whilst I was engaged in gardening at a time following a very heavy fall of rain. The fellow who bothers about his carpets when you have a big idea to unfold is surely no

. . . *"Was your resolution to give up using door-mats?"*. . .

real wireless man, as I lost no time in telling my stout friend. However, to humour him I walked across the room and out through the French window into his disreputable garden, where I removed the thick of it with Poddleby's penknife which I had borrowed for the purpose. Then coming back I inquired sarcastically if he would kindly inspect me carefully to see that there were no other shortcomings in my attire. This done I proceeded to tell him of my conversion.

Valves—Pah!

What is the good of using valves? Any fool can pick up quite a lot of stations with the greatest ease by making use of these idiots' delights. Is the valve satisfactory? A thousand times no! If you do not drop it or sit upon it whilst it is in your coat-tail pocket, it goes up in a blue flame of its own accord sooner or later. When you twiddle your condensers the valve squeaks at you. It eats current and adds years to your life every week when you have to take your accumulator to the charging station and bring the charged one home again. It costs a lot of money unless you have crowds of friends from whom you can borrow, and if you do borrow they become nasty about it in time, especially when you return their miserable valves minus their filaments or their bulbs.

Jims and Doohickies

Then look how you have to pamper a valve to make it do its work. It will not rectify satisfactorily unless you provide it with a gridleak and a condenser or a special grid biasing arrangement. You have always to be pandering to its whims by furnishing it with gadgets, jims and doohickies. You mount one particular valve as low-frequency amplifier, resolving to make it work at its very best. You spend weeks in finding the correct adjustment of the plate, the grid and the filament potentials; you fiddle about with a multitude of condensers and resistances, and just when success is in sight it does you in the eye by deliberately burning out.

The Sublime Crystal

The crystal, as I told Poddleby, is a far, far better thing. It is perfectly straightforward and it is robust. It is cheap. If you cannot afford to buy one you can always make shift with a piece of coke or a lump of sugar. True, it cannot amplify, but who wants amplification? The passion for noise is one of the most distressing symptoms of the present age. Its range is naturally not so great as that of the valve. This is where skill comes in. It gives experts such as Poddleby and myself a chance of showing their mettle in the matter of making efficient components. It gives all of us—you notice that here I include you—a real chance of reporting sensational feats. Nobody thinks anything nowadays of tales of the

. . . *Poddleby ran round in small circles sucking his finger* . . .

reception of even the most distant stations with a valve set. But the man who can tell the club how he received KDKA or WBZ on a crystal and get away with it may feel that he has really accomplished something.

Poddleby Agrees

To my surprise Poddleby immediately expressed himself in full agreement with all that I had said. He said that it had been slowly coming over him that valves were played out and that the crystal was the thing. The first thing to do, I told him, was to get rid of his entire stock at once so that there should be no temptation for him to go back again to his old evil habits.

Very nobly I offered to store them for him until he should want them again. This suggestion was not well received; I am afraid that Poddleby still has a hankering after valves. It was arranged that we should immediately begin a series of really important experiments with a view to ascertaining just what a skilfully used crystal could do. We therefore resolved to lay in a large stock of various kinds and to begin by testing them out for sensitivity.

Preliminary Tests

We spent the next few days in a perfect nightmare of crystals. We tested and tried and measured and proved Ohsotite, Justnotrite, Boomite, and Mondaynite, Perizzite and Jebusite and Hittite, yea and even Girgasite and Amalekite. The curves we drew, if flattened out into a single straight line, would extend from the Town Hall at Little Puddleton to almost anywhere you like and very nearly back again. I need hardly point out that if so straightened out the curves would be even less useful than they are to us at present. Still, it was a noble work which kept Poddleby busy for hours on end.

Catwhisker

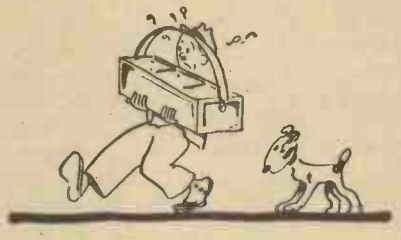
We next investigated the properties of catwhiskers. The straight and the marcelled, the single and the multiple, the sharp and the blunt, the long and the short, the thick and the thin, the gold, the silver, the brass, the copper, the natural or felix, and many others. When I say investigated them, I mean that we read the advertisements, and having found that every one was the best, decided at once that there was no need for us to do any more work in a field which appears to have been so amply covered by others. Having thus got all the data we required to work upon, we bought a crystal of a kind not contained in our list, so that we might bring unbiased minds to the task, and set to work to obtain practical results.

Out of Practice

I must admit that both Poddleby and I are not yet at our best with the crystal set. We seem somehow or other to have lost the knack of it, since it is so long now since either of us used one. Mounting the crystal in the cup, for example, we found a distinctly ticklish business. I filled the cup with chips of Wood's metal and held it in a pair of pliers over the flame of a spirit lamp until the psychological

. . . *I sank into a deck chair which I had thoughtfully brought with me* . . .

moment arrived. Then I directed Poddleby to insert the crystal and to press it down firmly with his forefinger. Want of practice in crystal mounting has made Poddleby lose the protective layer of thick skin which all its enthusiastic devotees develop upon the forefinger. I did not realise this until Poddleby, whilst in the act of pressing the crystal down, gave a sudden scream and began to run round in small circles sucking the injured member. That he upset the Wood's metal and flung the crystal out of



. . . *Adds years to your life every week* . . .

the window is a matter of no great importance, for as I have said crystals are cheap, and supplies of Wood's metal are readily obtainable. Several other more or less abortive attempts followed, the crystal in one case being pressed down so heartily with a screwdriver that it disappeared altogether in the molten mass, and proved after being extracted with some difficulty to have gone on strike owing to the heat to which it had been subjected. As the temperature was about ninety in the shade, we followed its good example and refrained from further efforts until the following day.

So Simple

After several hours of hard work on the next day we got the crystal satisfactorily home and succeeded, though here again we were a little rusty, in wiring up the circuit. "Don't we need a buzzer or something now?" I asked Poddleby. Poddleby had a dim recollection that something of the kind was usual, and that if you had not got one you could use your electric bell. We removed the gong from the front door bell and ran a lead from one of its connections to the earth terminal of the set. Being, as you know, a whale for work, I volunteered at once to do the hard part of the job. I would keep the bell going whilst Poddleby searched for the sensitive spot. Poddleby having seated himself at the table, I went to the front door, removed the casing of the bell, inserted a penny between the contacts, and sank into the deck chair which I had thoughtfully brought with me. Poddleby's front garden is a restful place in the summer time, and I think my eyes must have closed, for at all events I felt greatly refreshed when he came out to announce that he had found a sensitive spot. Carefully we disconnected the bell and prepared to revel in really pure reception. Just as I donned my pair of headphones a traction engine ambled past the house, causing it to quiver like an aspen leaf. When silence was once more restored we found that we had lost the sensitive spot. I therefore returned hurriedly to the door bell, but Poddleby hurried rather faster and got there before me. At the end of about an hour's hopeless struggle I found that his penny had fallen out. I told him pretty plainly what I thought of the kind of fellow who is too jolly lazy merely to stand and press a bell push for two or three minutes.

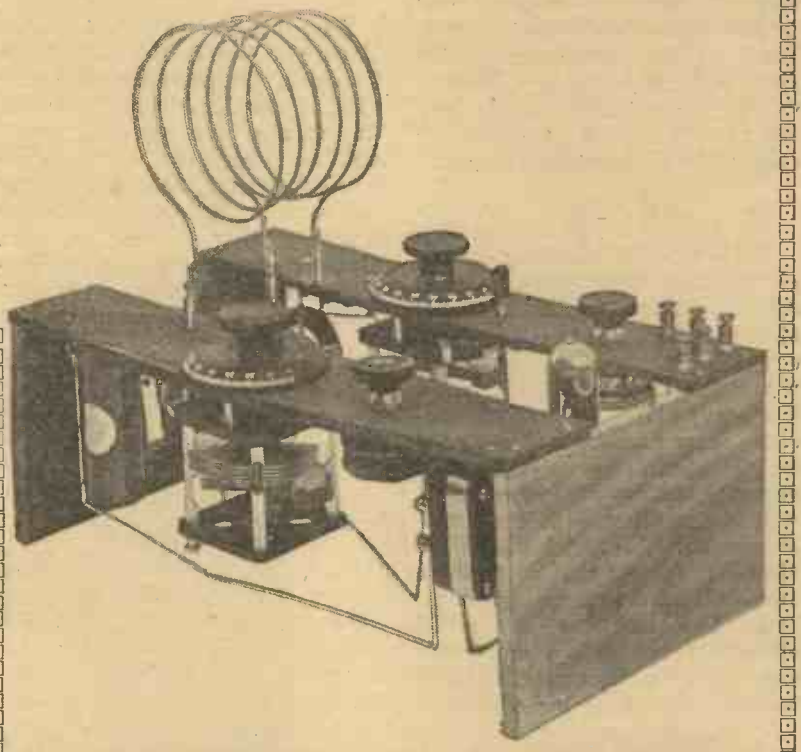
That is as far as we have got up to date with our experiments.

WIRELESS WAYFARER.

Ultra Short-Wave Reception, Using Four-Pin Valves.

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

The interest and fascinating phenomena to be met with in short-wave reception hardly need commenting upon, and in this contribution Mr. Rattee gives constructional details for a receiver which will receive wavelengths well below 30 metres using ordinary valves.



The coil shown in the photograph permits reception well below the maximum of 30 metres.

IN *Wireless Weekly*, Vol. 6, No. 11, the present writer gave some experiences met with upon short wavelengths, and it is proposed to deal here with the construction of the receiver with which the experimental reception was carried out, in addition to some further notes upon short-wave work in general.

Absence of Panel

The receiver, of which an illustration is given above, is made up of two ebonite strips instead of the conventional panel, to act as supports for the various components, whilst these two strips are themselves supported by means of two wooden end pieces. The reason for the absence of the usual panel is, of course, with a view to eliminating as many losses as possible—the more "air spaced" the components the lower the losses when operating upon these high frequencies. As a further precaution the wooden support, which serves as one of the "stands" at the high-frequency end of the receiver, is cut in such a way as to leave a large V-shaped space between the two strips of ebonite, it being generally admitted that the presence of too much wood in short-wave receivers is not advisable.

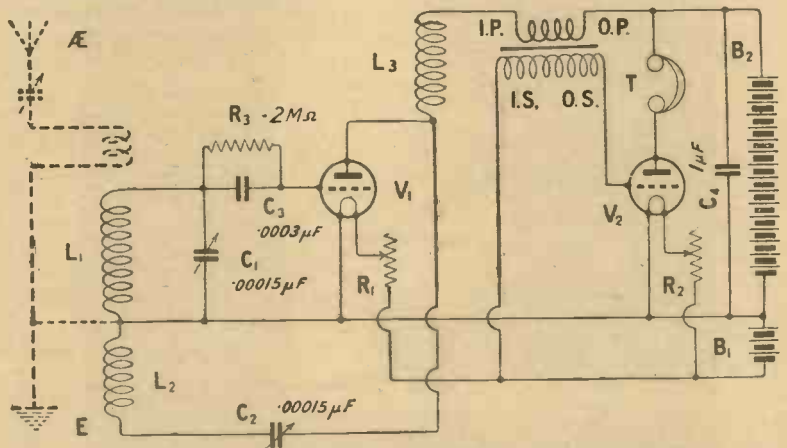


Fig. 1.—The circuit is a Reinartz arrangement, the aerial being loosely coupled, as shown by the dotted lines.

Design

An inspection of the photographs will indicate to the reader the lines upon which the receiver is constructed and the manner in which the coil is mounted. The two variable condensers, arranged one on each strip of ebonite, are for grid circuit tuning and reaction control, the Reinartz circuit being used. The filament rheostats and terminals also appear above the ebonite strips.

The Circuit

As previously stated, the circuit used is the well-known Reinartz arrangement, as described by Mr. A. D. Cowper in *Wireless Weekly*, Vol. 6, No. 8, but with certain modifications as

to condenser values, etc. The arrangement is reproduced in Fig. 1, which also shows the aerial circuit in dotted lines so as to make quite clear how the receiver is coupled to the aerial. The coils L1 and L2 are actually one coil wound continuously and tapped at a point to be indicated later. By means of valve sockets fitted to the receiver and valve pins soldered to the coil the arrangement allows different coils to be plugged into circuit.

Radio Choke

The condenser C1 is a .00015 μF variable, which tunes the grid coil L1, whilst the condenser C2, also of .00015 μF, is the reaction condenser always associated with the Reinartz circuit. The radio frequency choke L3 is a commercially-made component, and must be of little total distributed capacity, otherwise the receiver will not oscillate with even mild efficiency. The remainder of the circuit is merely that of a single stage of low-frequency amplification, the inclusion of which eliminates to some extent body capacities usually met with upon wavelengths below 100 metres.

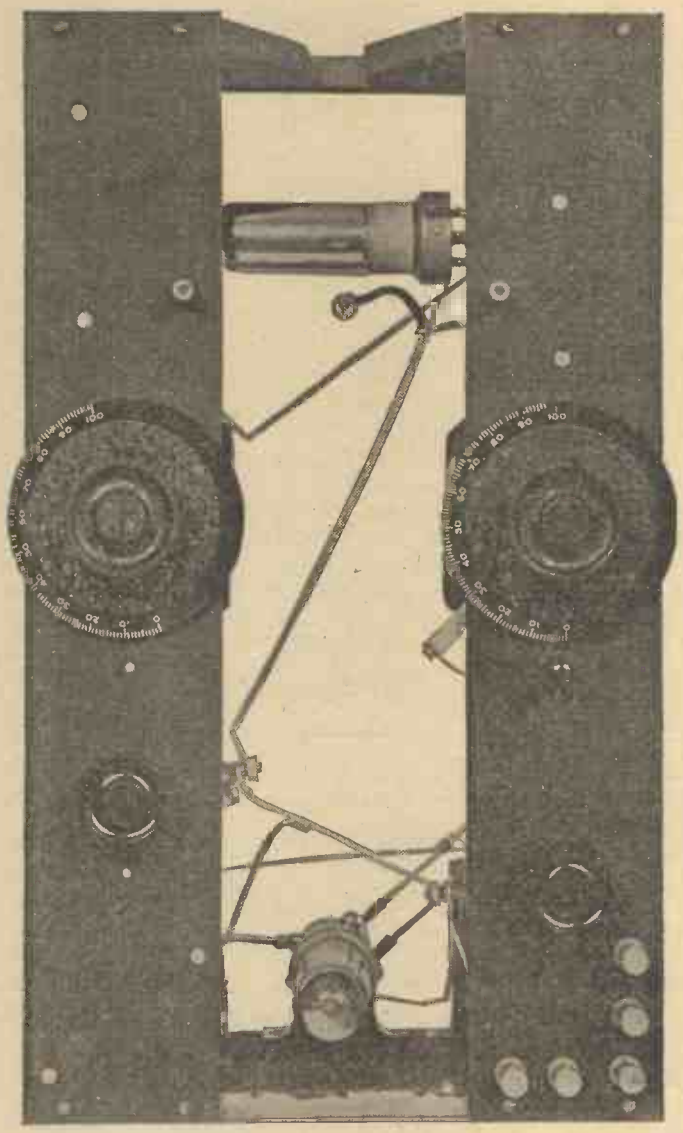
Aerial Circuit

The aerial circuit for use in the reception of wavelengths below 30 metres, the *maximum* wavelength which the present receiver will reach with the coil shown in the photograph on the previous page, is not of particular importance, but the most generally useful arrangement, in that tuning is extremely simple, is that shown in the circuit diagram. The aerial itself may be either an average-sized outdoor arrangement, or else one of the popular indoor varieties, connected to one terminal of a boxed-in .001 μF variable condenser; to the other terminal of the condenser a few turns of large gauge wire, as indicated later, are connected, the ordinary "earth" being connected to the other end of these turns.

With this arrangement it is possible to move the aerial circuit coil in such a way as to vary the coupling between the aerial and grid coils without in any manner interfering with the set itself. In order that there may be a means of overcoming any difficulty resulting from the set being tuned to the natural wavelength of the aerial circuit, and consequently refusing to oscillate, the condenser of .001 μF capacity should always be included.

Valves

As already stated by Mr. Cowper in Vol. 6, No. 8, and confirmed by the present writer, this type of circuit permits the use of the ordinary four-pin valve without the precaution of first removing the cap, and, as a matter of interest, the receiver illustrated, when lent to Mr. Cowper for purposes of calibration, actually gave a decided grid-leak howl when adjusted to a wavelength of approximately 18 metres; on wavelengths below this figure the condition of oscillation is most definitely marked, even at the lower scale of the grid condenser. As to the type of valves used, considerable experiments have been made with the D.E.3B, B.T.H. B4, the French Radio Micro .06 valve, and, so far as Mr. Cowper is concerned, the receiver was calibrated when using first a D.E.5B, and secondly a Metal R valve. In the case of the D.E.3B, B.4 and French .06 valves 50 volts anode potential was used, whilst with the D.E.5B 77 volts, and 20 volts for the R valve.



The V-shaped wood support is shown at the top of this photograph; whilst the centre tapping connection is seen just below the detector valve. The holder for the L.F. valve is fitted to the wood support which forms the base line of this photograph.

Oscillation

Using any of these valves with the receiver illustrated will cause the set to be brought into oscillation with quite easy operation, and though it is not suggested that other valves will not do the same, those given above are known definitely to give satisfaction upon these short wavelengths, with the circuit used in the receiver under description.

Components

Should the reader decide to build a receiver to the specifications given herein, he must obviously be careful in the choice of components, and for that reason the actual parts which go to make the set illustrated are given below. In the matter of variable condensers these must necessarily be of good manufacture, otherwise the receiver will be noisy and useless for any but the loudest of signals, and, as previously stated, the radio choke must be of small self-capacity :—

Two ebonite strips measuring 14 in. × 2½ in. × ¼ in. (Paragon).

Two filament rheostats (Polar).

One radio frequency choke (Lissen).

One grid condenser of .0003 μF capacity (Dubilier).

One grid leak two megohms (Darco).

One " Antipong " valve socket (Bowyer - Lowe). If any other make is chosen this must be of the anti-capacity type.

Two .00015 μF variable square law condensers. (Those illustrated are Bowyer-Lowe "four-square" condensers.)

One low-frequency transformer (Royal).

One fixed condenser of 1 μF capacity (T.C.C.).

Five terminals.

Radio Press panel transfers.

Three valve sockets.

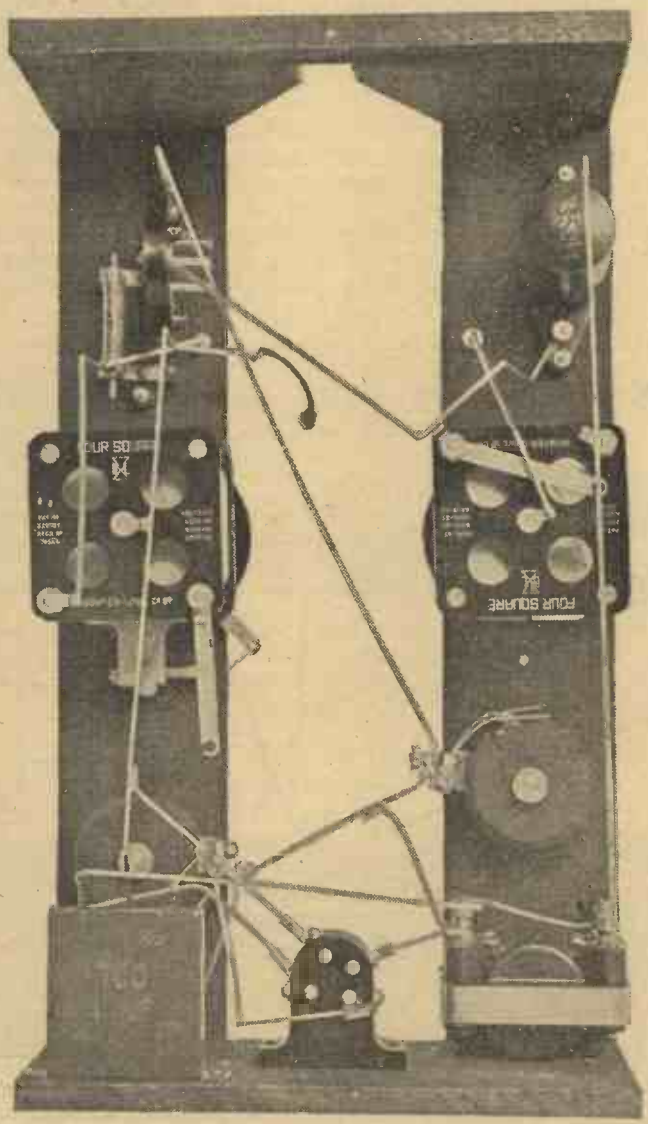
Six valve pins.

One valve holder (Aermonic).

Twelve feet No. 12 bare copper wire.

Fifteen feet No. 14 bare copper wire.

Two wood supports not less than 6 inch high and 8 inches wide.



The careful spacing of the components, together with their positions, should be noted. The manner in which the two ebonite strips are arranged is clearly understood from this illustration.

The Variable Condensers

The variable condensers in the receiver illustrated are of a novel type, known as the " four-square " type, and on looking at the photograph, which shows the underside of the set, it will be seen that three terminals are involved. The centre of these terminals is connected to two sets of moving vanes, whilst the outside terminals are each connected to two separate sets of fixed vanes. By means of the small brass strap, which is seen in the same photograph, various capacities may be obtained, and though the actual arrangement of the strip is not gone into here, complete details are supplied by the makers. For the purposes of the present instrument the arrangement of the strap is as shown by the photographs.

The Layout

Those readers who intend building this receiver should not in any way depart from the design, otherwise considerable difficulty may be experienced in making the receiver, either oscillate at all, or else oscillate over the whole range of the grid tuning condenser. The layout given is the result of very careful experiment with a view to eliminating losses on the one hand, and giving easy oscillation over the whole range on the other. The position of the various components in relation to each other should be treated with every respect, particularly those which form the grid and reaction circuits; the position of the detector valve should also be carefully observed.

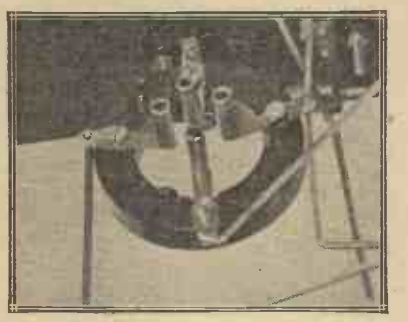
Wiring of the Receiver

The valve socket for the detector valve has its grid leg actually soldered to one of the tags of the grid condenser, while the remaining grid connections are also as short as possible. The filament positive leg of the same valve, in addition to being connected to the L.T. positive, has connected to it a short length of rubber-covered flexible wire, to the other end of which is soldered a valve leg, any unwanted stem being cut off by means of a pair of pliers. This valve leg may be seen in the photographs, and provides the centre tapping connection with the centre tapping of the coil.

The remaining connections of the set are all consistently short and well spaced, and though those connections which follow the detector valve are not so particularly important, it is as well to observe the same rule of careful wiring throughout, as a precaution against stray capacities and losses.

Coils

The wavelength range of the receiver is approximately that given by Mr. Cowper in Vol. 6, No. 8, and the coils used are precisely as described by him in the same issue. The method of winding these thick wire coils is to procure a strong ebonite or cardboard former of three inches diameter, and by bending and winding the required number of



Showing the manner in which the detector valve-holder is held in position.

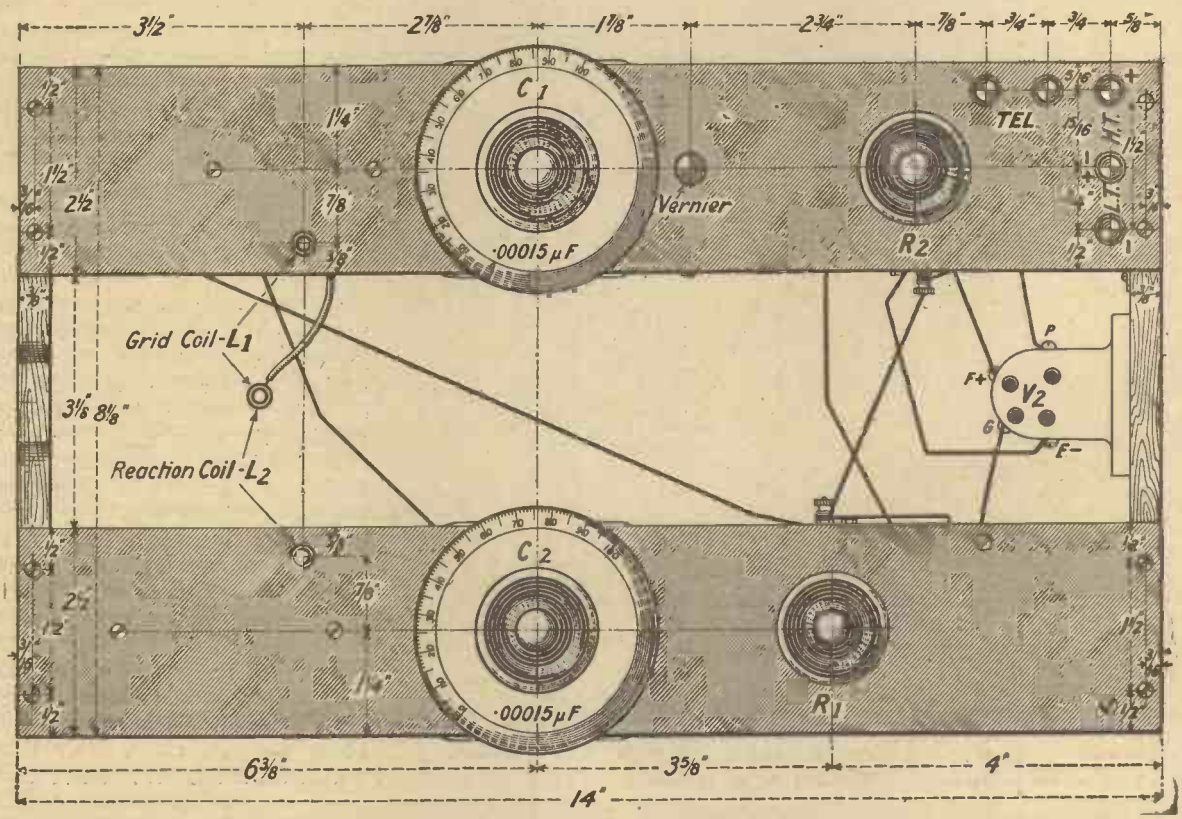
turns, they will spring to approximately a four-inch diameter when removed from the former. The correct spacing will also be given when the coil is stretched to permit its being fixed into the two outside valve sockets provided in the set.

The Centre Tapping

A centre tapping is made by soldering a short length of the same wire to the centre of the coil, bent downwards to allow of the centre valve socket being fixed. The three contact points of both coils, meaning the six-turn and eleven-turn coils, are each fitted with a valve pin, thus ensuring good contact; if when the set is working a loud cracking noise is heard at times, the valve pins are not making good contact, and should therefore be splayed by means of a pen-knife blade.

Low-Tension Leads

If the low-tension connections to the set are long, meaning those leads which connect the L.T. terminals to the accumulator, it is possible that some difficulty may be experienced in making the set oscillate, particularly if the leads are coiled at all. Should this difficulty be met with, then it is recommended that two small basket-weave aircore chokes of some twenty turns



Details of the layout and drilling dimensions should be taken from this drawing. The two ebonite strips are represented by the shaded portions.

of No. 22 d.c.c. wire be included in each low-tension lead, when the difficulty will be found to have been overcome.

Calibration

The best method by which the receiver may be calibrated is given by Mr. Cowper in Vol. 6, No. 8, though some rough indication of the 20 metres adjustment may be obtained by tuning to the motor noises referred to by the present writer in Vol. 6, No. 11, when using either coil. Another method is to tune during the daylight to any amateur who may be transmitting, when invariably some indication of his wavelength will be given by him. Using the six-turn coil during the dark hours is not likely to result in any success in this direction, as the short wavelengths covered by this coil are "killed" by darkness. Using the eleven-turn coil, however, will permit of several amateurs on various wavelengths being tuned in, thus giving some rough indication of the wavelengths covered.

Daylight Reception

During hours of daylight the 40 metre band is one upon which one or two transmitters may be heard, and now that the days are getting longer this wavelength is quite a useful one upon which to attempt short-wave tests. Further, though it was the general opinion that signals upon this wavelength were killed by darkness, it is quite possible to "hold" signals for some little while after sunset, though certainly not for long. Using the six-turn coil, the maximum wavelength range of the receiver then becomes 30 metres, and using this coil daylight is the only possible time for reception; with this coil signals are few and far between, though as time goes on the number of 20-metres transmitters will increase.

Very Short Waves

Another coil which the writer uses in conjunction with the receiver consists of three turns of No. 12 bare copper wire, wound to 4 inches diameter, tapped in the centre as before. Using this coil which gives a 1½-turn grid coil the receiver will still oscillate with valves of the B.4 and D.E.5B. types, though what are the actual wavelengths covered by this coil I am not at present able to ascertain. Actually no signals of any kind can be received with this arrangement, and only experiments with various aerial circuits have been made, with a view to ascertaining various effects upon the oscillating ability of the receiver with different valves, etc.

Aerial Circuit

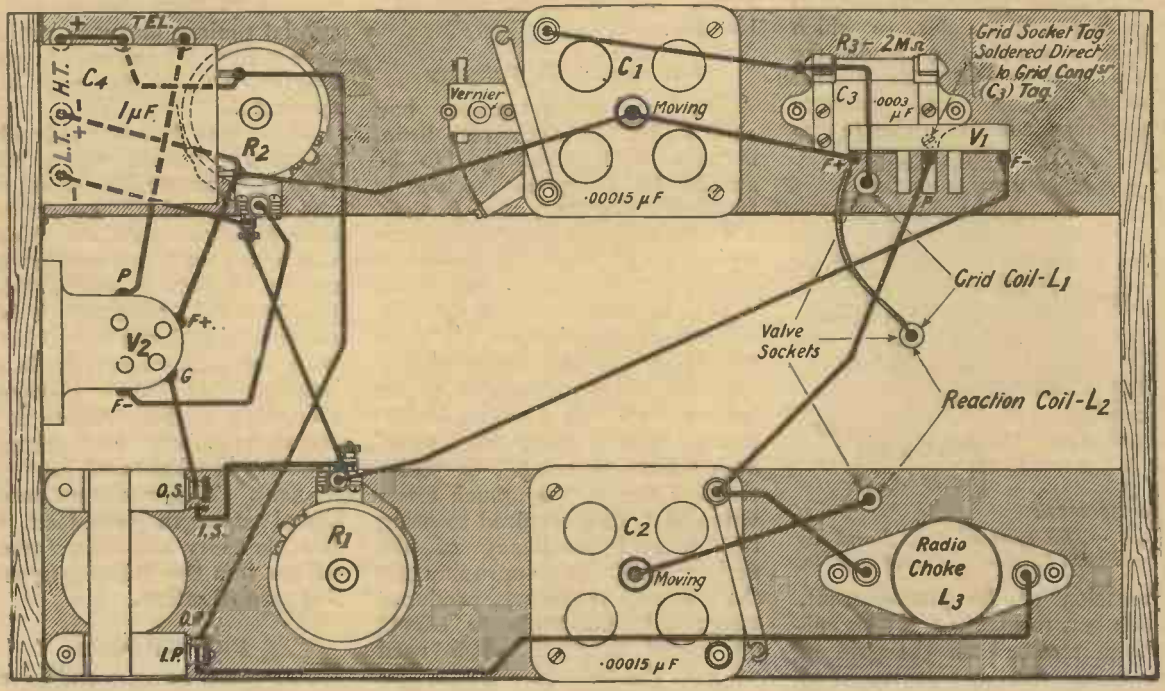
A description of the various aerial arrangements which have been tried with this receiver was given in Vol. 6, No. 11, and since their description is necessarily a lengthy business, readers are referred to that issue for further particulars. Upon the shorter wavelengths readers should try various arrangements of their own, for it would seem that even local surroundings can have quite an effect upon the length of the aerial best suited to their own particular needs.

Operating the Set

For the successful operation of the receiver the operator should place himself on the reaction condenser side of the instrument, using his right hand for tuning with the grid-tuning condenser, his arm stretching across the L.F. end of the set.

With the coil covering the required wavelength fitted to the set, the grid-tuning condenser should be set to the zero scale

(*Continued on page 370*)



The wiring of the receiver should be carried out strictly in accordance with this diagram. The wires themselves should be well spaced and straight.

Tuned or Untuned Aerial Circuits?

By A. D. COWPER, M.Sc.

A problem which occupies the minds of many experimenters is here further investigated by Mr. Cowper, following upon his earlier conclusions which were given in our last issue.

N order to determine the optimum conditions and in particular the best type of aerial coupling to use in conjunction with the ultra-low-loss inductances developed from quantitative experimental data to give a maximum inductance-resistance ratio (*Wireless Weekly*, Vol. 6, No. 4, p. 121), the writer has made a number of additional signal-voltage measurements by the method of the Moullin voltmeter on the local B.B.C. station's wave when using a good, high aerial at a comparatively short distance. This voltmeter has recently been applied in a practical manner in a number of quantitative investigations by Mr. G. P. Kendall, who gives a full account of the method in several recent articles, to which reference should be made for further particulars. A shunted Weston Model 375 galvanometer was used to indicate the

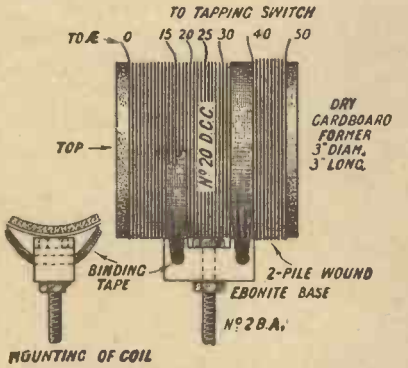


Fig. 1.—The type of coil found by experiment to give the best results.

depression of the plate-current, which is a measure of the signal-voltage received on the grid of the valve, and was arranged so that (approximately) signal-volts could be read off directly on the scale. An important point to note is the necessity of providing a low-resistance H.F. path to earth from the anode, by a blocking condenser of, say, .002 μF capacity, otherwise very conflicting results may be obtained at times, as observed by Mr. Kendall.

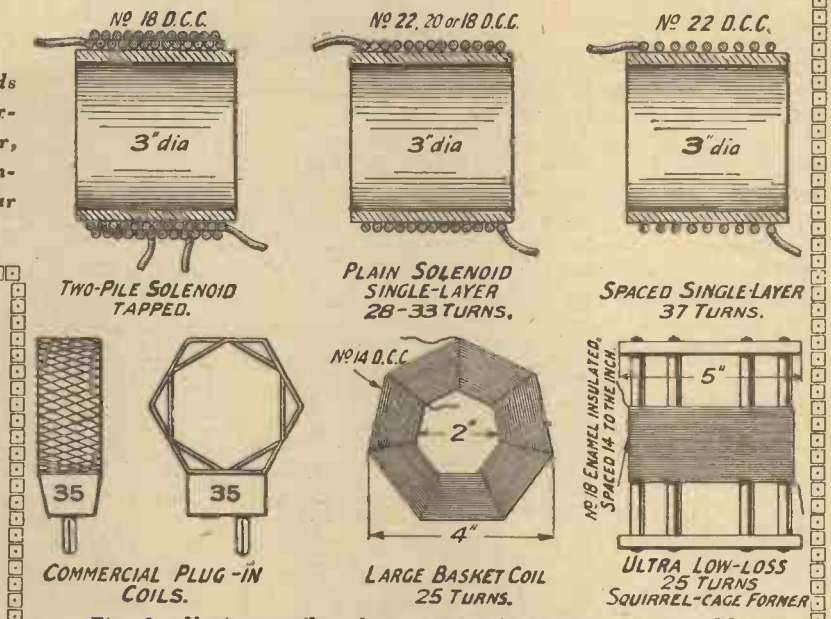


Fig. 2.—Various coils, whose properties were investigated by Mr. Cowper, are illustrated here.

Semi-Aperiodic Primary

Previous experiments had shown that there was very little, if any, real advantage to be gained by using an accurately tuned primary coil, and, further, the precise design of this coil appeared to be largely a matter of indifference. The one point which appeared strongly to influence signal-strength as registered in the secondary circuit was the inductance value of the primary coil. A primary inductance, which tuned the aerial *above* the wavelength of reception, or one of very much *lower* value than that required to bring the natural frequency of the aerial-circuit to approximately the station's frequency, produced measurably unfavourable effects on signal strength when used without the help of reaction and with fairly tight coupling. But the tuning, if any, of the primary was extremely flat (users of three-coil tuners of conventional design have long noticed this point), and it was possible, under some circumstances, to register actually a higher signal strength in the secondary circuit with a primary which had no special tuning, and was available over quite a range of wavelengths, *i.e.*, which was semi-aperiodic.

What was desired to elucidate, by actual measurements under strictly comparable conditions and on a signal which gave readable indications on the Moullin voltmeter, was the best practical design of such a semi-aperiodic primary coil, to cover a large range of wavelengths and for use with a variety of aerials, in conjunction with the ultra-low-loss secondary. The matter of extreme selectivity was relegated to the background for the moment. The maximum possible signal strength combined with fair elasticity and a practicable design was the prime purpose of this investigation.

Primary Design

For compactness, and in view of the heavy damping effect of the direct-coupled aerial, an

ultra-low-loss design was impracticable, and was evidently not called for, in the *primary*. Accordingly, various compact forms of coil were first investigated for their suitability in this connection, by direct measurement of the resulting signal strength across them, by the Moullin method. They were connected in the ordinary way across aerial and earth, and the additional tuning capacity required on the large, high aerial (of fairly large capacity) given by a parallel tuning condenser, the special coils being adjusted in turns so that the additional tuning capacity was within the range of a three-plate condenser. Then, with the additional tuning capacity needed to tune to 2LO's wave on this aerial :—A No. 25 coil of fine d.c.c. wire, multi-layer, and of known high resistance, gave 1.0 volts; a No. 35 of the same make and wire, with less tuning-capacity, 1.3 volts; a No. 35 coil of quite good properties, of two layers of fairly stout d.c.c. wire and with air-spacing between layers, gave 1.4 volts; a really low-loss coil of No. 18 air-spaced enamel-insulated wire, on a large low-loss former, 25 turns, gave 1.5 volts. A tapped two-pile-wound coil of No. 18 d.c.c. on a three-inch cardboard former therefore with dead-end effects, gave 1.4 volts on 30 turns, and 1.1 volts on 20 turns with an additional tuning-capacity of about .0005 μF. A large 25-turn basket-coil of thick d.c.c. wire gave 1.3 volts with an additional .0002 μF tuning-capacity; a variometer with a large excess of thick d.c.c. wire (to reach the higher waves at will) showed the effect of the H.F. resistance of this with 1.2 volts; an excellent commercial type of variometer with windings in series showed 1.1 volts, and with these in parallel 1.35 volts, whilst a tapped-inductance (with dead ends) of No. 15 d.c.c. gave on 30 turns 1.35 volts. A *large* tapped low-loss coil of No. 18 air-spaced, with marked dead-end effects, showed on 21 turns only 1.2 to 1.3 volts. Evidently there was no very striking difference to be observed, so long as excessive tuning-capacity and dead-end losses of a marked order were avoided.

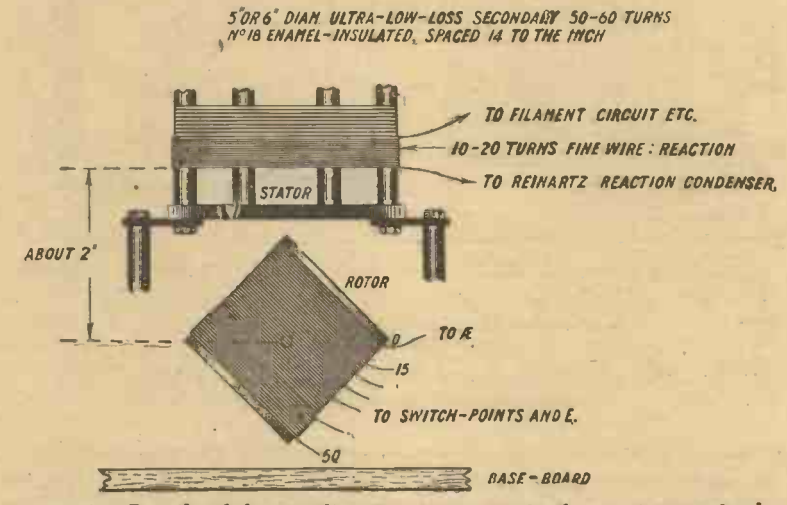


Fig. 3.—Details of the coupling arrangements in the receiver evolved from these investigations.

Therefore the convenient type of plain solenoid of fair-sized d.c.c. wire on a 3-in. diameter cardboard former was investigated, with the turns-number adjusted by trial. A 3-in. solenoid of 30 turns of No. 20 d.c.c. registered 1.55 volts; the ultra-low-loss coil gave sensibly identical results. A coil on the same kind of 3-in. cardboard former of No. 22 d.c.c. gave 1.5 volts; whilst a similar coil of 33 turns of No. 18 d.c.c. gave precisely the same figure. The extra length of the thicker d.c.c. wire required to reach the same inductance-value had introduced resistance which just compensated for its extra available surface-area—it should be recalled that only a small fraction of the outermost surface of the wire is effective in conducting these high-frequency currents.

Spacing of Turns

As it has been suggested (and the suggestion is well supported by some interesting figures given by Mr. F. J. Marco in a recent number of *Q.S.T.*) that a finer gauge of wire, if *spaced* on the former, may give a lower resistance; this was investigated as a practical test here : a coil of No. 22 d.c.c. was spaced on a 3-in. former by the convenient and familiar expedient of winding on doubled wire and then removing the one winding after securing the ends of the other wire, which gives, therefore, a spacing roughly equal to the diameter of the d.c.c. wire. In a second series of measurements this gave a signal-voltage of 1.45, as compared with precisely the same figure for the No. 20 d.c.c. coil; 1.5 volts for the air-spaced low-loss No. 18 coil and 1.25 to 1.3 volts for commercial No. 35 coils. As the spaced No. 22 coil was about 3 in. long for its 37 turns, whilst the No. 20 close-wound coil gave a similar inductance with 30 turns wound in $1\frac{3}{4}$ in. length, there was evidently no advantage *here* in adopting a thinner gauge of wire and spacing it by more than the thickness of the d.c.c. insulation.

Fine Wire

This does not, of course, rule out the possibility that at some wave-lengths a thinner wire carefully air-spaced on a smaller low-loss former may give a lower resistance for a given inductance than the particular type arrived at for the secondary inductance here, i.e., a 5 in. or 6 in. coil with No. 18 wire air-spaced about 14 to the inch.

A Suitable Coil

With this practical optimum, then, of No. 20 d.c.c. close-wound on a compact 3-in. diam. cardboard former, the tapped coil, the necessity for which had been implied by the preliminary experiments, was made up, and after several designs had been tried and tapping points adjusted, the final design of a 50-turn coil, 40 turns single-layer and the last ten turns double-banked or two-pile-wound in order to keep the overall length

down to the permissible 3 in., was arrived at, with tappings at turns Nos. 15, 20, 25, 30, and 40. This was found to give good results both on the large, high aerial and on a low single-wire one of unusually small capacity; the many tappings permitted the choice of a primary inductance that nearly, but not quite, tuned the aerial up to the wavelength of reception, and allowed therefore ready oscillation whilst not losing signal strength by working very far below the required wavelength. Even with the dead-end effects implied by the 50 turns and tappings, the actual signal voltage recorded when this was used as a direct-coupled tuning inductance, in comparison with the plain No. 20 d.c.c. 30-turn solenoid, showed sensibly the same value.

Measurements

The next point was to make sure that one was not actually losing available signal strength by using a coupled circuit at all. So measurements were made on a variety of large inductances direct-coupled by a *series* condenser, which I find in practice to give the best signals on the short waves when this method of signal measurement is used. A commercial plug-in coil of good design gave for the No. 75 coil on the large aerial 1.1 volts; the Nos. 60 (with about .0002 μF) and 50 (with about .0004 μF in the series tuning condenser) gave each 1.8 volts; a poor type of commercial coil of thin d.c.c. wire gave for the No. 50 size 1.5 volts, and another type gave 1.7 volts; a large 50-turn basket-coil of No. 22 d.c.c., 1.8 volts, and another of No. 20 d.c.c. but 1.5 volts. In the latter case evidently the tuning capacity was too small for optimum efficiency. In comparison the ultra-low-loss coil of about 50 turns of No. 18, air-spaced, on the 5-in. low-loss former, gave no less than 2.3 *volts*, showing the great increase in signal strength possible with the low-loss coil when fairly loosely-coupled to the damping aerial. It will be recalled that the improvement with the low-loss coil when direct-coupled and tuned by a parallel condenser was inappreciable, as compared with a plain No. 20 solenoid.

Secondary

With this optimum figure established, the next step was to measure the signal strength given by the loose-coupled semi-aperiodic primary proposed, in conjunction with the ultra-low-loss secondary. That the latter was worth while was already apparent, and was strikingly confirmed by measurements made with other types of secondaries, in conjunction with the standard 3-in. solenoid of No. 20 d.c.c. as primary. Thus the No. 20 basket-coil gave 1.8 volts when used in this way as a secondary; the No. 22 basket gave an identical figure, when coupled about 3 in. away, front edge of solenoid to centre of basket (the optimum coupling) in a two-coil holder of conventional design.

A Common Fallacy

The better type of No. 60 coil as secondary gave 1.7 with the same coupling approximately; with optimum coupling, 1.75 volts; whilst the corresponding No. 50 coil gave 1.7 volts (*i.e.*, less than when direct series-condenser coupled, when it gave 1.8 volts). This confirms what the writer has invariably observed in very many measurements of signal strength *with ordinary types of inductances* that have heavy losses; that there is *no* voltage build-up in a radio-frequency transformer of this type, above that which direct-coupling of the right sort will give, so that the usual facile simile of the power A.C. transformer is wide of the mark.

But now, with the ultra-low-loss inductance as *secondary*, the signal voltage gave the record figure for this aerial of 2.4 *volts*, as compared with the 2.3 volts previously recorded with the same inductance when direct series-condenser coupled. Later at night this figure rose to 2.45 volts.

Then, as a last step, the signal voltage was measured with a number of different primaries in comparison with the tapped No. 20 primary; all these were able to tune the aerial approximately to 365 metres without added tuning capacity. Whether one used the No. 20, tapped or plain, the No. 22 spaced, the No. 35 poor type of commercial coil, the No. 35 good type of plug-in coil (these at or just above the end of the secondary coil, at optimum coupling in each case), a No. 40 coil of good commercial design coupled 3 in. from the end of the secondary, or a low-loss primary of No. 18 air-spaced on a skeleton former identical with the secondary in general design but of 25 turns, whether coupled at 2½ in. or merely stood alongside of the secondary about ¾ in. away: *identically the same* signal strength was recorded, at optimum coupling and secondary tuning adjustment, on this low-loss secondary. The No. 22 or 20 solenoids also gave the same figure when stood alongside of the secondary and nearly touching the latter; whilst the tapped coil, when subsequently mounted so as to swing below the secondary, could be moved to a

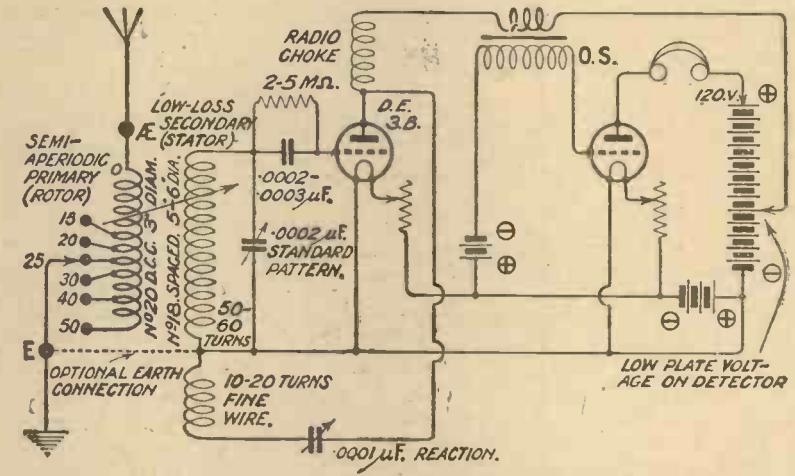


Fig. 4.—The circuit recommended by the author, the values of the components being as indicated.

position of fairly loose coupling with advantage.

Design of Primary

It would appear, then, that the design of the primary is merely a matter of constructional convenience, and of suitable inductance value in order to establish approximately the desired condition of an aerial slightly detuned *below* the wavelength of reception. Our No. 20 tapped solenoid fulfils this condition, and gives, as shown, the same optimum signal strength on a measurably strong signal as any other favourable arrangement. Actual measurement of signals when using this inductance tapped at a lower figure and tuned up to exact resonance by a separate parallel tuning condenser, showed precisely the same as with the untuned, rather larger number of turns, when at optimum coupling, on the large aerial.

Another Aerial

Trials on the small single-wire aerial (about 80 feet long and 20 feet high) gave 0.3 volts with 50 primary turns, coupled at 60 deg., and untuned, and but 0.25 volts with 40 turns, tuned, and with somewhat closer coupling. The only advantage of tuning closely the primary by a separate condenser appears to be that, as closer coupling can be used without serious loss, the selectivity is of a somewhat higher order. However, as with the tapped but not accurately tuned (*i.e.*, semi-aperiodic) primary, and with fairly loose coupling, the selectivity is already sufficient to separate two distant telephony stations when their mutual heterodyne note is actually heard continuously; and since, whether tuned or untuned, to eliminate the shock excitation of nearby powerful transmissions either wavetraps or else some further filter arrangements will be necessary, there is little in this in return for another tuning-point, and considerable complication in tuning.

Practical Details

The final design adopted is indicated in the figures: this appears to give about the optimum possible signal strength on the aerials used, without reaction, and over the usual short-wave range. The tapped 3-in. diameter solenoid of No. 20 d.c.c. is mounted to swing on a horizontal axis *below* the low-loss secondary, and at what appears to be about the best coupling distance of 2 in. from the latter, the whole being arranged precisely as indicated in the photographs and figures in the article on an application of low-loss inductances in *Wireless Weekly*, Vol. 6, No. 9, this tapped solenoid merely replacing the large basket-coil primary suggested there, and being mounted in a very similar manner to rotate through 90 deg. below the secondary. The six-way switch needed for the tapping arrangement, is, of course, accommodated on the front panel, connections being made by short pieces of flex between the tapping-points and back-studs of the switch. Both the cardboard former and the cotton insulation of the wire should be kept bone-dry. The secondary tuning condenser should be a standard (proportional capacity scale) .0002 μF *actual*, or of .00025 to .0003 nominal of some commercial types, to reach 500 m. with all in, and with a secondary of the type indicated, of 50-60 turns air-spaced on a 5-in. or 6-in. former. The square-law type gives a more distorted scale over the B.B.C. range with this kind of inductance, unless it has been arbitrarily adjusted to the particular values of distributed and casual capacities by the maker. The scale will be found practically linear from 500 down to about 350 m., and then slightly curving down to a minimum of 200 to 250 m., depending on the condenser, etc.

Eliminating Interference

For cutting through the local interference, a real low-loss series acceptor circuit with an inductance of identical design to the secondary, and a series condenser of .0003 μF, arranged across the aerial-earth terminals of the primary, is extremely effective, and gives little trouble in practice if kept well away from the rest of the circuit.

Practical Trial

In conjunction with the trap, and using a O.V.I. receiver, with fine reaction on the secondary, Manchester and the new French station on 380 metres are well clear from London, at about a dozen miles from 2LO, and a steady carrier wave on 370 metres could be isolated but not resolved. Cardiff was heard at about equal strength simultaneously with London on the former's wavelength, the latter getting past the trap to that extent. Below Cardiff, and

(*Continued on page* 369.)

THE AMATEURS' FIELD DAY.

In our last issue photographs were given illustrating various incidents during the combined societies' field day, and the above photograph shows the station in the bell tent at Mill Hill.

MR. PERCY W. HARRIS P

Further letters have been r regarding the progress o America, and, pending acco summarised outline is being in order that our readers m of his pr

The studio at the WAHG station is very comfortably furnished. Note the microphone seen in the centre of the photograph.

THE early part of his first week in New York Mr. Harris spent very largely in the company of the principal radio editors of both the daily Press and the wireless magazines, in investigations into the position of the American home constructor and allied subjects.

Reception Tests

At this time Mr. Harris was also in communication with a number of the prominent American manufacturers of receiving apparatus, in addition to the visit to the works of Messrs. Attwater Kent, which was mentioned last week, and he had placed at his disposal a selection of their instruments for his investigations upon American receiving conditions, and his remarks indicate that he has been gathering some very remarkable impressions upon the selectivity question, and also of the problem of the oscillator and the degree of the elimination of this nuisance which has been achieved in America.

A Dinner at the Harvard Club

The dinner given in his honour by the principal radio editors at the Harvard Club provided him with the opportunity of meeting a number of prominent personalities, as will be gathered from the key to the photograph of the dinner which is given overleaf.

Throughout his first week Mr. Harris was spending much time in the evenings making practical investigations into receiving conditions, and reports that he has carried out tests at distances of from 9 or 10 miles to 30 miles out from New York, in addition to experiments actually in the heart of the city itself.

Visits to Long Island

Much of this work has been done upon Long Island, where he has also visited the works of Messrs. A. H. Grebe & Company at Richmond Hill. The name of this firm is well known to British

Mr. Percy W. Harris receiving th after his talk fr

AYS A VISIT TO WAHG

eceived from Mr. Harris f his investigations in unts from his own pen, a presented on these pages ay gather a general idea gress.

experimenters in connection with the design of short-wave receivers, for which it justly enjoys a very high reputation, and many

e cake from Mr. A. H. Grebe m WAHG.

A part of the apparatus room at WAHG. Note the Grebe receiver seen in the foreground.

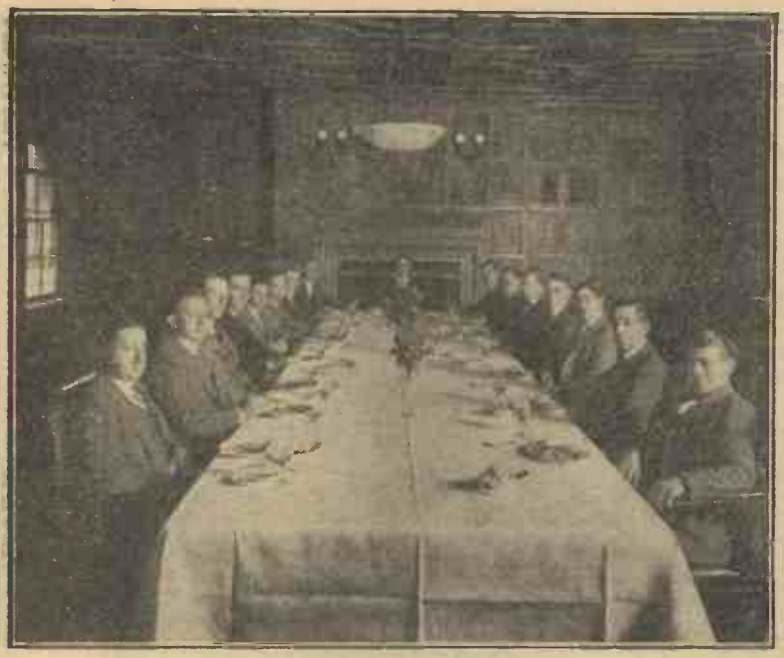
of Mr. Harris's selectivity experiments have been carried out on Long Island with the aid of Grebe apparatus. It may be mentioned at this point that his impressions regarding selectivity convinced him that the question is such an important one that it will be necessary to bring some representative American sets back to the British Isles for further tests under British conditions.

Broadcasting from WAHG

During one of his first visits to Long Island, the necessary arrangements were made for Mr. Harris to give a short address from Messrs. A. H. Grebe's broadcasting station, whose call sign is WAHG. As is customary, advance notices were circulated to the Press regarding his talk, giving the subject as "Radio From an English Point of View," and the time for its delivery as 10 p.m. Referring to Mr. Harris as "an eminent British editor, who is the author of numerous wireless text books and constructional designs," mention was made of the fact that probably the great majority of the home-constructed receiving sets in use in the British Isles were built to his designs, and allusion was made to "the famous Harris Hookups"!

The Address

During his address, Mr. Harris appears to have given a general description of British conditions, an account of the main and relay stations used in this country, the methods employed in simultaneous broadcasting, our licensing, conditions, and so on. His visit appears to have been an occasion of considerable ceremony, and his talk was followed by an amusing presentation of an enormous "radio cake." As soon as Mr. Harris's talk had concluded, the announcer explained to the listeners what was going on in the studio, and said that the cake was "as large as a tub, covered with frosting, English and American flags, and



Mr. Percy W. Harris.
Mr. Casem (N.Y. Telegram).
Mr. Paul McGinnis (N.Y. Journal).
Mr. Roe (Radio News).
Mr. Arthur H. Lynch (Radio Broadcast).
Mr. W. C. Alley (Radio Retailer).
Mr. M. Clements (Radio Retailer).
Mr. A. B. DeLacy (Popular Radio).
Mr. L. M. Cockaday (Popular Radio).
Mr. H. C. Bodman (Radio Merchandising).
Mr. M. B. Sleeper (R. and M. Engineering).
Mr. Nixon (Radio Dealer).
Mr. P. C. Oscanyon (Amateur Radio).
Mr. Ch. H. Albrecht (N.Y. Graphic).
Mr. Bragdon (N.Y. Sun).
Mr. Sylvan Harris (Radio News).

The dinner at the Harvard Club.

bearing an inscription 'To Percy Harris, Leading Broadcast Authority of the British Empire, from WAHG.'" The announcer further referred to the radio cake as containing sixteen ingredients, of which every one was connected in some way with radio, but lacking a further report from Mr. Harris regarding the properties of the cake, we are somewhat in the dark as to its actual constitution.

A Visit to WJZ

Another broadcasting station which Mr. Harris has already visited is WJZ, which readers may remember was one of the very first to be heard in this country. He was here given the greatest freedom to see everything that there was to be seen, and to make the fullest inquiries. He appears to have been particularly impressed by the fact that the modulation of the station is checked by watching the record of an oscillograph, and by the fact that all the announcers of the station are University men, the management apparently fully realising their responsibilities as regards the influence of broadcasting upon the pronunciation of listeners.

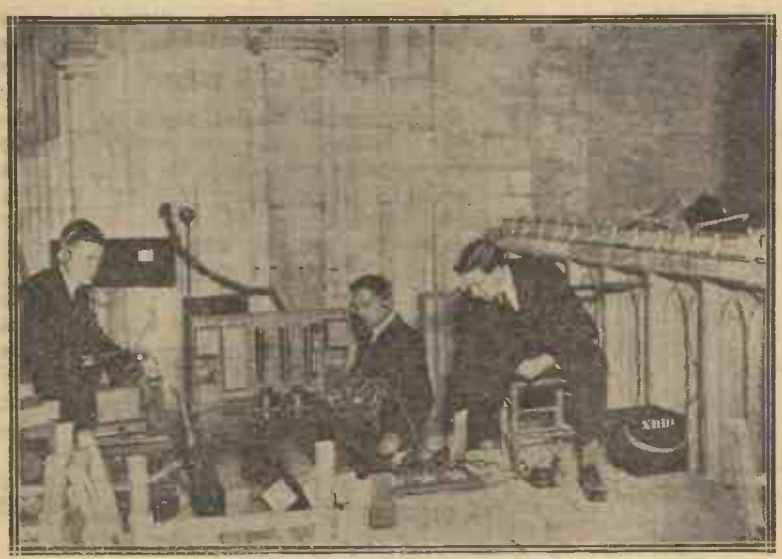
At the "Radio Broadcast" Laboratories

Another visit which is likely to bear fruit in some very interesting impressions from Mr. Harris is one which he paid to the experimental station and laboratory run by the American magazine *Radio Broadcast*, at Garden City, Long Island. In this laboratory some of the most popular and successful American designs for home-constructed sets are prepared, and a good deal of valuable experimental work has been carried out.

Among the activities of the second week in New York was a visit on Tuesday to the new broadcasting station which has just been built by the *Radio News*, and which will be controlled by that magazine, with the call sign WRNY. This station is of the standard Western Electric type, and is capable of using powers between 500 and 1,000 watts.

Latest Movement

Mr. Harris's detailed reports to date carry us no further than the point which has just been reached, but cables have been received from him more recently, which indicate that he has now passed on to Washington, where he has been interviewing some of the chief authorities of the Government departments connected with wireless, including Dr. L. W. Austin and Dr. J. H. Dellinger, of the radio section of the Bureau of Standards. A final communication received from him just before this issue of *Wireless Weekly* goes to press, indicates that he has been to see Dr. Taylor, who controls the Government experimental station of NKF, and this is referred to elsewhere in this issue.



Arranging the amplifying apparatus at the Canterbury Cathedral for the transmission on June 5.

An Adapter for Reinartz Tuning

By A. S. CLARK.

An easily made unit which, when connected to an ordinary direct-coupled receiver, adds considerably to the selectivity of the circuit.

The adapter is made up with very few components, as the above photograph shows.

THE advantages offered by the Reinartz tuning and reaction methods merit greater attention than they have hitherto received, although the Reinartz arrangement (a single-valve circuit with this form of tuning is shown in Fig. 1) is quite popular with those who have given it a fair trial. The reason why more amateurs have not used this arrangement is probably due to the fact that it is not convenient to build a completely new receiver merely with a view to trying a different method of tuning. For this reason the following unit should prove useful.

The Object of the Unit

The unit makes it possible to try the Reinartz circuit on any set employing a standard circuit

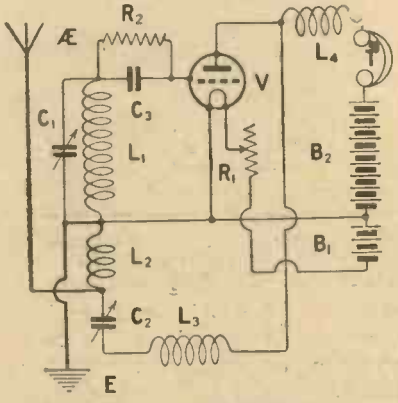


Fig. 1.—The Reinartz circuit is selective, easily operated and gives a fine control of reaction.

with magnetic reaction. It is, of course, assumed that the set has plug-in coils, and this being the case no alterations to the set whatever are required, even although H.F. amplification is used.

The construction of the unit is extremely simple, and not expensive. Those who have not yet experienced the advantages of the Reinartz arrangement, but who are desirous of so doing, should make the unit illustrated.

Components

The circuit of the adapting unit is given in Fig. 3, from which it will be seen that the components required are few. The components actually used are given in the following list, and although the makes used are indicated, others will give equal satisfaction :—

One ebonite panel, 6 in. by 8 in. by ¼ in. (Paragon.)

One 3-way coil holder. (Burne-Jones, Ltd.)

One .0003 μF variable square law condenser. (Jackson Bros.)

Five large lacquered terminals.

One containing box. (Camco.)

Two Clix sockets and plugs. (Autoveyors, Ltd.)

Radio Press panel transfers.

Square wire, screws, flex, etc.

Drilling and Wiring

The drilling diagram, Fig. 2, gives the drilling centres for all the necessary holes to take the components; it also shows the transfers required, and where to place them.

The wiring is straightforward, and should be carried out exactly in accordance with the wiring diagram of Fig. 4. It is best to

tin all points to which wires are to be soldered before actually attaching them. When the wiring is completed, screw the panel to the box, and the unit is ready to put into service.

Connecting Up

The connections of the unit to the set with which it is to be used are quite simple. The reaction coil socket of the receiver is utilised to take an H.F. choke, and this should be a No. 300 coil or its equivalent, although this value may vary with different sets, and a slightly larger or smaller one may be tried. Before plugging this coil in, ascertain which side of the coil socket goes to the plate of the detector valve, the reason being that an extra connection has to be made from this to one side of the Reinartz reaction coil. Having found which side goes to the plate, plug the coil in and at the same time jam one end of a piece of flexible wire into this pin and socket connection. The other end of this wire is

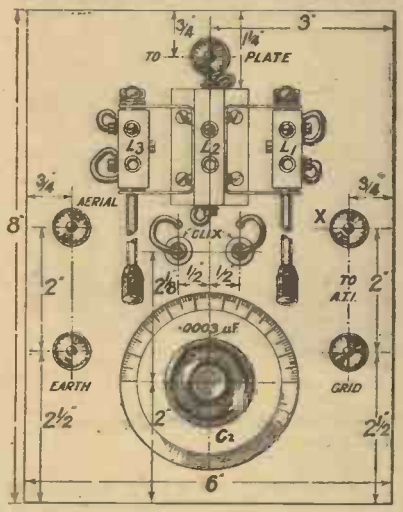


Fig. 2.—The layout of the panel is extremely simple, and should appeal to the beginner in constructional work.

connected to the terminal at the back of the tuner, which is marked " To Plate."

Connections

When the A.T.C. on the set is in parallel with the A.T.I. the terminal marked " Grid " is connected to the aerial terminal of the set, and the other terminal on the right hand side of the unit, marked ×, is connected to the earth terminal of the set. If the condenser is not in parallel, an adapter is required to plug into the A.T.I. of the set, the two wires from this going to the two terminals on the right hand side of the unit, care being taken to see that the wire which goes to the terminal marked " Grid " is

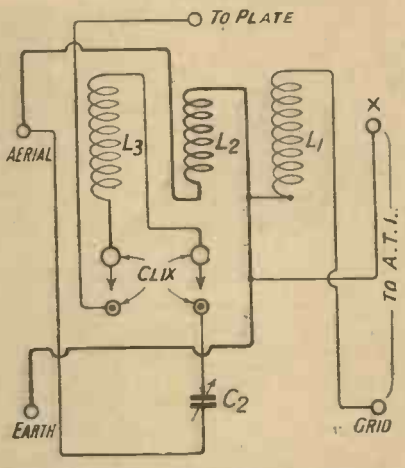


Fig. 3.—The theoretical circuit of the adapter. The Clix permit the connections to the reaction coil to be reversed.

the correct one. Now join the aerial and earth terminals of the set together, thus putting the condenser in parallel. With the actual aerial and earth connected to their respective terminals on the unit we are in a position to consider which coils to use.

The aerial coil is semi-aperiodic, and the coil which will give the best results will depend to some extent on the particular aerial in use; a No. 25 may be tried as a start. This coil has to be inserted in the middle socket of the coil holder on the unit. The grid coil, that is, the right-hand one, should be a No. 50 for broadcasting on the lower wavelengths, and a No. 200 for Chelmsford. When working, the aerial and grid coils are coupled for the best results. The left-hand coil, which is the reaction coil, may be a No. 75 for the lower broadcasting band, and a No. 150 or 200 for the longer wave station. On the longer waves the aerial coil will be a No. 100 or 200.

Adjusting Reaction

The degree of coupling between the plate coil and the two others is determined in the following manner. Set the plate coil at right-angles to the others, and tune in your local station. Now set the reaction condenser, that is the one in the unit, at about 90 degrees, and bring the reaction coil up to the others until the set just oscillates. All reaction control can now be made with the condenser alone, and there should be no overlap. If a large variation is made in the wavelength on which the set is to receive, the reaction coil will naturally need readjusting.

The two Clix are for the purpose of reversing the reaction coil if this is necessary, and if bringing the plate coil up to the aerial coil does not increase signal strength, but decreases it, the two Clix should be changed over.

Attaching to Loose Coupled Sets

In cases where the unit is used with sets employing loose coupling, the connections which have to be made are similar to those already given when an adapter is used, except that the secondary coil socket must be treated as the A.T.I., the aerial coil socket being neglected altogether.

An adapter for the A.T.I. may be made from a small piece of

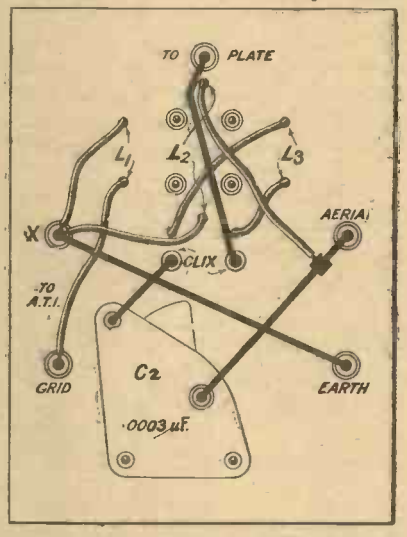


Fig. 4.—The wiring of the adapter is here shown, together with the purposes served by the terminals.

ebonite and a pin and socket mounting, from which flex connections of suitable length are taken.

Results

The unit has been tried on several sets, both with and without H.F. amplification, and proved in all cases almost as good as a specially designed Reinartz receiver. The results, especially as regards the degree of control over reaction, were always better than with the tuners incorporated in the sets to which the unit was connected.

Tuned or Untuned Aerial Circuits ?

(Continued from page 363)

above Manchester, other stations were quite free from London. For example, on the big aerial, and late at night, London, Manchester, Paris, Bournemouth, Newcastle, Glasgow, Belfast (plus his usual mush), and Birmingham could be heard in London in quick succession with the single adjustment, that of the secondary T.C., and each clear from any other station. The usual round of French and German stations, Radio Belge, etc., could be made with ease and comfort on the two valves; some of the relays and the short-wave German stations came in excellently.

Reaction

With the simple tuning and moderate, nearly uniform reaction-demand, it seemed to be the ideal long-distance receiver.

All the measurements given here were made *without* the use of any reaction, and are therefore indicative of the relative efficiency of reception of *distant* stations with the use of finely-regulated reaction. On the local loud station experience (and actual measurement of signal voltage indicated when adjusted as near as might be at maximum permissible reaction for clear reception of telephony) shows that *with* reaction much the same signal strength is obtained with tuning inductances of very varying character; and that, *e.g.*, a high outside aerial, such as that used here in most of the experiments, gives no louder signals than those given by a small one, on account of the saturation and natural limitations of the detector - valve used. Fine Reinartz type of reaction was used in the experiments in actual reception.

Short Wave Experiments

The s.s. *Charles Brower*, commanded by Captain Carl Hansen, is a commercial ship in the fur trade. Calls will be made at the following ports before returning to San Francisco about October 15, 1925: Nome, Cape Prince of Wales, Point Barrow, Barter Island, Icy Reef, Alaska, thence to Hershel Island, and return.

Like the MacMillan expedition, the s.s. *Charles Brower* will be equipped with Zenith Radio apparatus. They will attempt to keep in touch with the outside world during the entire voyage. Experiments will be made at Cape Prince of Wales and Point Barrow, where atmospheric conditions make radio reception extremely difficult. It is also hoped that they will hear Commander MacMillan broadcast from the Arctic. The greatest part of the trip will be in constant daylight, which will further add to the difficulties of radio reception.

U.S.S. "Seattle"

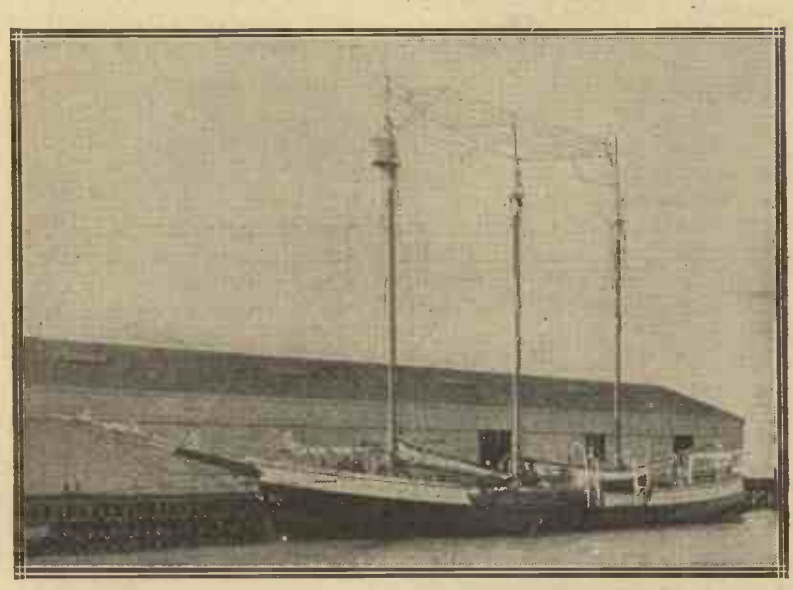
The MacMillan Expedition, with their short-wave receiving and sending apparatus, will no doubt bring forth many interesting and new developments in radio reception and transmission. By special arrangement, the U.S.S. *Seattle*, flag-ship of the U.S. Fleet, operating in Pacific waters, will stand by to receive MacMillan radio messages from the frozen Arctic.

Radio amateurs, who so ably performed past experimental work with MacMillan in the Arctic in 1923 and 1924, are making short-wave receiving and transmitting apparatus from diagrams and instructions furnished by Lieut. John L. Reinartz.

Press News

Never before in the history of radio has so broad an arrangement been made in the interest of scientific research—experiments which will practically belt the entire earth with radio waves. Once again the amateur will form an important link in this relay work, keeping in touch with Commander MacMillan during his entire trip. Messages received from the expedition will be released to the entire Press of the country, therefore it will not be necessary to await the explorer's return to find out the results accomplished, as has been necessary before radio became a part of an explorer's equipment.

S.S. "CHARLES BROWER"



The s.s. "Charles Brower" which, equipped with short wave apparatus, will endeavour to maintain communication with the MacMillan Expedition.

A Home-Made Variable Resistance Unit

By R. W. HALLOWS, M.A., Staff Editor.

MOST experimenters must have felt pretty often the need for a variable grid-leak or anode resistance, capable of calibration that is approximately accurate, and such as can be relied upon to remain constant. The instrument I am going to describe in this note is not intended to be mounted as a permanent part of a receiving set. It is meant for use upon the bench to enable the best value of grid-leak or anode

Fig. 1.—The clips and Clix sockets are arranged as shown.

resistance for any circuit to be found. When this has been done a fixed leak or resistance of this value can be fitted to the set with every confidence that results will be satisfactory.

Grid-leaks

One way of discovering grid-leak values is to purchase an accurate set of leaks from, say, .5 megohm to 5 megohms. This is, however, rather an expensive business, since, if one wishes to be able to make ½ MΩ changes between these values, no less than ten will be required. This unit, which uses only four leaks, allows the following values to be readily obtained: .25, .5, 1, 1.25, 1.5, 2, 2.25, 2.5, 3, 4, 4.5 and 5 megohms. The components required are four sets of grid-leak clips, ten Clix sockets for panel-mounting, a piece of ¼-in. ebonite, whose size will depend upon the pattern of leak that is used, and five short lengths of wire with an insulated Clix plug at each end.

Fig. 1 shows how the clips and the Clix sockets are arranged upon the ebonite panel. Dimensions are not given since leaks of different makes vary in their lengths. The constructor, however, will have no difficulty in arranging his own layout to suit the particular components that he uses. There is no permanent wiring, all connections being made by means of the short Clix-fitted pieces of wire mentioned above.

Values Used

The rules governing the values of combinations of resistances are exactly the opposite of those for capacities. By placing resistances in series you increase the total value, whilst by placing them in parallel you decrease it. If two resistances of equal value are wired in series the total resistance is twice that of one of them. On the other hand, if a pair of equal value are wired in parallel the resulting resistance is half that of one. The actual resistances used for the grid-leak type of unit are two of .5 megohms each and two of 2 megohms each. We thus have

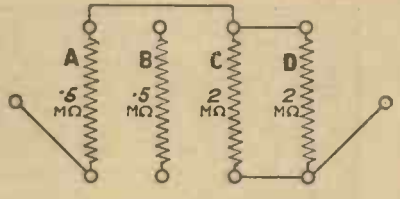


Fig. 2.—Showing how a total resistance of 1.5 megohms is obtained.

two pairs, each of which is composed of two resistances of equal value. By means of the Clix connections we can make very quickly series and parallel combinations which will give us a large range of values—actually there are twelve possible between .25 megohm and 5 megohms. Fig. 2 shows, for example, how a total resistance of 1.5 megohms is obtained. Resistances C and D each of 2 megohms are placed in parallel, the resulting resistance being half that of either, or 1 megohm. Resistance A is connected in series in this combination, and the resistance between the terminals is then 1.5 megohms. The following table shows the values that may be obtained and the combinations which give them. In it the + sign stands for in series with, and the = sign for in parallel.

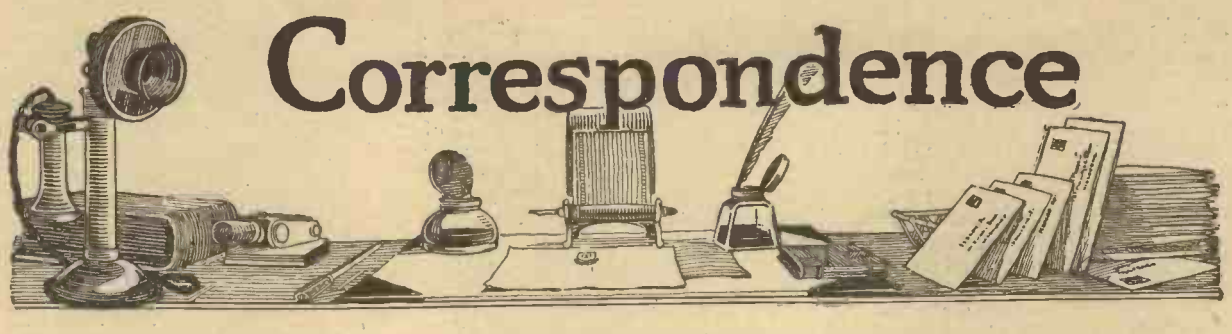
Megohms.	Combination.
.25	A=B
.5	A
1	A+B
1.25	A=B+C=D
1.5	A+C=D
2	C
2.25	A=B+C
2.5	A+C
3	A+B+C
4	C+D
4.5	A+C+D
5	A+B+C+D

ULTRA SHORT WAVE RECEPTION

(Concluded from page 359)

reading, and the reaction condenser slowly turned from zero reading towards the higher end of the scale until the receiver oscillates. Once this condition has been established then the two condensers, grid-tuning and reaction, should be turned simultaneously, the grid-tuning condenser being turned slightly faster than the reaction condenser. Once signals have been found then the best results should be tuned for by means of the grid condenser, and final reaction adjustments made upon the reaction condenser.

So long as the layout has been respected and the wiring copied in detail, hand-capacity effects should be relatively small, and in the receiver illustrated they are particularly so. A set of this type is obviously not intended for any but the serious experimenter, and for that reason the reader who hopes to listen to broadcasting upon the coils given will be disappointed. It is, however, my intention to describe in a later issue a plug-in coil unit, which may be used with this receiver for use in ordinary broadcast reception.



THE SEVEN-VALVE T.A.T. IN CHILE

SIR,—I should just like to let you know the results I have obtained on first trials of the "Seven-Valve T.A.T. Receiver," by John Scott-Taggart, F.Inst.P., A.M.I.E.E., as described in *Modern Wireless* of January, 1925.

The circuit was made with American components and almost exactly as described. Home-made "spider-web coils" were used for the tuned coils, and the tapped reactances were made exactly as described. Only *one stage* of audio-frequency amplification was used. Cunningham C301 A valves were used throughout, having 90 volts on the amplifier valves and 45 volts on the detector. Reaction was not used.

Local stations came in at full loud-speaker strength. These locals, I might add, are what are called here "Mosquitoes," and consist of two or more UV201A's, with the 220 volts of the lighting mains as H.T.

Santiago, "Radio Chilena CRC," came in very loud on the loud-speaker. Next I tuned Buenos Aires, and LOR and LOW came in wonderfully clear and as strong as Santiago. By strong I mean that in a large-sized room signals were just not too loud to be unpleasant. Santiago is about 60 miles distant, I suppose, and Buenos Aires 600 to 700 miles. I also received a small amateur station at Buin, south of Santiago, on the loud-speaker, and an American station giving a geography lesson, but I could not miss my dinner to get the name of this station, enthusiastic as I am. I forgot also to mention reception of the station of the newspaper *El Mercurio* from Santiago. This is a smaller powered station than CRC, but it came in at good loud-speaker strength.

I found the set very selective indeed, and was able to get through "local rubbish" with no trouble at all.

Static here is terrific, but on this receiver seemed to be less than on others I have.

I congratulate you on this receiver, as, honestly speaking, it is by far the best I have made to date.

Yours faithfully,

T. S. R. KNIGHT.

Valparaiso, Chile.

P.S.—The above are first-night trials with unsoldered joints, etc., and when I finish the set as it should be and add a stage of "push-pull" L.F. amplification, it should give even more wonderful results.

Mr. Cousins' All-Concert de Luxe Receiver.

ENVELOPE No. 4

SIR,—If Mr. Harris could only see the crowd of several hundred people that listen when I put the loud-speaker out of the window, I am sure he would be highly gratified with the design of his "All-Concert de Luxe."

I manage to get most of the stations, all the B.B.C. and some of the relay ones. America, too, on the loud-speaker from 11 till 2 o'clock during the winter without X's or fading.—Yours faithfully,

G. S. COUSINS.

Bury St. Edmund's.

ENVELOPE No. 10.

SIR,—Having read the letters published in the July issue of *The Wireless Constructor* regarding Mr. John Scott-Taggart's "Twin-Valve" Receiver, published in Radio Press Envelope No. 10, I should like to confirm the various reports as to the excellence of this circuit. Both for power on the local station and range it would be hard to equal, but it is as a portable set that I am particularly pleased with it. I have just re-built the set in a suit case with a frame aerial in the lid. Signals at six miles from 2LO are so strong that the set has to be de-tuned slightly for comfortable hearing, and although I have not had the opportunity yet of taking it further afield, I have no doubt that it would have a considerable range on the frame.

Thanking you for publishing such a fine circuit, not forgetting its designer, and wishing your excellent papers every and continued success.—Yours faithfully,

C. H. MARRIOTT.

Bedford Park.

THREE-VALVE DUAL RECEIVER

SIR,—I thought I should like to write and let you know some of the results I have had since I built the "Three-Valve Dual Receiver" (by Mr. John Scott-Taggart) which first appeared in *Modern Wireless*, April, 1924. I built the receiver with the various terminals on the panel for use as a three-valve dual,

two-valve dual, etc., and am more than astonished at the results I have been getting. I get all the main B.B.C. stations on the loud-speaker, and Chelmsford and Birmingham at good loud-speaker strength on the two-valve dual. Recently I received Dundee on the loud-speaker on the two-valve dual. The receiver is surprisingly easy to handle, and as stable as a rock, and can be switched off at night on any station and then be certain of that station being there when next used without having to alter anything. I regularly get Hamburg on the loud-speaker also Radio-Paris and many other Continental stations, at good loud-speaker strength, which I am unable to identify. My aerial is a single one of thick copper wire about 30 ft. high at the far end and about 15 ft. high at the receiver end and is well exposed on a slight hill.

Thanking Mr. Scott-Taggart for a most excellent circuit through *Modern Wireless*.—Yours faithfully,

J. H. W. DOUGLASS.

Market Harborough.

SIR,—Just a few lines to express my appreciation of your Three-valve Dual set (*Modern Wireless* for March, 1924, by Mr. J. Scott-Taggart). I built this set early in the winter, and on a favourable night I could get all the B.B.C. main stations at loud-speaker strength, and several relay stations on 'phones, but since the long evenings have come results are not so good. With aerial and earth disconnected I have often picked up Belfast, 38 miles away (quite readable), and in the dark evenings with a 14-ft. indoor aerial, 7-ft. high, I have heard a number of the main stations on 'phones at good strength, and on one rare occasion London, Bournemouth, Manchester and Newcastle at loud-speaker strength. I would very much like to have a stage of H.F. which I could add to this set; perhaps in some future issue of *Modern Wireless* you could see your way to give details of such a set. There are five of your sets in use close to me (in the country) all giving satisfaction.—Yours faithfully,

J. T. BURNS.

Co. Tyrone, Ireland.

WIRELESS IN LONELY PLACES

SIR,—I am giving to you herewith a very interesting letter which has just been received from one of the outposts of civilisation—Battle Harbour, Labrador. Cartwright, in his *Journal of Labrador,* says of that country in 1778 :—

"The mariner, cruising along the coast of Labrador, is impressed with the feeling that the Creator, after having made everything else, having a lot of rocks left over, threw them up here and called it 'Labrador.'"

And may I say that Labrador has not changed from 1778 to the present day. I visited Battle Harbour, Labrador, last year, and it is one of the most desolate spots on the face of the earth. There is nothing there but a little trading store, a handful of fishermen, one of those wonderful Grenfell Missions, and a radio station maintained by the Newfoundland Government for the benefit of the fishermen. I doubt if this station at Battle Harbour handles more than ten to fifteen messages per year. When I was there I presented the radio operator, Stanley W. Brazill, the author of this letter, with a broadcast receiver, as the receivers which he had were efficient only on the extremely high and commercial wavelengths. This letter comes by the first mail out of Battle Harbour, Labrador, and indicates appreciation of radio of a sort that can only be felt where the need of communication is as great.—Yours faithfully,

E. F. MCDONALD.

New York.

"Commander E. F. McDonald, Jun.,

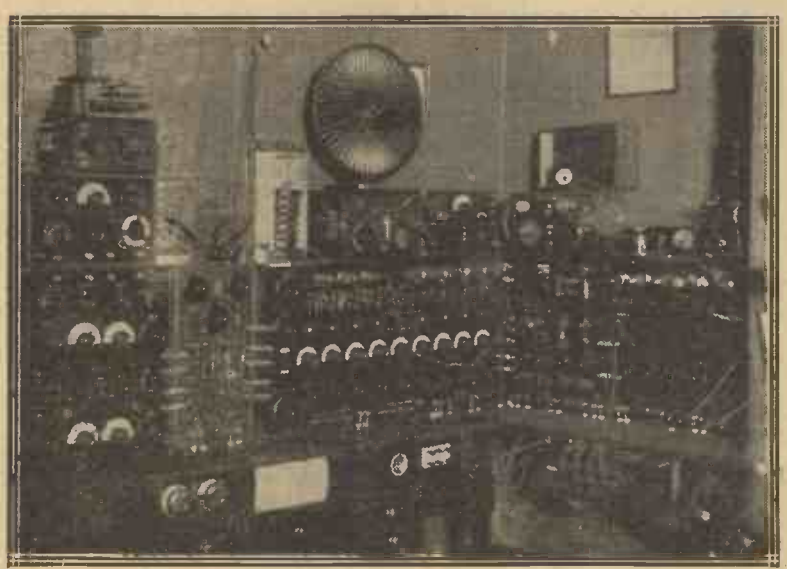
President Zenith Radio Corporation, Chicago, Ill., U.S.A.

MY DEAR COMMANDER, — Your esteemed favour of October 15, 1924, has just reached me, having been on the way all these months. It was delivered by a fishing schooner which brought us the first written tidings in many moons. This reply will probably be picked up by the same schooner, for the captain offered to stop for mail on the way back. If it weren't for the occasional fishing crew venturing far off the beaten tracks and throwing anchor here before the arrival of the first mail boat of the season, we would be in a very bad way for mail.

Our solitude, however, is not nearly what it used to be before the advent of radio. I am really wanting words to tell you what the radio which you so kindly presented to me has meant to the entire settlement of Battle Harbour during the past long and intense winter. It lifted us out of the monotony and isolation which kept us bound for many months at a time, and afforded us with world news almost daily—and entertainment of a sort as has never before been experienced here. It spread new life among us and worked as a charm, effectually destroying the sense of almost complete separation that besets us who are so far remote from the populated centres.

We have listened to stations in Los Angeles, New York, Chicago, Davenport, St. Louis, and many others too numerous to mention, including the stations that we heard during the Transatlantic test. Some of our folk have never been outside this immediate vicinity, and I have often wished I could get inside of them to find out just what their ideas are of the places and the people whence come the different kinds of broadcasting. I wonder what the Eskimos and the Indians see in their mind's eye of New York, Chicago, San Francisco, and how they have visualised the orchestras which thrill their souls with the enchantment of music.

Reception during the months of November, December, January and February was flawless. The



The elaborate receiving station belonging to Mr. David G. Bird, of South Shields.

Northern Lights had no disturbing effect that I know of.

I am looking forward to the time when I can come down to your country to meet some of the men and women who have entertained us and whose voices and musical technique are so familiar that we recognise them even before names are announced.

Radio certainly has been a blessing to us.—Yours very truly,

S. W. BRAZILL.

Battle Harbour, Labrador.

A CRYSTAL SET

SIR,—I have made the crystal set with No. 16 wire which you published in *Modern Wireless,* September, 1924 (by Mr. Percy W. Harris), and on which you ask for reports.

I am on the top of the hill at Wimbledon, eight miles direct from 2LO, and have a P.M.G. aerial of electron wire 35 ft. high with earth to main water pipe 15 ft. directly below the instrument. The aerial is well in the open and not screened. For London I find the ordinary arrangement of A.T.I. using 40 out of the 60 turns is best.

(1) Straightforward reception is such that music and speech is just audible about 3 ft. from the 'phones, but speech not intelligible. On an Ethovox 2,000 ohms loud-speaker a good announcer is just intelligible 12 ft. away in a room 16 ft. by 9 ft. if there is perfect quiet, and with Savoy bands or a soprano the tune is easily audible under the same circumstances.

With these results I thought I would try if I could get anything on a frame aerial (loop, no earth). After finding the best spot I could on the crystal with the ordinary aerial and earth I disconnected both these and connected a loop of 12 turns and 3 ft. 6 in. square. With this I found I had to plug in a 35 coil in the coil holder and use all the 60 turns of A.T.I. At 12 midnight yesterday I heard Big Ben quite distinctly and could just distinguish the announcer declare "Closing down." At 3 p.m. to-day I tried it again. The tuning note was perfectly clear, so was Big Ben, but not so loud as the night before. The announcer was heard, but was not really intelligible.

At the same time, I think these results must be out of the ordinary and show that the use of the thick wire for the A.T.I. and the method of winding it produces a very sensitive receiver. It is certainly 100 per cent. better than my old tapped coil crystal set. Two stages of resistance-capacity note magnification produce quite satisfactory loud-speaker results.

With many thanks for your design.—Yours faithfully,

F. O. BURKETT.

Wimbledon Common, S.W.19.

A REINARTZ RECEIVER

SIR,—I thought you might be interested in the results obtained with my Reinartz tuner. I am at present using the receiver described by Percy W. Harris in *Modern Wireless,* March, 1924, viz. :—Det. and 2L.F. The circuit is a lay-out on a board, each condenser and valve being in its own small box, and the following particulars may be pertinent :—

Location.—10 miles west of Manchester.

Aerial.—60 ft. of 7/22; average height, 30 ft.; lead-in, continuous with main aerial.

Earth.—6 ft. lead Electron wire to buried lead piping (3 ft.).

Results :—All main B.B.C. stations are received at good L.S. strength on an Amplion Junior de Luxe, with exception of Cardiff. London, Bournemouth and Newcastle, however, suffer interference from Manchester. Manchester has to be de-tuned, and can be received without an aerial. Of the relay stations Liverpool is almost as loud as Manchester. Others received are Hull, Leeds, Sheffield, and Edin-

burgh, all giving speech and music, which can be followed quite easily and enjoyed. Foreign stations received are :—

	Strength.
Petit-Parisien ...	L.S.
Zurich	L.S.
*Frankfurt ...	Fair L.S. (fades)
*Breslau ...	,, L.S.
*Stuggart ...	,, L.S.
*Madrid ...	,, L.S.
Hamburg ...	L.S.
Ecole Sup. ...	L.S.

* Equal to British Relay Stations.

By L.S. I mean volume equal to that of a good gramophone.

Is not this list truly amazing! And the beauty of the business is that it can be done any and every night, which statement can be vouched for. The main B.B.C. stations I can also get in the afternoon at nearly the same strength as at night.

Features of the circuit I find are :—

1. Remarkable simplicity of tuning.
2. Delightful build-up of signals on increasing reaction condenser.
3. Smooth and easy control of reaction.

I might add that I find a radio choke (300 turns) between the plate of the first valve and the OP of the first L.F. transformer gives greater freedom of oscillation. I hope I have not wearied you, but when one comes across such a really excellent design one feels bound to thank the giver, and that can best be done, I think, by showing exactly what can be done with it.

Wishing you and your periodicals every prosperity.—Yours faithfully,

HAROLD FAIRHURST.

Manchester.

A READER'S RESULTS

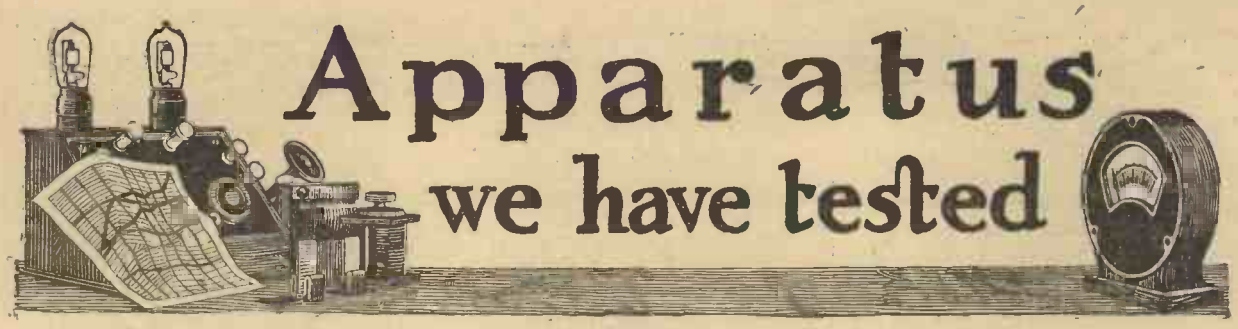
SIR,—For some months past I have been using a set of which you gave a theoretical diagram (April, 1924, *Modern Wireless*), under the heading of "Some Useful Multi-Valve Circuits." I constructed the first of the three given. Although it was published merely as a four-valve set (I.V.2), I have made it up in five panels—one for tuner and one for detector, one H.F., and one for each of the two amplifiers, and I find that I prefer to use only the three valves (I.V.1). The set is very sensitive, and using only the three valves I have heard the following 43 stations :—

Seventeen B.B.C. stations (four relays I have not heard), Eiffel Tower, Radio-Paris, Ecole Sup. de P. et T., Petit Parisien, Hamburg, Frankfurt, Konigswüsterhausen, Leipzig, Berlin, Munich, Breslau, Rome, Madrid, Brussels, Zurich, Lausanne, Stockholm, Hilversum, Hague, Persbureau Vaz Diaz, Ymuiden, WBZ, WGY, WEAF, KDKA and CNRA (Canada).

I think you will agree with me that this is a very good performance for a straight three-valve set, especially as most of the B.B.C. stations and many of the Continental ones come in at moderate L.S. strength. I think your three magazines are most useful to the average amateur. The use of double reaction makes the set very selective, Manchester being tuned in without any undue interference from London, which is only seven miles distant, and differs in wavelength by only 10 metres.—Yours faithfully,

C. D. W. ARNOTT.

Woodford Green, Essex.



Apparatus we have tested

Conducted by A. D. COWPER, M.Sc., Staff Editor.

Sterling "Non-Pong" Valve-Holders

A valve holder in which special provisions have been made to reduce to a minimum the troublesome microphonic effect noticed with some types of dull-emitter valves, particularly those of the .06 variety with extremely slender filaments, has been brought out by Messrs. Sterling Telephone and Electric Co., Ltd., in the "Non-Pong" holder. This has an ordinary type of solid cylindrical valve holder supported in an elastic manner by what appears to be a sleeve of sponge rubber, in a flanged hollow circular base-piece fitted with four soldering tags for connections and with holes in the rim for holding-down screws. The various connections are clearly marked, and are completed within the hollow base by short flexible connections to the respective sockets. These are recessed somewhat in the holder, for the prevention of accidental short circuits when inserting the valve. On testing the sample submitted, it was very noticeable how extremely flexibly the valve was supported; when tried for microphonic effects with a D.E. valve of notorious proclivities in this direction, it was found that quite a sharp rap could be given to the table on which the holder stood without making any loud "pong" in the 'phones, and that any noise produced by mechanical disturbance died down very quickly. The improvement in this direction was marked.

The insulation-resistance proved excellent on trial; casual capacities between sockets were not unusually high, though that between the grid and the filament socket might with advantage have been a little less. The holder appeared to be strongly made and well finished.

New Model "Clix" Terminals

A new model of the well-known "Clix" terminal, together with an additional fitting in the form of an adapter-socket which can be used directly in an ebonite panel or with insulating bushes in a wood panel, has been lately brought out by Messrs. Autoveyors, Ltd. The new pattern, samples of which have been submitted for our inspection and trial, is interchangeable with the old pattern and has a 1B.A. thread and nickeled finish. The additional adapter fitting, which

sells at a slightly lower price, has a similar thread and finish, and has the familiar cone fitting for holding the standard pattern plug, whilst itself providing an under-panel soldering point. A slot in the end gives purchase to a screwdriver when inserting it in the panel, and also facilitates the operation of wiring. Small insulating bushes in six different colours are available for use in wood, matching the range of coloured insulators on the "Clix" plugs themselves; the adapter is secured in position by the usual lock nut underneath the panel. It is unnecessary to reiterate the manifold uses of these devices for regular connections to a radio receiver in the place of screw-up terminals, and in experimental work for rapid interchangeable connections. These adapters will still further extend the scope of their possibilities.

"Energo" L.F. Transformer

Samples of their 5:1 ratio low-frequency intervalve transformers have been submitted for test by Messrs. Energo Products. These are of the small, open type, with a horizontal coil and a rectangular iron core of dimensions rather above the average in small instruments of moderate price, though we note that four bolts pass through the laminations. Four small terminals, plainly marked and fairly accessible, are mounted on fibre insulating strips at the ends of the instrument.

On practical trial, following an R valve and preceding a small power valve with ample H.T. and grid bias, in comparison with standard large types, the amplification was not conspicuously great, although distortion in the direction of the "tinny" tone usually associated with small instruments was minimal. The resistances of the primary and secondary windings implied a resistance ratio (not necessarily identical with turns ratio) of around 3:1, and that a fair amount of wire had been used. The insulation resistance between windings and from windings to the frame (the latter of the order of 20 megohms only), although adequate for immediate ordinary service, might be improved. The instruments are attractively finished; the two samples submitted showed very similar performance.

Fellows' Variable Condenser

A peculiar type of variable condenser, with but two plates and with mica-and-air dielectric, is that submitted by Messrs. Fellows Magneto Co., Ltd. This has the usual one-hole-fixing device, is contained in an oval leatherette-covered box measuring 5 in. by 3 in. by 1¾ in., fitted with two terminals in insulating bushes at the bottom, of good size and very accessible. The knob and 180-degree bevel scale are arranged at the top and outside the panel in the customary way. The mechanism within involves a fixed plate of stretched copper foil, covered with a thin sheet of mica; on to this is depressed by a cam on the end of the spindle carrying the knob and scale a curved metal plate, which at full capacity engages with the whole of the flexible foil surface. By suitable shaping of the cam and curved metal plate the makers have succeeded in obtaining a very uniform capacity scale, as was shown on actual calibration of the instrument. The capacity increased in a practically linear manner from about .00006 μF at 30 degrees to .00065 μF at 180 degrees on the scale, whilst the first portion of the scale showed a curved characteristic down to a minimum of about 25 μμF. It is therefore fully equivalent to a .0006 μF maximum multi-plate variable air-condenser, and gives as precise and uniform a scale for tuning. There was no noticeable increase in reaction demand when used in a secondary circuit. The instrument appeared to be well made and neatly finished.

Information Department

SUPPLIED BY RADIO PRESS SERVICE DEPT., LTD.

O. D. (BRISTOL) has a 3-valve Dual receiver, details of which were given in "Modern Wireless" for April, 1924. He says he obtains excellent results from the local station, that is Cardiff, and also from Chelmsford, but that since the laying of alternating current mains past the house he has been considerably troubled by a humming noise, which he finds is decreased slightly by using constant aerial tuning but is still sufficiently prominent to mar perfect reception. He states that he has, on the advice of a friend, tried the effect of using a counterpoise earth but the interference still persists. He wishes to know whether there is any way out of the trouble.

Reflex receivers in particular are somewhat prone to pick up currents by induction from lighting and power mains, and this would appear to be the case with our correspondent's set. Since the use of constant aerial tuning does not sufficiently reduce the interference, nor does the use of a counterpoise, we would suggest that the effect of using an aperiodic aerial arrangement be tried, since the use of a coupled circuit is often the means of getting rid of this type of interference, and by using an aperiodic arrangement our correspondent can readily approximate to a coupled circuit whilst at the same time retaining the same simplicity of control as previously. A 3-valve Dual receiver should be arranged for parallel tuning, but instead of taking the aerial to either of the aerial terminals a lead should be taken from it and then wound ten to fifteen times round the outside of the aerial coil and finally taken to the earth terminal, which should be connected to earth. If 18- or 20-gauge double cotton-covered wire is used a sufficiently rigid coil can be made to tie readily up to the side of the ordinary aerial coil. If plain parallel tuning was previously used, a one size larger coil should be substituted, but if constant aerial tuning was used the aerial coil will not need changing.

With such an arrangement our correspondent will have what is practically a coupled circuit, but with only the same controls as previously and the fact that there are only a few turns in the aerial coil

will act as a practical short circuit to the interference from the mains, whilst the signals desired will be received in the normal manner by tuning on the original aerial condenser.

For Chelmsford it is impossible to give a definite number of turns for the aperiodic coil since a compromise will have to be struck between the coil which gives the maximum signal strength from 5 XX and that which gives the least interference, 50 or 60 turns of No. 24 d.c.c. being suggested.

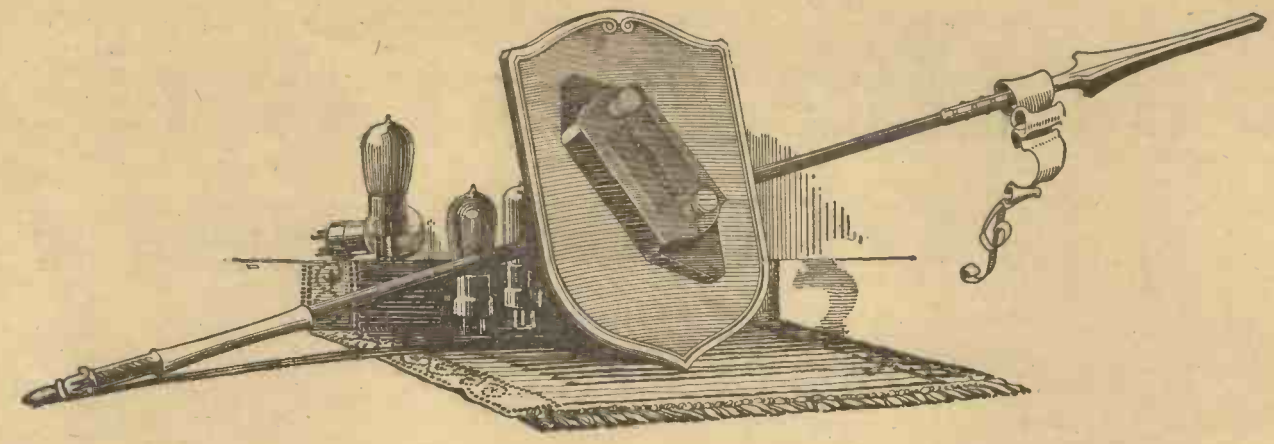
J. D. B. (CAPETOWN) asks what is meant by the Amplification Factor M of a valve, and how this may be obtained from the normal characteristic curves given by the makers.

The amplification or magnification constant of a valve is the ratio between the change in the potential of the plate to the corresponding change in the potential of the grid which is necessary to maintain the plate current at a constant value. Put perhaps more simply, the amplification constant is the ratio of the two voltages which must be applied to the plate and to the grid respectively, in order to obtain the same value of anode current. The required amplification factor may readily be obtained from characteristic curves such as supplied by the makers and dealing with a practical case of a small power valve of which we have the maker's curves before us the procedure is a very simple matter. The makers show a number of curves, in this particular case for values of high tension of 40, 60, 80, 100 and 120 volts. We will consider the two curves for 100 and 120 volts respectively and take the case of the plate current being kept constant at 7 milliamperes. For the 120-volt curve a grid bias of 5 volts negative is required to limit the plate current to 7 milliamperes. This value of plate current is obtained in the case of the 100-volt curve when the grid is 2.2 volts negative.

From these figures the amplification constant may readily be calculated. The change in anode voltage for a constant plate current of 7 milliamperes is 120 minus 100 volts, namely 20 volts. The change in grid voltage, which has the same effect as the 20 volts change in anode voltage, will be 5 minus 2.2, namely 2.8 volts. It will thus be seen that a change in grid voltage of 2.8 volts is equivalent to a change in anode voltage of 20 volts. The ratio between these two figures is the magnification constant of the valve, in this case 20 divided by 2.8, that is, approximately 7. This figure is the M value for the valve.

H. U. (St. AUBINS JERSEY) has a pair of 4,000 ohms telephones which are defective. He states that at first signals were received quite well but that later these became erratic in nature and finally ceased altogether. He asks our advice stating that undoubtedly the trouble is located in the telephones since another pair used with his set still works quite well, no crackling noises being obtained.

From the symptoms our correspondent gives undoubtedly the trouble is located either in defective leads or in a breakdown in the windings. The first experiment to try is that of replacing the old leads by new ones and noting whether signal strength is completely restored. If signals are still absent when the fresh leads are substituted the effect of short-circuiting each earpiece individually should be tried. By this means if the winding of one earpiece has alone broken down, the other will be found to work satisfactorily, and the defective earpiece should be returned to the makers for repair.



PROTECT YOUR VALVES
with the
"DUBRESCON"

THE disconcerting flash that occurs when the filament terminals of a valve are accidentally touched across the anode and grid sockets of the valve-holder is one of the expensive kind—say 8/- or more. Every amateur probably flashes away quite a lot of money this way every year. There is also a similar effect when the H.T. leads are mistakenly connected to the L.T. terminals, and the valves switched on.

These mistakes are like all others — expensive.

Valve immunity, however, can now be purchased for SIX SHILLINGS. That is the price of the new Dubilier Dubrescon, which makes it impossible for valves to be burnt out by accidental short-circuiting or similar causes.

The Dubrescon must be inserted in series in one of the H.T. leads—quite a simple operation. The H.T. current can then never exceed the usual filament current, and your valves are secure for ever. The Dubrescon does not interfere with the passage of the H.F. currents.

It is advisable to buy one now, ready for next time. And in doing so, be sure that you

Specify Dubilier

THE DUBRESCON
Insert in series in one of the H.T. leads for protection of valves.

DUBILIER
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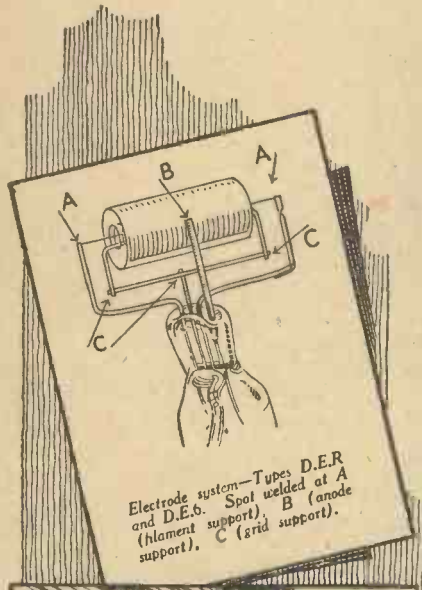
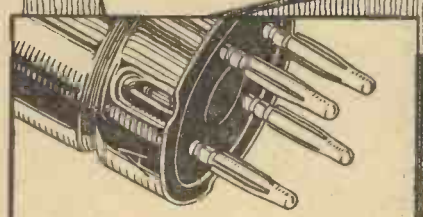
6/-

Get the *best* out of your set!

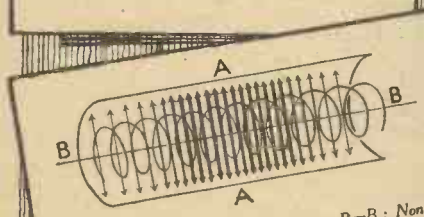
The most efficient type of electrode system for one type of valve is not necessarily suitable for other types. Certain deciding factors determine which is the correct design for the given working conditions.



Electrode system—Types D.E.R and D.E.6. Spot welded at A (filament support), B (anode support), C (grid support).



Cap of high insulation, subjected to tests before use. Leaf-spring pins to give "all-round" contact in valve holder, instead of split pins, which give only part contact.



A—A: Greatest emission in centre. B—B: Non-escape of electrons through ends, as the cool ends of the filament are non-emitting.

D.E.R.

Dull Emitter, 2-volt general purpose receiving valve. Filament volts, 1.8; filament current, .35 amp; anode volts, 30/80; amplification factor, 9; impedance, 32,000 ohms.

REDUCED PRICE, 14/-

D.E.6.

Dull emitter, 2-volt low frequency power amplifier. For use as last stage of amplifier with D.E.R. valves in the initial stages. Filament volts, 1.8; filament current, 0.48 amp; anode volts, 60/120; grid bias, 3-6; amplification factor, 5; impedance, 13,000 ohms:

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OUTSTANDING FEATURES:

ELECTRODE SYSTEM of horizontal arrangement. This makes for the minimum leverage and the least possibility of displacement.

PLATE—The maximum emission is obtained where it is most needed (*i.e.*, in the centre). The ends of the filament are cool and non-emitting; there is, therefore, no tendency of the electrons to escape.

LOW CURRENT CONSUMPTION—Emission (with operation at a dull red heat) equals that from a bright emitter consuming up to four times the filament watts.

FILAMENT IMPREGNATED THROUGHOUT—The high emission of these types is not dependent on an outer coating which may rapidly wear away. *The active material permeates the whole of the filament.*

BUY THE VALVES BACKED BY THE NAMES

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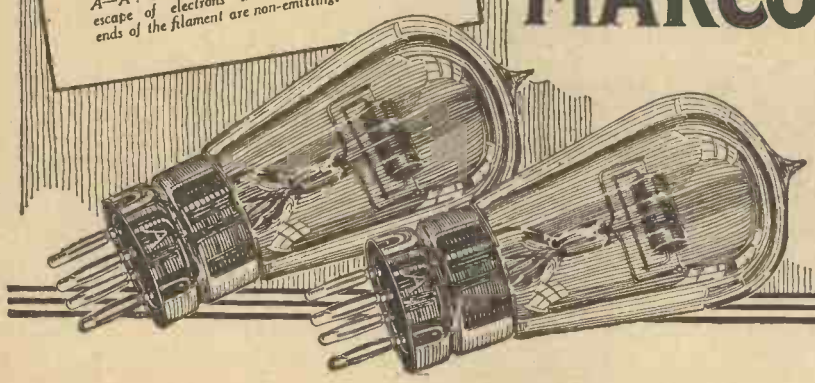
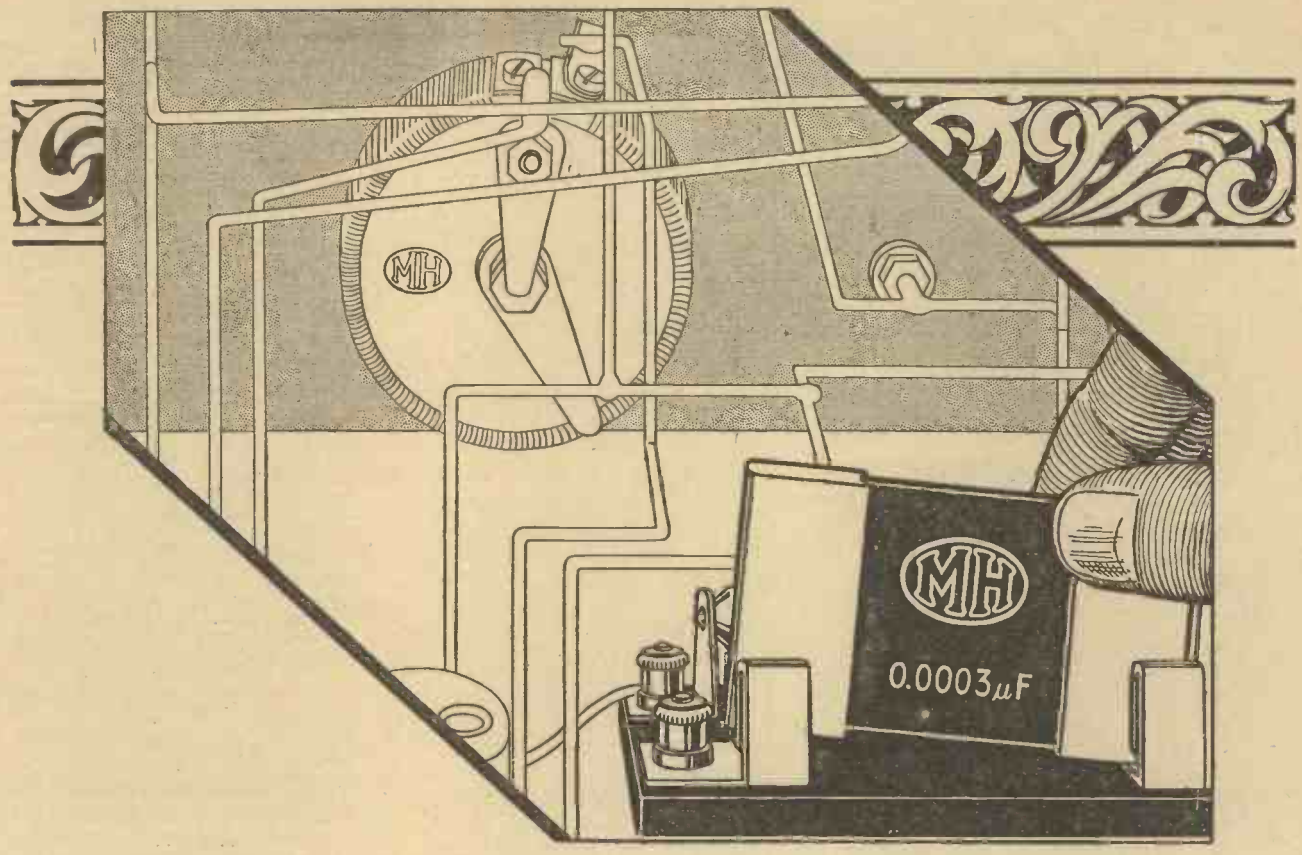


Both Valves work from your 2-volt accumulator



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0.0001 μF to 0.001 μF	1/9 each
0.002 μF to 0.01 μF	2/3 „

(Two clips are supplied with each condenser.)

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0.0001 μF to 0.001 μF	2/9 each
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Grid Leak, all values .. .. .. (040)	2/- each

(Each supplied with two clips.)

Mounted on ebonite base with terminals	3/- each

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Anode Resistance, all values .. .. (041)	2/6 each

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2 VALVE Amplifier, 35/-, use one or two valves; also 1 Valve Amplifier, 20/-, both perfect as new. 3 good Valves, 5/6 each. 3 pairs smart 20/- Headphones, as new, 8/6 each, 25/- the lot. New 4-volt Accumulator, celluloid case, 13/-. New Dura 60-volt H.T. Battery, guaranteed, 6/-. 2-Valve All-Station Set, works speaker, £4. Approval willingly.—W. TAYLOR, 57, Studley Road, Stockwell, London.

HEADPHONE REPAIRS. — Rewound, remagnetised, readjusted. Lowest prices quoted on receipt of telephones. Delivery three days. Est. 26 years.—Varley Magnet Co., London, S.E.18.

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WIRELESS WEEKLY.

Vol. 6. No. 12, June 24, 1925.

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A demonstration of the new Cossor Loud Speaker Valve—the W.3—will instantly recall to the mind of the listener the majestic grandeur of the church organ. Such mellowness of tone, volume and clarity marks a new era in Loud Speaker reproduction and is destined to exercise a significant influence on broadcast reception in the future.

The W. 3 for 2 volt Accumulators: Price 18/6

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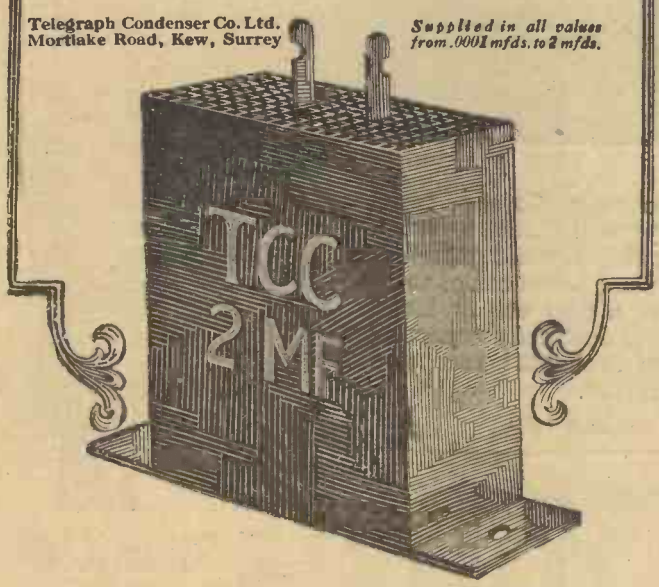
20 Years ago

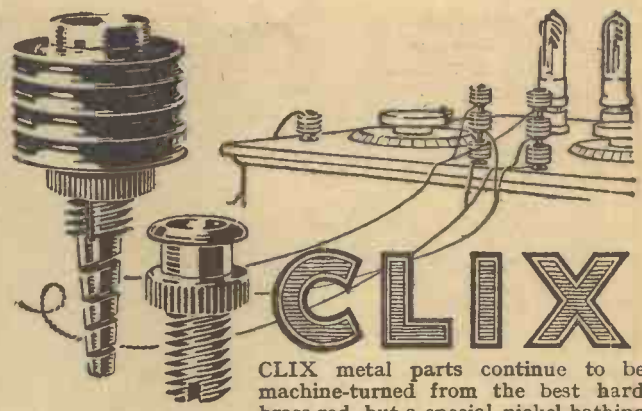
BEFORE the old "penny-farthing" ceased to be a familiar feature of the landscape, T.C.C. Condensers were being chosen by discriminating electrical equipment manufacturers. To-day still finds it favoured by Broadcast instrument manufacturer and amateur alike as the recognised Mansbridge Condenser. Throughout the whole of its long history there has never been the slightest deviation from the high standards originally set for accuracy, permanence and dependability.

Telegraph Condenser Co. Ltd.
Mortlake Road, Kew, Surrey

Supplied in all values from .0001 mfds. to 2 mfds.



Gilbert Ad. 3093



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The new skin of special nickel-silver alloy of high electrical conductivity ensures in CLIX a perfect fitting connection with a high frequency resistance of practically zero. This fact, in conjunction with the large area of contact surface provided with the minimum of capacitive metal in both plug and socket portions, gives CLIX its supremacy over every other form of plug, switch or terminal.

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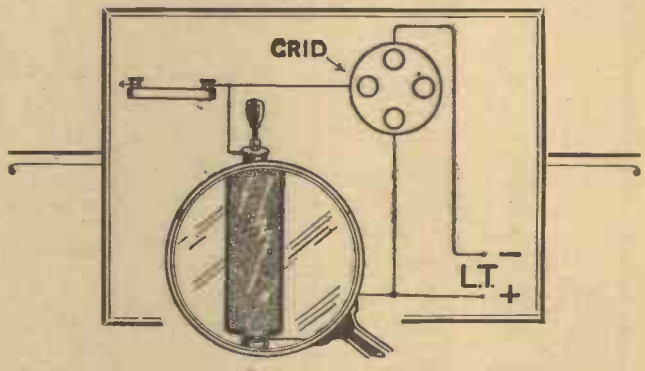

Through the Magnifying Glass

A SILENT BACKGROUND is essential if long distance reception is desired. The use of a grid leak containing carbon is bound to produce a noisy background. In a variable grid leak, especially, the resistance material used must be constant in use.

Such a variable grid leak is the

"BRETWOOD" GRID LEAK

Successfully used and recommended everywhere.

TO the inexperienced eye a variable grid leak is just that and no more. Examine one through a powerful magnifying glass however and we find out vital facts.

The carbon pellet, impregnated paper or pencil mark grid leak looks like so much coarse sand paper, and when put on test a minute arcing effect is noticed. This is so small as to be invisible except under the highest magnification. But as constant dripping wears away stone so this arcing may ultimately consume considerable portions of the leak material, rendering it inconstant in action and finally worthless. The use of such a leak produces a faint hissing noise that spoils the reception of weak signals.

By fitting a "Bretwood" variable grid leak you eliminate all such possible disadvantages. The material used is such that current flow is perfectly smooth and uninterrupted although it offers a high steady resistance.

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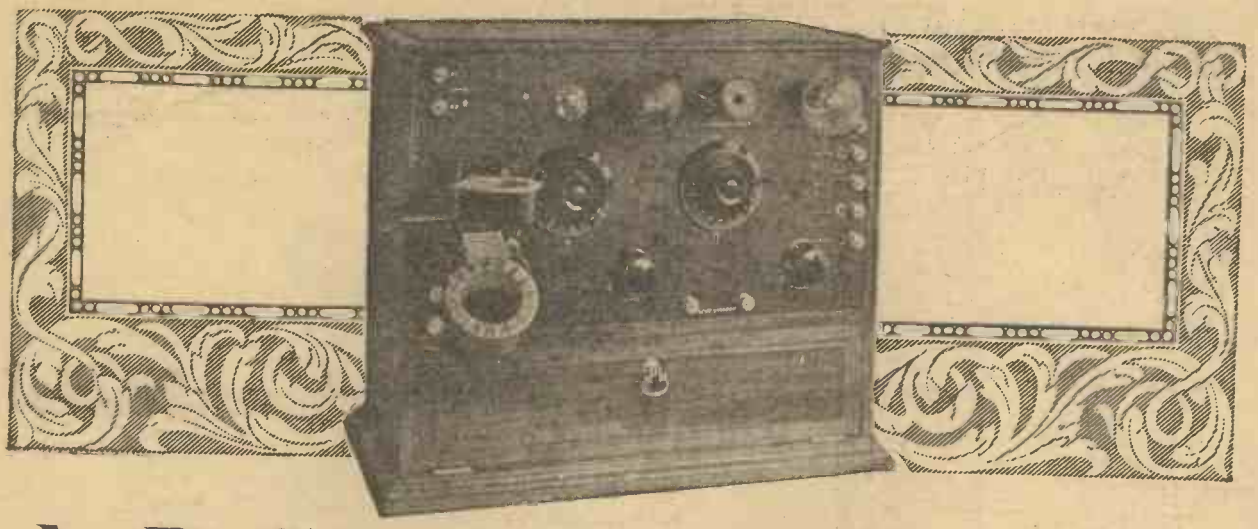

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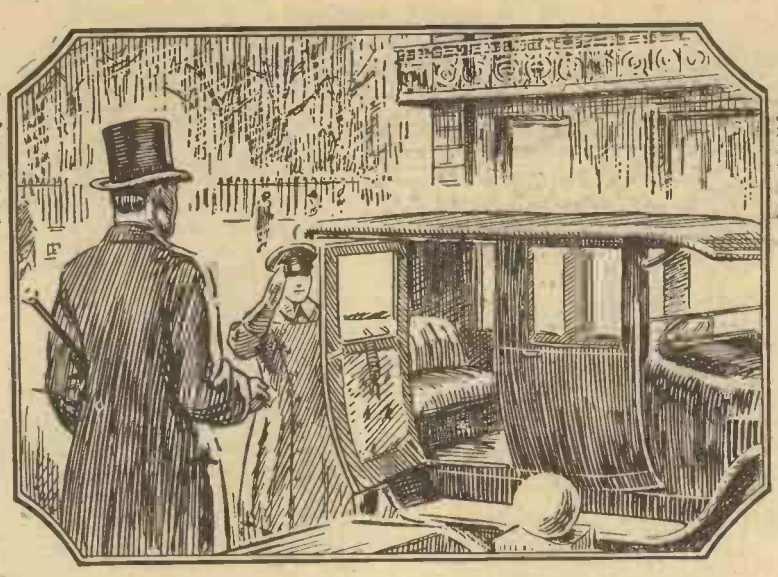

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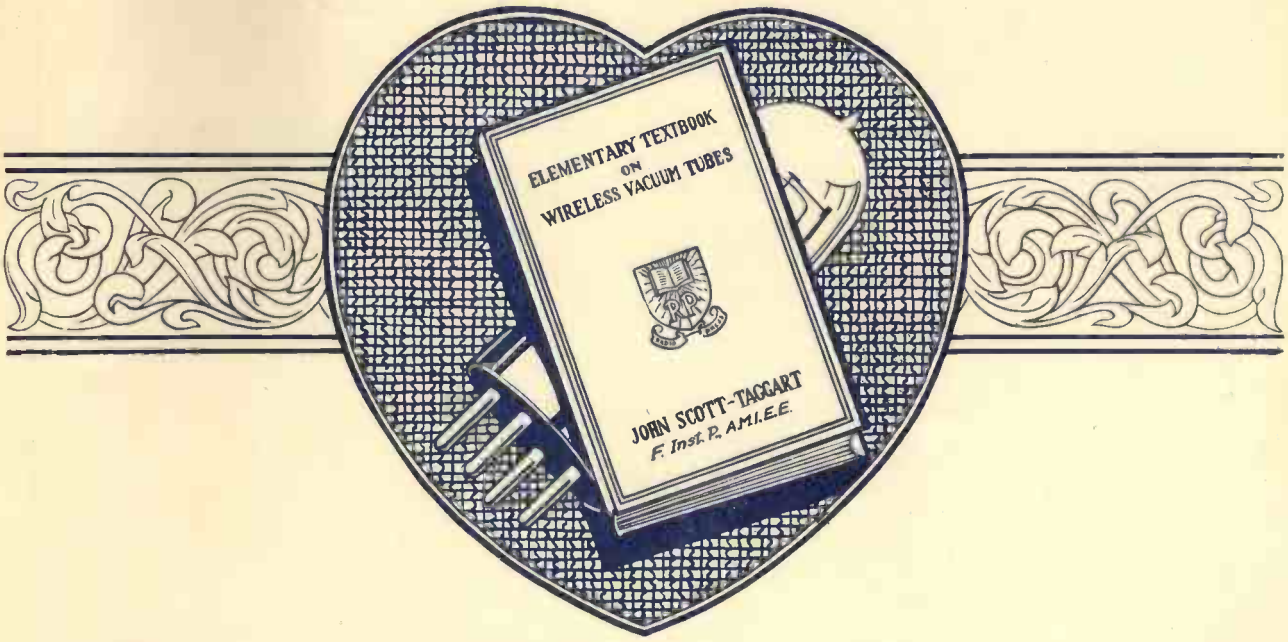

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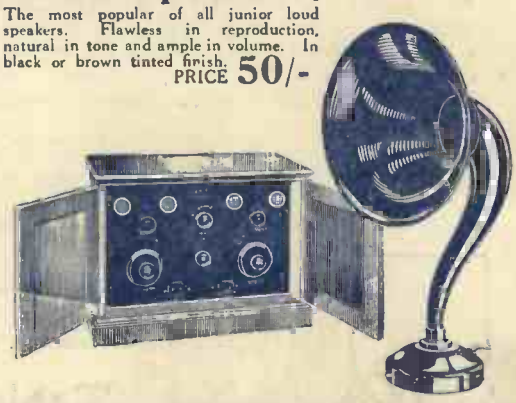

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