Vol. 1 No. 12 OCTOBER, 1935

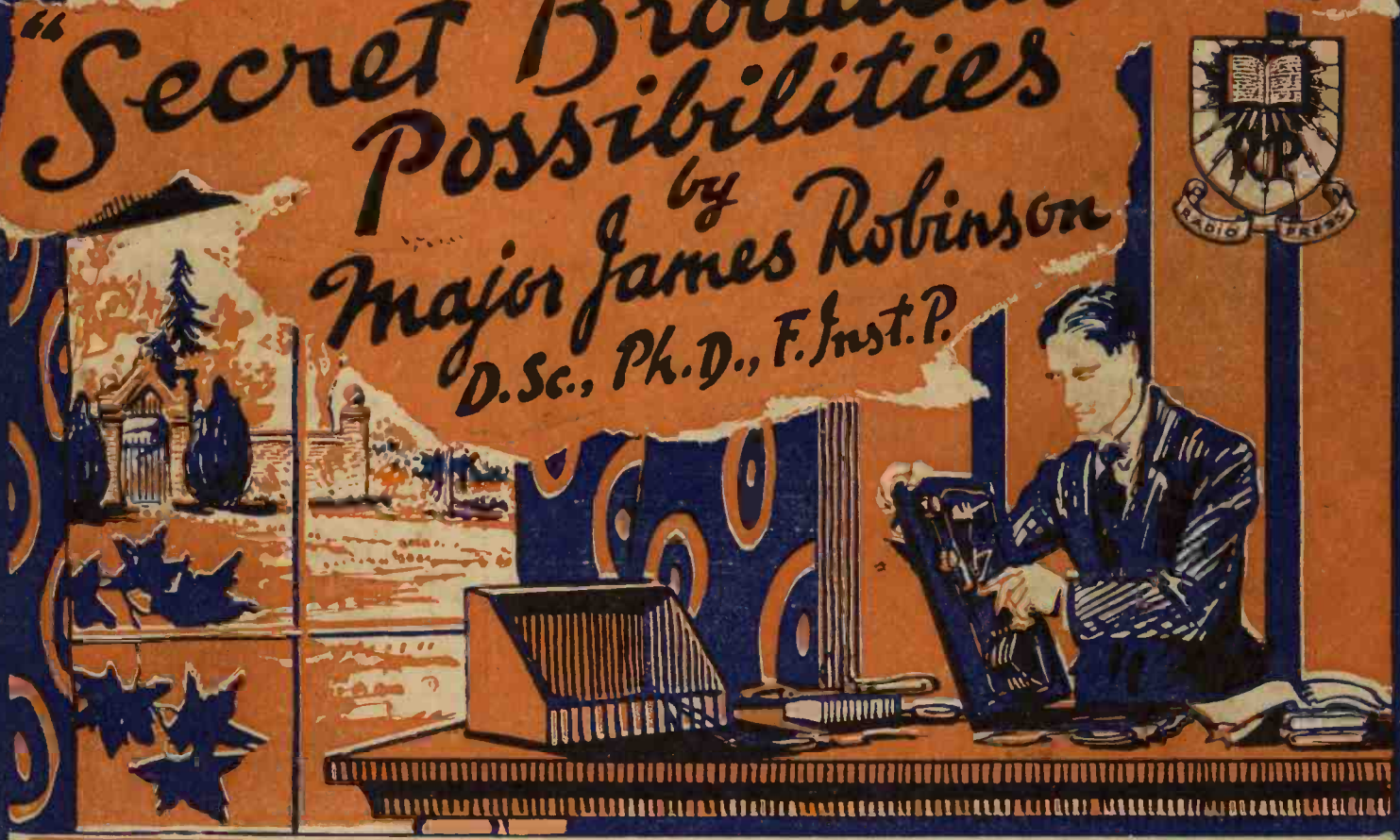
The Wireless Constructor

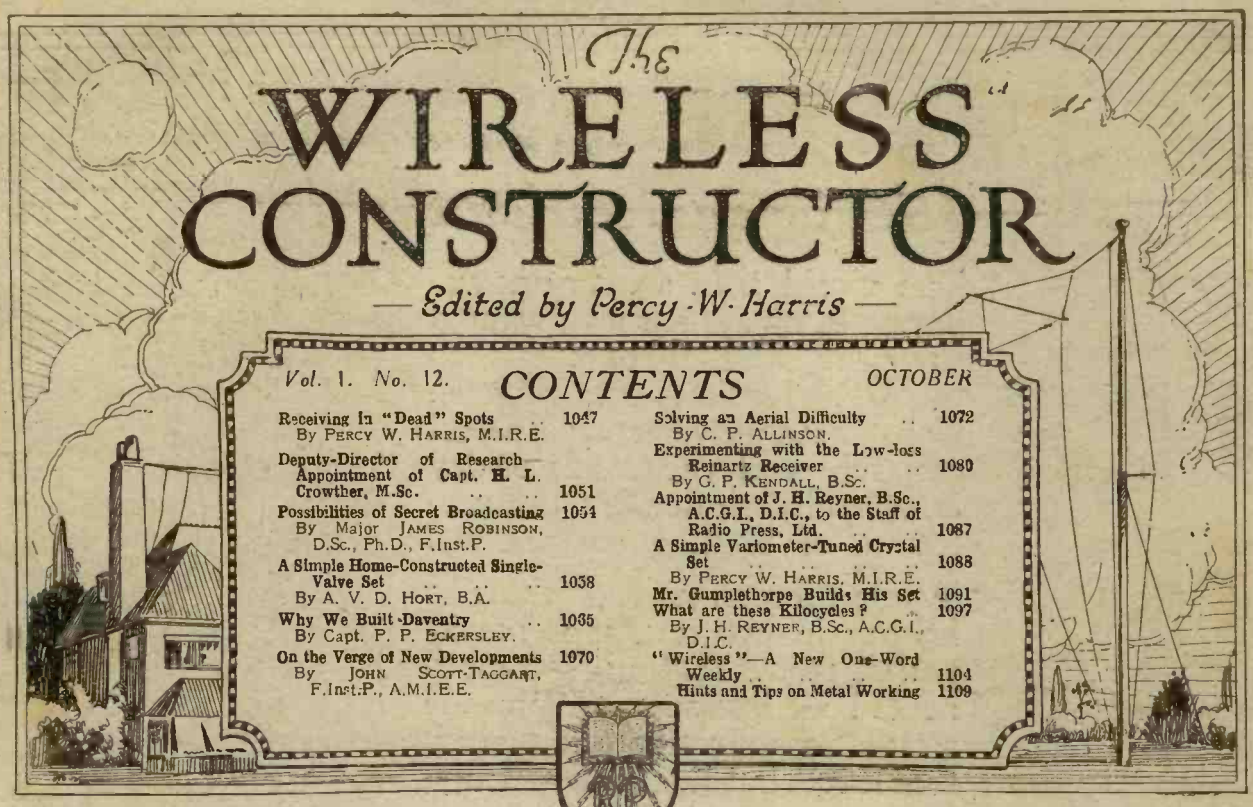
6D MONTHLY

EDITED BY
PERCY W. HARRIS

"Secret Broadcasting Possibilities"

by
Major James Robinson
D.Sc., Ph.D., F.Inst.P.





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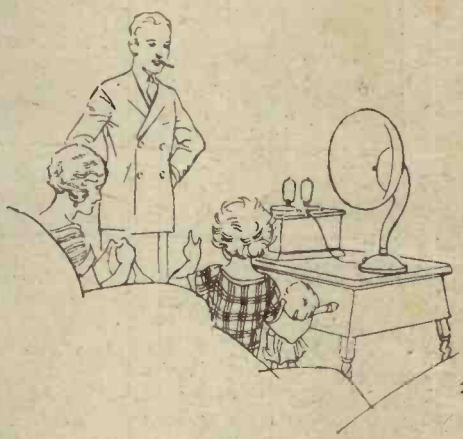

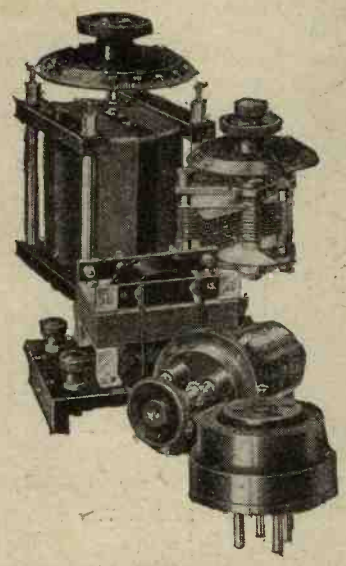

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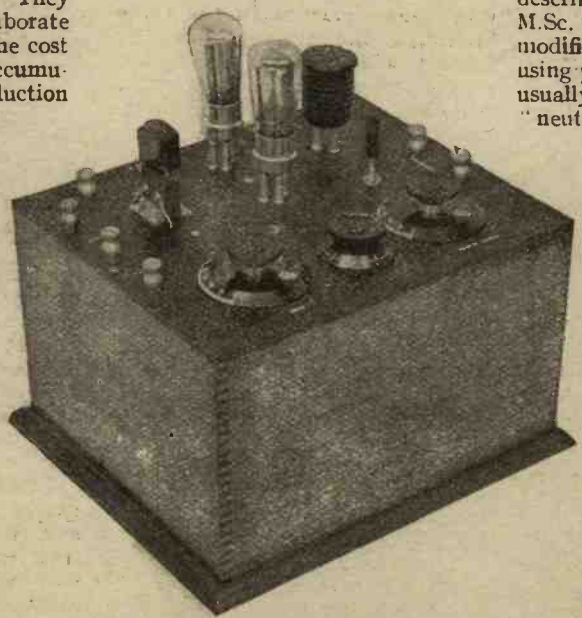
Vol. 1. OCTOBER, 1925 No. 12.

Receiving in "Dead" Spots

A LOW-LOSS TWO-VALVE NEUTRODYNE RECEIVER

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

VERY frequently I receive letters from readers who complain that the ordinary single-valve set (with or without a note-magnifying valve attached to it) will not give satisfactory results in their particular districts, which seem, from what they tell me, to be "dead" spots. They do not wish to invest in an elaborate multi-valve set, because of the cost of building, valves and accumulator charging. True, the reduction in price of dull emitter valves has considerably simplified the accumulator problem, but what is often needed is a set which will give them the results they require with the minimum number of valves. The set I am describing this month has been specially designed for use in "dead" spots, so that satisfactory telephone reproduction can be obtained from stations which are not heard at all in such cases. It will not work a loud speaker, even from the local station, but it "reaches out" in an astonishing manner, is quite reasonably selective and very simply controlled. For loud speaker work, any of the one or two valve amplifiers described in THE WIRELESS CONSTRUCTOR from time to time, can be added, although generally if you want a set to work a loud speaker, it is just as well to build one incorporating the necessary note magnifying stages.



The box is fairly deep owing to the length of the low-loss coil.

The circuit is given in Fig. 1, from which the more experienced reader will see that the set contains one high-frequency valve coupled by the tuned anode method to the detector valve, and neutrodyned to check the tendency to self-oscillation by the method first described by Mr. A. D. Cowper, M.Sc. It incorporates my own modification of the Cowper circuit using plug-in units of special design usually known in the trade as "neutrodyne units." The special feature of the receiver is the use of a low-loss coil with a semi-aperiodic coupling in the aerial circuit. This gives both selectivity and good signal strength.

Parts Required

The constructional work is very simple, all components being mounted on one 12 × 10 in. panel of suitable guaranteed material. I have used a Peto-Scott panel, but any of the guaranteed ebonite or Radion panels will do equally well. The other components required are as follows. The actual makes used are named, but other good makes can

be substituted without loss of efficiency :—

One square law variable condenser ·0005 μF (Bowyer-Lowe).

One square law variable condenser ·0003 μF (Bowyer-Lowe).

One low-loss coil former with grooved supports with sixteen threads to the inch (Collinson's Precision Screw Co.). This should be 6 in. long by 3 in. diameter, and can be obtained ready made and wound from the firm mentioned.

Nine terminals.

One dual filament resistance for bright or dull emitters (McMichael).

Three sets of valve sockets.

One neutrodyne condenser (Gambrell).

One socket for plug-in coil (Magnum).

One shorting plug for same.

One ·0003 μF condenser with clip for leak (Dorwood.)

One 2-meg. leak (Dubilier).

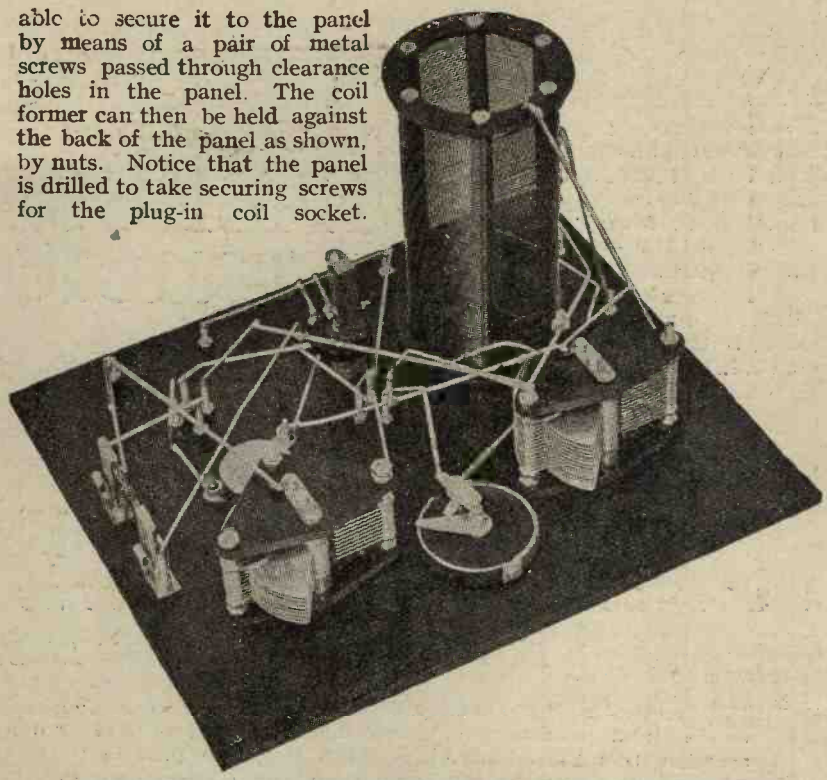
One fixed condenser with clips ·001 μF (McMichael).

Radio Press Panel Transfers.

Suitable cabinet.

Constructional Work

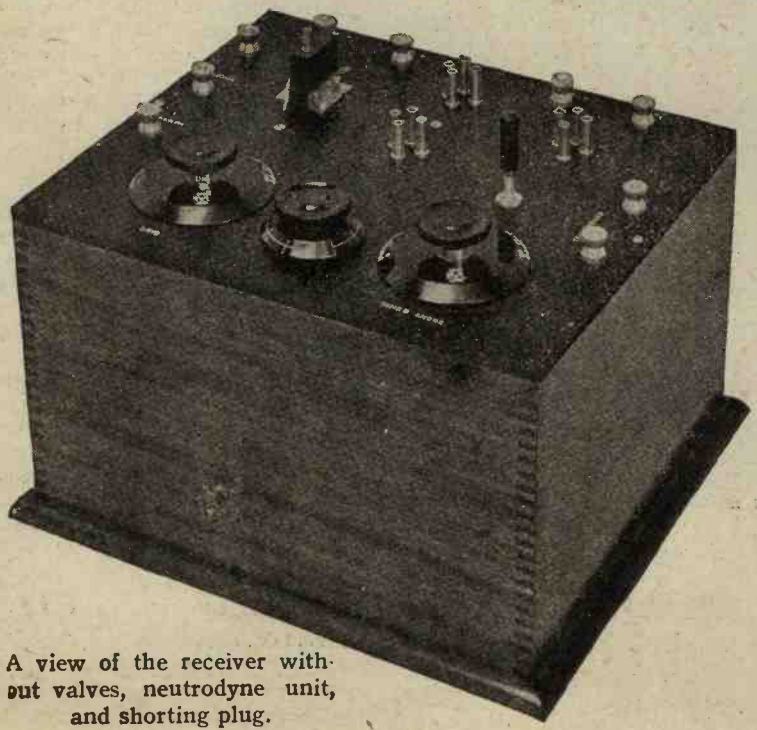
You can obtain the low-loss coil former either ready wound or unwound. In either case it should be wound with 90 turns No. 22 enamelled copper wire in the grooves. At the 18th turn from one end make a tapping (quite a simple matter if you scrape the wire free of enamel at that point), and solder on a lead to it. The coil former has two holes drilled in the end by which you will be able to secure it to the panel by means of a pair of metal screws passed through clearance holes in the panel. The coil former can then be held against the back of the panel as shown, by nuts. Notice that the panel is drilled to take securing screws for the plug-in coil socket.



A general view of the wiring, showing the connections to the coil.

This socket is necessary for adding the loading coil when it is desired to listen to 5XX. When wound as shown, with the turns indicated, the tuning range of the set will be from about 250 metres to well over 600. When it is desired to hear 5XX the short-circuiting plug is detached from the panel and a No. 100 coil plugged in. This coil then comes in series with the low-loss coil. The aerial connection is now changed and taken to the end of this coil nearest the grid. A terminal is provided for this purpose so that the change-over can be rapidly effected.

On the shorter waves, with some aerials it may be found that the minimum wavelength is too high. If this is so, take off about fifteen turns from the coil at the end nearest the panel. The wiring diagram (free blue print) shows all connections clearly, and I would particularly direct your attention to the connections to the coil itself and to the soldering lugs of the condenser and grid leak mounting.



A view of the receiver without valves, neutrodyne unit, and shorting plug.

Neutrodyne Unit

In addition to the components named you will need for the broadcast band a plug-in neutrodyne unit, which can be of any of the well-known makes. The filament resistance controls both valves simultaneously, for which reason it is necessary to have two similar valves. Two of the general purpose valves will serve excellently here, whether they are bright or dull emitters. The filament resistance itself acts as an on-and-off switch, and a particular note should be made of the best working position when it is found.

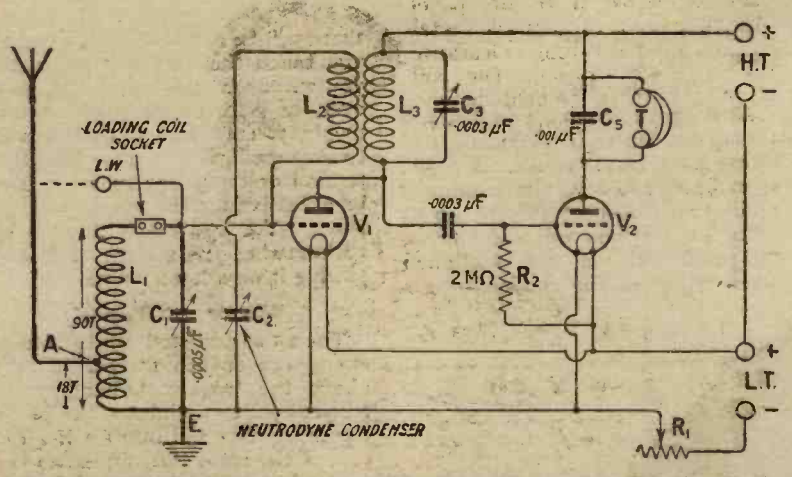


Fig. 1.—The aerial is joined to terminal L.W., and a coil is inserted in the socket, when it is desired to receive 5XX.

Testing Out

If you have no other set using batteries you will have to obtain either an accumulator or dry cells to supply the filament current. I would strongly recommend the use of an accumulator in preference to dry cells even with the dullest of dull emitters. Your dealer will recommend a suitable accumulator for the particular kind of valve you buy. A high-tension battery of, say, 60 volts with tappings will be required for the anode supply current, or, better still, use one of the many good high-tension accumulators now available.

Adjusting the Neutrodyne

If you are not used to operating a set using the Cowper neutrodyne method, you should read the following instructions carefully before attempting to listen in on this set. They are simple, but if you do not follow them, you may cause considerable annoyance to your neighbours, whereas properly carried out, the set will remain stable, and is not likely to give trouble.

First of all, conduct the tests either before or after broadcasting hours, so that your preliminary experiments do not upset your neighbours. Connect your aerial and earth, put the short-circuiting plug in position, turn your filament resistance to the off position, place two valves in their sockets and the neutrodyne unit in its socket, and connect the L.T. battery to the terminals marked. Gradually turn the filament resistance on, and see whether the brightness is increased

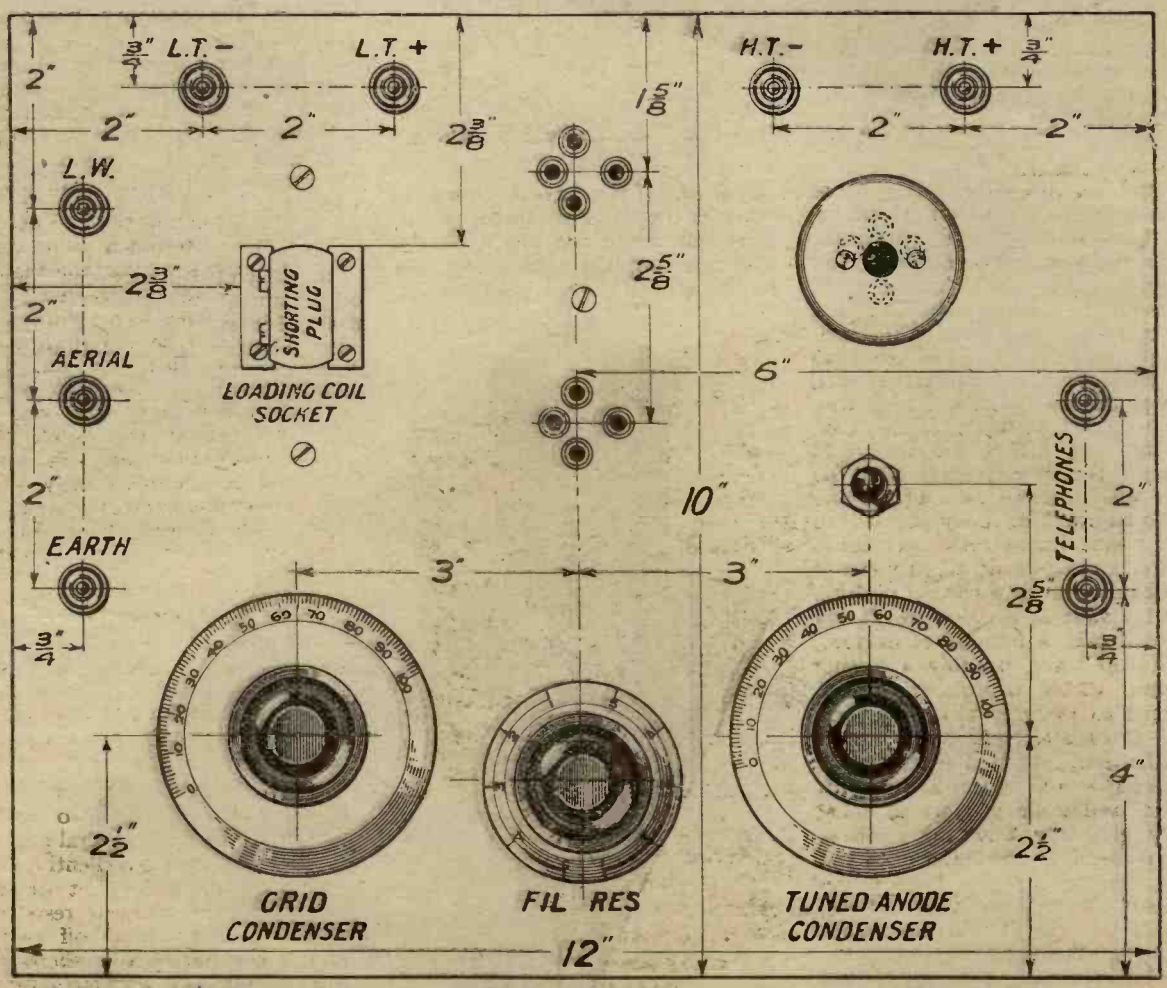
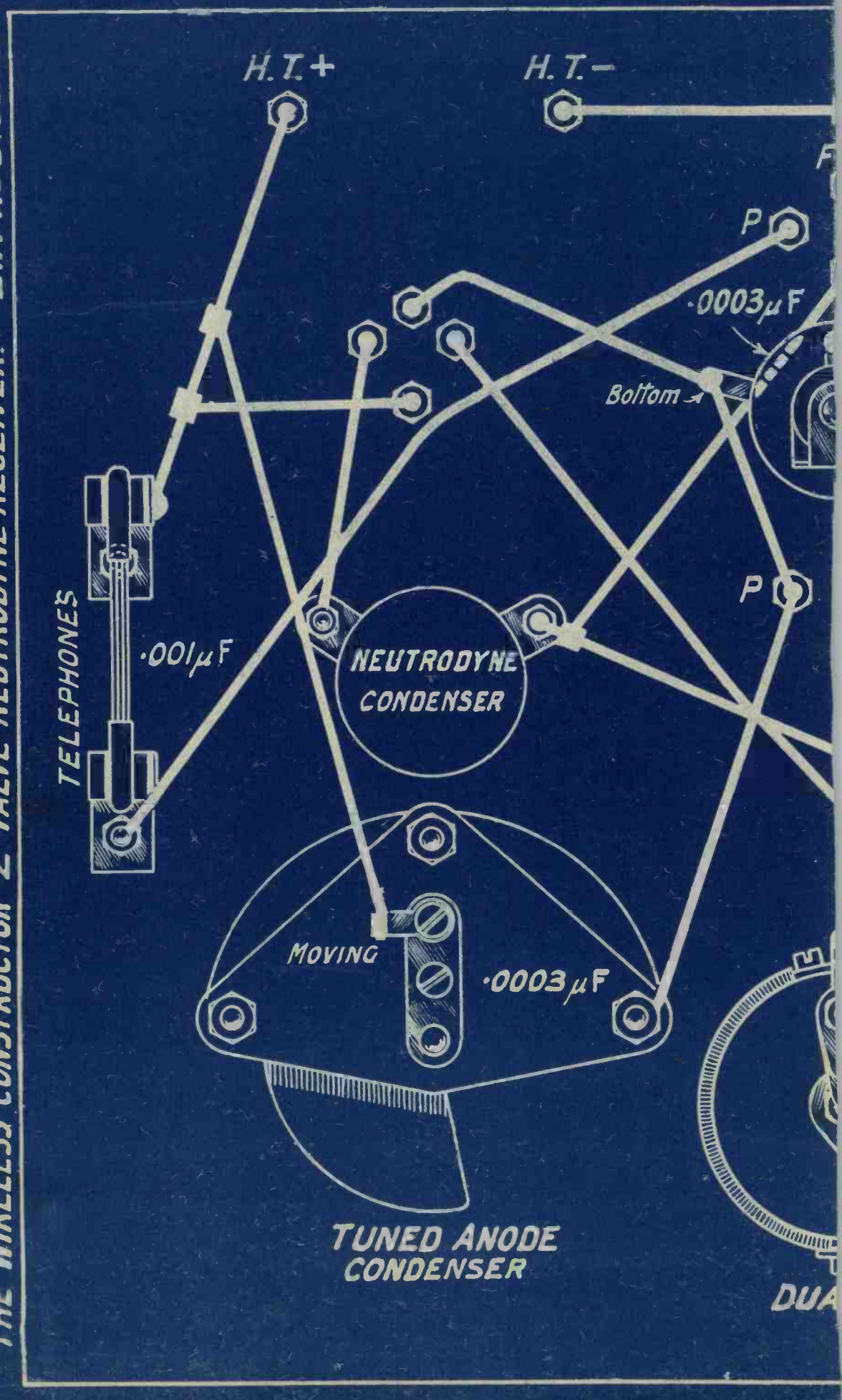


Fig. 2.—A half-size drawing of the panel layout, giving the drilling centres. Full-size Blueprint No. C.1021A may be obtained, price 1/6 post free.


THE WIRELESS CONSTRUCTOR" 2-VALVE NEUTRODYNE RECEIVER. B.P. NºC1021B
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·0003μF
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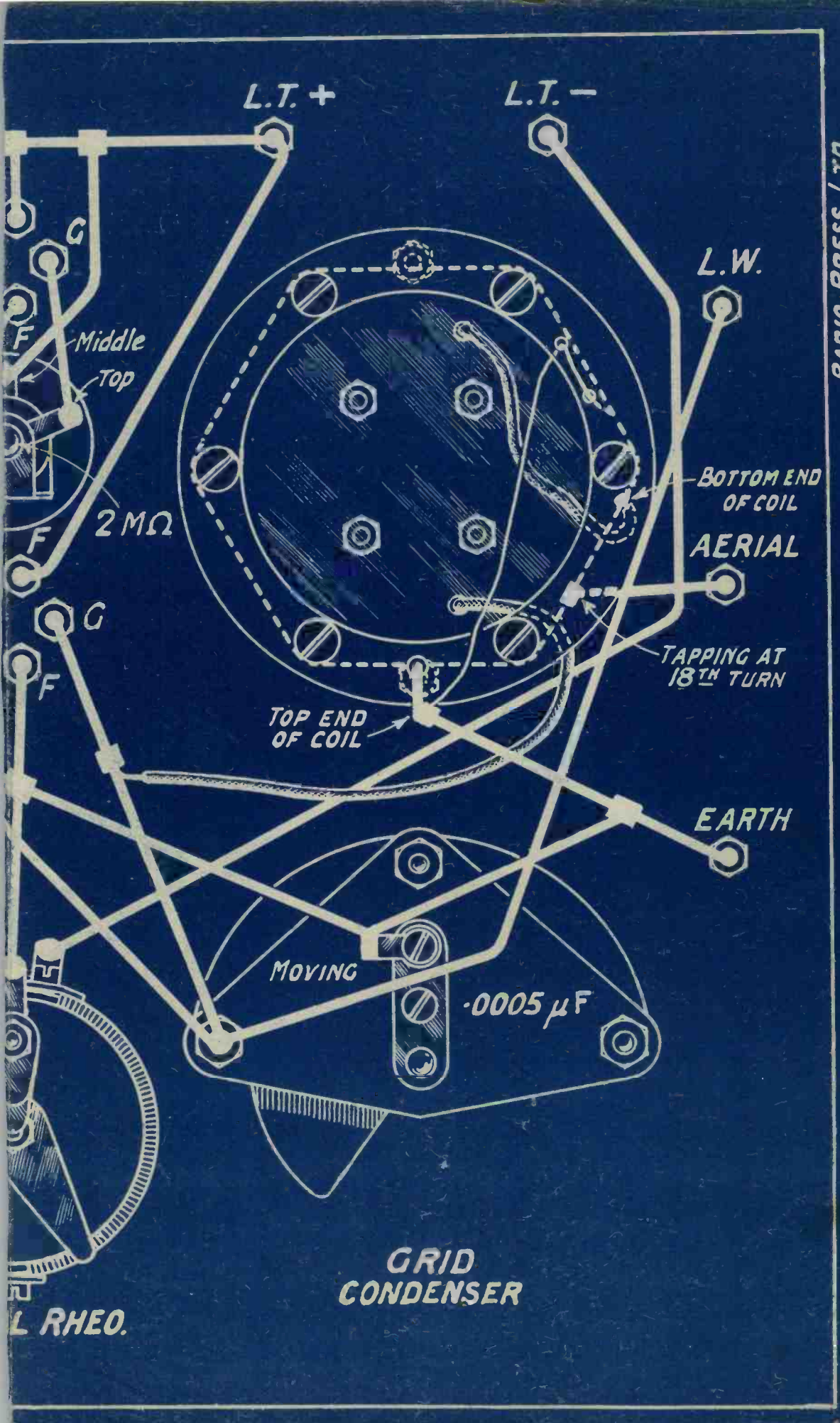

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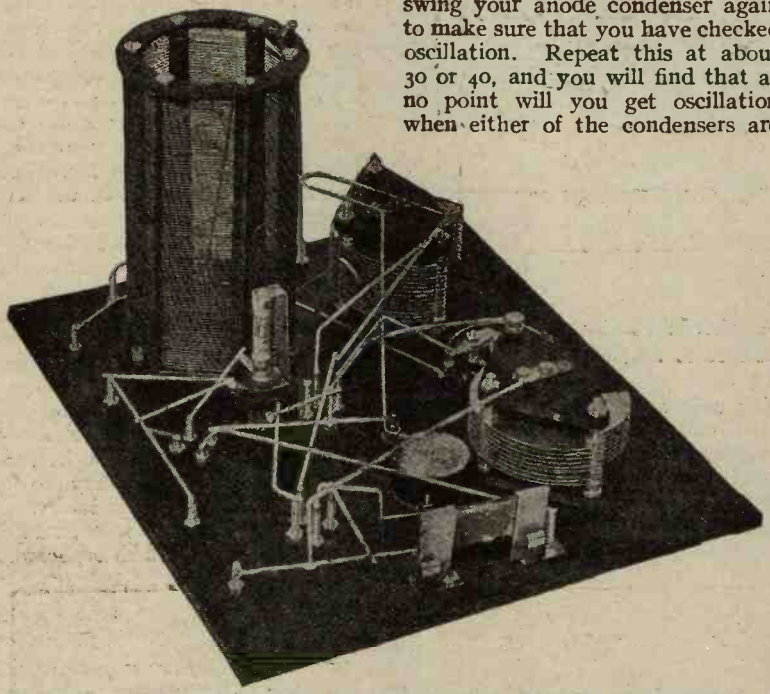
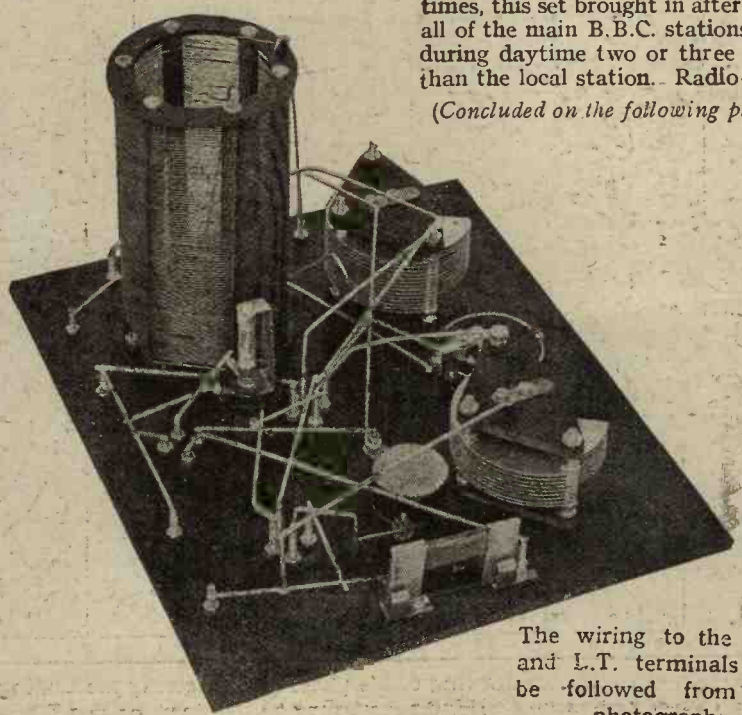
or decreased as you turn the knob one way or the other. If you are using bright emitters you will need to turn the filament resistance about three-quarters of the way round, if not a little more. If you are using dull emitters, about the first half of the first segment of the dual rheostat will be needed. Now turn the valves off, and connect up the high-tension battery and telephones. The knob of the neutrodyne condenser should be turned in an anti-clockwise direction until its plates are at the widest separation—that is to say, until the knob is full out. Now set your grid circuit tuning condenser (that on the left) to about 20, and, leaving it so adjusted for the moment, turn the anode tuning condenser backwards and forwards, when you will probably hear at a certain position on the scale (a position which will extend over a number of degrees) a "plop" and possibly a hissing sound, which, if you are accustomed to using wireless sets, you will at once recognise as a sign of oscillation. Turn the condenser backwards and forwards over this band, and while you are so doing very gradually turn the knob of the neutrodyne condenser until you find the width of the band is decreased. Continue your adjustments of the knob, meanwhile swinging the condenser until the band has narrowed so much that there is barely a degree of the condenser which will show oscillation. A further slight turn will check this completely.



Showing connections to the neutrodyne condenser and valve sockets.

Test for Oscillation

Now turn your grid circuit tuning condenser to about 10, and swing your anode condenser again to make sure that you have checked oscillation. Repeat this at about 30 or 40, and you will find that at no point will you get oscillation when either of the condensers are adjusted. If you have doubts as to whether the set is oscillating or not, wet your finger and tap it on the uppermost of the three terminals on the left. If the set is oscillating, there will be a loud click both when you touch this terminal and when you withdraw your finger. If, however, in spite of all these adjustments, you still find yourself unable to stop oscillation, reduce the high-tension voltage slightly, as it may be excessive for the valves you are using. You can easily do this by withdrawing the wander plug and placing it on a lower value.



The wiring to the H.T. and L.T. terminals may be followed from this photograph.

Wavelength Range

The set so adjusted will tune from about 250 or 260 metres to well above the broadcast band. To receive 5XX withdraw the short circuiting plug and insert a No. 100 coil, at the same time replacing the neutrodyne unit with a similar unit of the 5XX wave-band. You will probably find it necessary to re-neutralise the set for 5XX, which is done in a moment, by turning the knob slightly one way or the other. Notice, too, that for the reception of 5XX the aerial must be connected to the uppermost of the three terminals on the left, and not to the middle terminal, as is the case for the ordinary broadcast wavelengths.

When you are experienced, you can use the neutrodyne condenser as a delicate reaction control, although I do not advise you to do this until you are accustomed to using the set in its fully stabilised condition.

Results

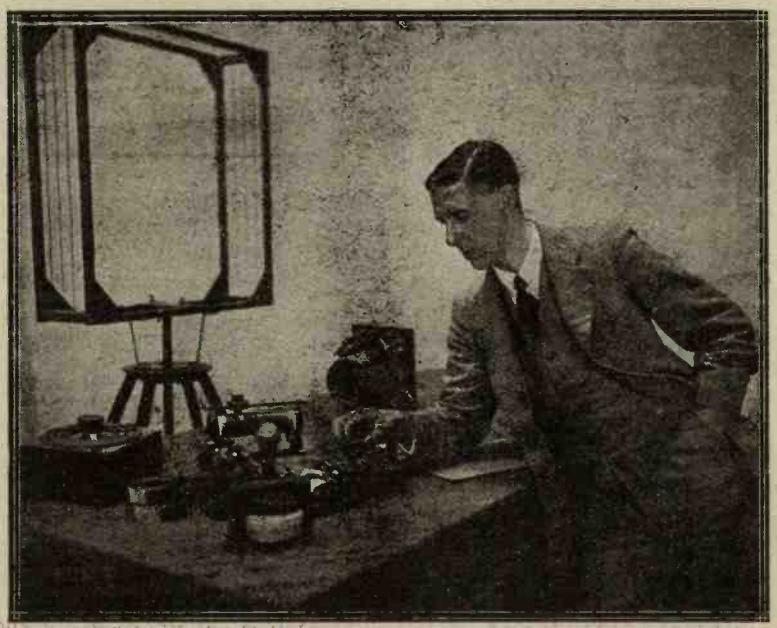
In difficult summer conditions, on a number of tests at different times, this set brought in after dark, all of the main B.B.C. stations, and during daytime two or three other than the local station. Radio-Paris

(*Concluded on the following page.*)

Deputy Director of Research to Radio Press, Ltd.

APPOINTMENT OF CAPTAIN H. L. CROWTHER, M.Sc.

READERS of THE WIRELESS CONSTRUCTOR will have seen, no doubt, our advertisement regarding the vacancy for a Deputy Director of Research for the new Radio Press Laboratories at Elstree, this post carrying a minimum salary of £1,700 per annum. The appointment has just been filled, the successful applicant being Captain H. L. Crowther, M.Sc., who, curiously enough, has just been appointed to the same position as that held by Dr. Robinson (our Director of Research) under the Air Ministry.



Capt. H. L. Crowther, M.Sc., the newly-appointed Deputy Director of Research.

Captain Crowther is at present in charge of the Wireless Research and Design Laboratories of the Royal Air Force, and it is a coincidence that the two successive holders of this position should have been appointed to the Elstree Laboratories. Dr. Robinson is now with us, of course, and Captain Crowther will join the Company about September 15.

Captain Crowther was born in 1891, and studied at the University of Birmingham when Sir Oliver Lodge was Principal. His special subjects were physics, mathematics, engineering and chemistry, and in 1912 he received the B.Sc., with Honours, and later obtained the degree M.Sc. for research work. Before the War he held an important scholarship for research work, while from as far back as 1911 he was a prominent amateur wireless experimenter, his transmitting and receiving station being probably one of the best known in the country. In 1914 he joined a Special Wireless Corps, and at the beginning of 1915 received a commission in the Royal Naval Air Service. He was later transferred to the wireless experimental staff at Eastchurch for the development of wireless in aircraft. For the last eleven years Captain Crowther has been engaged entirely on radio research and design work for the Royal Air Force, and has now risen to the highest position available to him.

Captain Crowther is an expert on valves, and is a member of the Valve Committee of the Radio Research Board. He has also served on the Wireless Board. A number of his inventions were extensively used during the War, and many, of course, are still in use. For these he has received awards from the Air Inventions Board.

The appointment of Captain Crowther will give a further indication of the great importance we attach to the new laboratories which will serve the Radio Press journals.

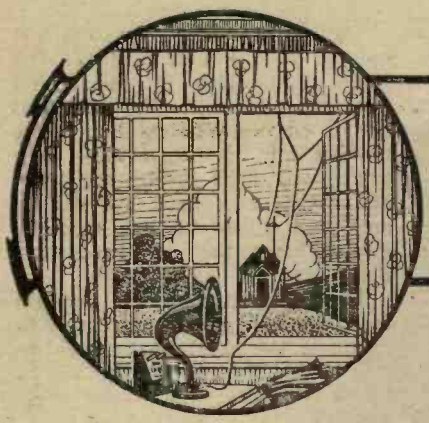
Receiving in "Dead" Spots

(Concluded from the previous page)

and a German station were also heard in daylight and, of course, after dark numerous Continental stations came in at excellent telephone strength. The use of fairly loosely coupled semi-aperiodic aerial coupling cuts down a good deal of the interference which frequently comes from atmospherics and from spark jamming in those cases where the listener is situated close to the sea shore. For those who require still simpler sets to construct, the low-loss coil can be omitted entirely, and the socket for the loading coil used for a plug-in coil of the shorter wavelength band. This will also give good results, but you will not get the selectivity obtainable with the arrangement indicated.

ERRATUM

Owing to a printer's error, the price given in the advertisement of Messrs. Gambrell Bros., Ltd., in our last issue was incorrect, and should have been as shown in their advertisement on page 1068.



What Two Readers Think of the "Twin-Valve" Receiver

Originally described in the January issue of this magazine, complete details of this receiver are now available in Radio Press Envelope No. 10

SIR,—Having made up the Twin-Valve Set as described by Mr. John Scott-Taggart in the January issue of THE WIRELESS CONSTRUCTOR, I wish to congratulate him on evolving such a fine circuit, as the results obtainable are remarkable. I have followed the design to the letter, the only alteration being an R.I. transformer in place of the Success, the primary and secondary connections for which I find the same. Results obtained may interest you. The set was completed just a few minutes before 2LO closed down, and the volume obtainable from this station was tremendous. Using an Ultra loud-speaker, music could be heard all over the house. Madrid was the next station received, and was comfortably audible in a large room on the loud-speaker.

The next day I received Belfast, this being the only B.B.C. station working in the afternoon, also 5NO.

The next morning at 1.30 a.m. I tuned in WGY, which station was received at about R6 on phones and audible 6 ft. from the loud-speaker. Subsequently I received KDKA on 326 metres. One other station, 5AF, on 425 metres, has been heard, but so far I have not been able to identify where this transmission came from, although the announcer spoke English.

Thanking you once again for this valuable circuit, by far the best of many I have tried.—Yours faithfully,

J. H. ROSS.

Isleworth, Middlesex.

* * *

SIR,—I think you may be interested to hear the results obtained with the "Twin-Valve Reflex Receiver," described in the January number of THE WIRELESS CONSTRUCTOR by Mr. John Scott-Taggart. It is a remarkably sensitive set, and receives 5XX without aerial or earth. In this case the aerial was connected to earth outside the house, about 10 ft. away from the set. The reception was at moderate phone strength using a 200 coil in the aerial and a 150 for reaction, reversed.

On an indoor aerial consisting of 20 ft. of twin flex running along a passage, 5XX comes in at comfortable loud-speaker strength, and London, Radio-Paris and Newcastle quite loud on the phones.

With an outdoor aerial 100 ft. long and about 26 ft. average height, the following stations are obtained with great regularity:—5XX, too loud on the loud-speaker (a Brown H2) to be comfortable, and easily heard all over the house (I usually detune to a moderate strength); London, Newcastle, Bournemouth, Radio-Paris and Petit Parisien are received at good loud-speaker strength.

All other main stations and relays come in easily on the phones, and, of course, dozens of Continental ones. I am also agreeably surprised to find that the set is almost as easy to handle on the shorter waves as on the long ones. I have had a great number of amateurs on wavelengths varying from 125 to 300 metres. I am delighted with the receiver and feel that it is only right to let you know how satisfied I am.

Wishing your excellent publications every success.—Yours faithfully,

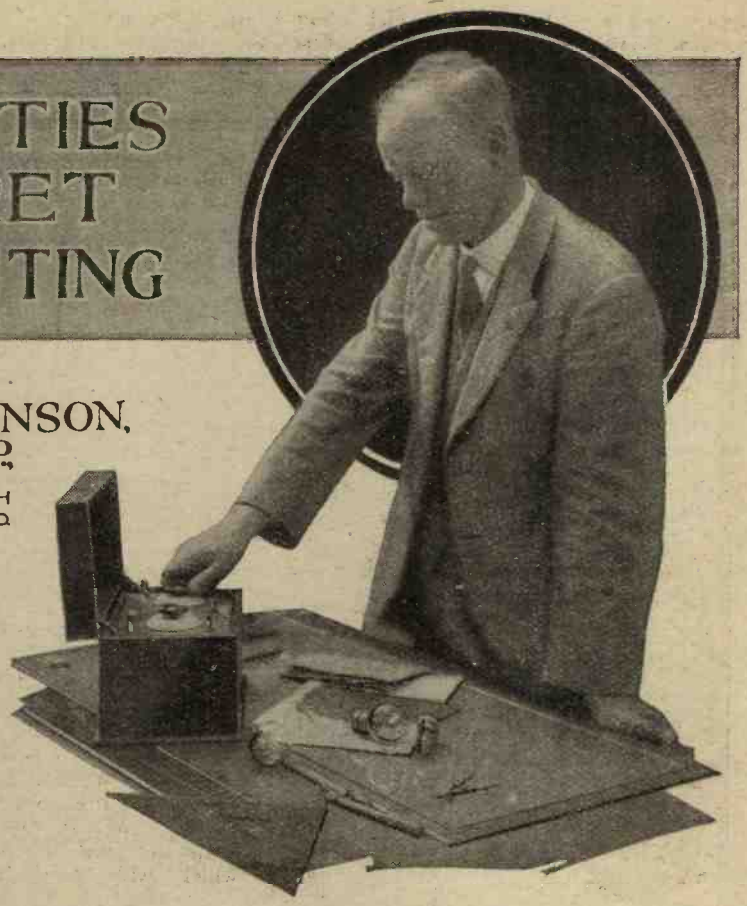
HAROLD C. LEE.

Herne Bay.

Much to the relief of the insurance companies, with whom he was insured for £100,000 (and also a separate insurance for another £10,000) during his recent visit to America, Mr. Percy W. Harris has now returned to his editorial chair at Bush House. He has, since his return, been engaged in preparing a remarkable series of articles for the new weekly paper "Wireless" which he is editing and the first number of which is published to-day (September 15).

What do *you* think about it?

POSSIBILITIES OF SECRET BROADCASTING



By
MAJOR JAMES ROBINSON,
D.Sc., Ph.D., F.Inst.P.
DIRECTOR OF RESEARCH TO RADIO PRESS LTD.

A COMPANY has recently been formed for the purpose of Secret Broadcasting. The aims of this company are to have a system of transmitting wireless programmes which can only be received by people who are in possession of apparatus and information which will enable them to receive such programmes, and thus to found a healthy commercial undertaking. The present methods of broadcasting make reception of the programmes open to all. The object of secret broadcasting is to place a lock on the programmes which can only be opened by a special key which will have to be bought. This raises the very interesting problem of national policy as to whether it is in the best interests of the community to depart from the present system of monopoly. The discussion of this problem will be very long drawn out, and will be entered into by both technical and non-technical people. It is intended, to give some idea as to whether it is technically possible to have a system of secret broadcasting.

A Limiting Factor

A large number of patents have been granted for systems of secret broadcasting; and some of them are very ingenious. The object is to make it exceptionally difficult for anyone who is not in possession of knowledge of the methods used to construct or adjust apparatus to receive the programmes. It can safely be said that any system proposed up to the present could be disentangled by the most highly skilled engineers, but by making a system sufficiently complicated and difficult, very few would trouble to attempt to solve the various secret devices. Again, if a system were of such complication that it required very highly skilled engineers to discover it, the effect on the commercial side of a secret broadcasting company would be negligible. It should be remembered, however, that what is complicated to-day may become commonplace and simple to-morrow.

"Wired Wireless"

There are proposals to transmit programmes along electric power lines, and it is very possible that broadcasting may develop in this way, though not to the complete detriment of the present form of wireless broadcasting. Such proposals, however, do not assist towards secret broadcasting, for unless special complications are introduced into the transmission system, it will be just as easy for anyone to receive these programmes as with the present wireless methods provided the electric power supply is installed in one's house. Again, if some uncommon form of radiation is used, such as for instance very short wireless waves of, say, one-tenth of a metre wavelength, secret broadcasting would not be effected.

Necessary Conditions

Some special complications in the transmission system, and thus in the receiving system, are required either with wireless, or with the electric power lines, or else special electric lines must be installed merely for broadcasting purposes. Restricting ourselves to wireless and to the allied problem of transmission along existing electric power lines by systems usually called wired wireless, there is no doubt as to the technical possibility of introducing sufficient complications into the transmitting and receiving apparatus as to make broadcasting secret except to the most highly skilled engineers. It is obvious that it will be much more difficult to maintain the receiving apparatus in good working order with these added complications.

Methods Available

The methods which have been proposed fall generally into the following groups :—

1. Methods which use more than one wavelength for transmission, or which vary the wavelength irregularly.

2. Methods which introduce other noises into the transmission

which can be removed by special devices at the receiving end.

3. Methods which completely change the form of sounds during the transmission so as to be unintelligible with ordinary receiving apparatus. This is done by transmitting a note of frequency 1,000 as a note of some other frequency.

4. Combinations of some or all of the other three methods.

It is impossible here to describe every method which has been proposed, but a number of examples will be given.

Changing Wavelength Method

A number of methods for secret broadcasting have been proposed where the wavelength is changed at the transmitting station and at the receiving stations in the same way and at the same time. This

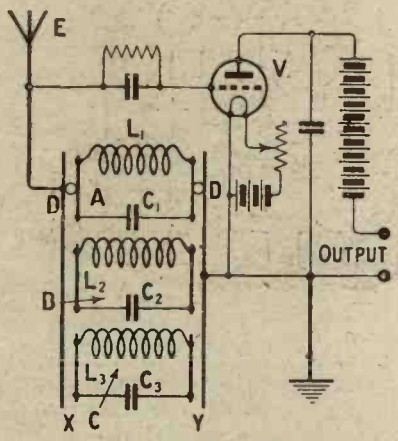


Fig. 1.—Illustrating the principle of the Anstey system.

involves the difficult feat of synchronism, but although difficult it is quite possible of achievement. Some of the methods involve a number of fixed wavelengths to which the transmitter and receivers are tuned, and a switch at each station to change the wavelengths at the same instant, the duration of transmission on each wavelength and the order of occurrence of the wavelengths being known only to the people who have paid for the information. Other methods involve a continuous variation of wavelength, the changes at the transmitter and all the receivers being effected at the same rate and in the same way. In these methods the rate of change of wavelength can be made regular or irregular by the use of cam devices or by the use of variable condensers which are made to rotate at a uniform rate, but the plates of which are cut in some irregular manner.

A method of changing the wavelength in steps will be briefly described. This is the invention of R. W. Anstey, and is interesting in addition as it brings in the features of the second group, transmitting objectionable noises on one of the wavelengths not in use. The object of this is that it is easy for anyone to discover the wavelengths in use, but not so easy to find out the order in which they are used. Thus any eavesdropper may obtain a small part of the programmes, but for most of the time he will not be able to avoid these noises.

Two Transmissions

Two transmitters are required for this system, both capable of transmitting on three wavelengths the same for each. One transmitter is used for sending out the programmes, and the other for sending out noises, the two always working on different wavelengths. Suppose the wavelengths are 380, 400 and 420 metres respectively, the order in which these are used is different for the two, thus, when the programme is on 380 the noise may be on 420, when the programme is on 400 the noise may be on 380, and so on. In addition, each transmitter has a special switch which will be described shortly.

Each receiver is also in two parts, one part with three separate circuits, and the other for a special purpose.

Switching Arrangements

In Fig. 1 is shown a diagram of a simple valve receiving circuit, with the three tuned circuits A, B and C connected through a special switch XY to the grid circuit. In these switches there are metal balls D to join the outer portions to the inner portions, which are in three parts, one part joined to each circuit. It will be seen that the position of the balls determines which circuit is being used.

The switches consist of inclined planes (Fig. 2) down which the metal balls D can roll. Provided all switches are identical and are inclined at the same angle to the horizontal, the balls, if again identical, will roll down in the same time. All that is now required is for all the balls at all stations, including the transmitting station, to commence rolling at the same time. It is for this purpose that there must be another receiving circuit.

Synchronism

A central station is arranged to transmit short powerful signals at regular intervals which are picked up by the special receiving circuits. These signals are made to operate a relay which turns a ratchet wheel one tooth at a time. This wheel is arranged to carry a number of balls, and on being moved one tooth, one ball is set rolling down the inclined plane. Special arrangements are also made for the balls to be brought back into the toothed wheel. In this way a ball is set rolling at the same time at all receiving stations and also at the transmitting station.

It will be obvious from this description that secret broadcasting can be effected. The technical difficulties are not slight, and the initial adjustment of a receiving station and the maintenance of it will involve much more expense than in the case of ordinary broadcast reception. It will be difficult for any unauthorised person to hear programmes perfectly, and his difficulties can be increased considerably by changing the order of the wavelengths, and the lengths of each transmission on each wavelength from time to time.

A great disadvantage of this system is that three separate wavelengths are used, this taking up too

Fig. 2.—The method of synchronisation adopted in the Anstey system depends upon the rolling of identical balls down similarly inclined paths. (See D in Fig. 1.)

large a band of wavelengths when there are so many calls on wavelengths for various purposes.

Second Method

An illustration of the second group of methods has already been given in the foregoing description of Anstey's system. A much simpler way than his of effecting the introduction of objectionable noises at the transmitting station and of removing them at each authorised receiving station, is described in a British patent of the Marconi Co. (No. 198,368). In this case a normal form of telephony transmission is employed, and the objectionable noise is introduced into the microphone circuit. Thus there is transmitted the usual telephony intermingled with a noise so as to make it impossible or at least unpleasant to receive a programme when using ordinary receiving apparatus. All that is required, however, is a special

filter at the receiving station to take out the disturbing noise. This may have a frequency above that most commonly employed in speech or music, say, 5,000. At the receiving station a "low pass filter" is required which will allow all frequencies below 5,000 to pass but which rejects all frequencies above. Again, the disturbance may have a frequency below those common in speech and music, say, 25. In this case a high pass filter to reject all frequencies below 25, and to allow all frequencies above to pass, is required. Similarly the disturbing noise may have a frequency inside the audible range, when another type of filter circuit must be used to eliminate a narrow band of frequencies including that of the disturbance.

Additional Apparatus

With such a system of secret broadcasting, all that is required in addition to the ordinary receiving apparatus is a number of filter circuits, so that the correct filter can be used from time to time. It will be necessary with this system to change the frequency of the disturbance periodically, as the complications introduced are not so serious as in the first case described. This type of transmission has, however, the advantage that only one wavelength is required for each broadcasting station. Further than this, the receiving apparatus is very flexible, and stations on various wavelengths can be listened to without much trouble.

Speech Inversion

The third group of methods is very ingenious, depending on the device of actually changing the speech or music frequencies for transmission. The simplest method of doing this is to invert the speech frequencies. Speech and music consist of an arrangement of different frequencies from about 25 to about 10,000, the frequencies being of different intensities, usually being more than one frequency at any time. Each sound has a particular combination of frequencies, each being of a definite intensity. For instance, middle C in music has a frequency of 256. When struck on the piano, other frequencies accompany it, called harmonics, which are 2, 3, 4, &c., times the fundamental. These harmonics have not the same intensity. We thus have frequencies, 256, 512, 768, 1,024, etc., present in middle C struck on the piano. Now suppose we have a continuous wave of, say, 2,000 frequency and modulate this by our middle C. The following frequencies will result: 2,000 less 256; 2,000 less 512, etc., *i.e.*, 1,744, 1,488, 1,232, 976, &c., which is called a side band resulting from the difference in frequencies of the continuous wave and the tone frequencies.

Sideband Suppression

There is also another side band resulting from the sum of the frequencies, and this consists of the frequencies, 2,256, 2,512, 2,768, 3,024, etc. Now, if we can reject the upper side band, which is possible by the use of a low pass filter, we are left with the lower side band, which is a combination of frequencies entirely different from that of our original middle C of the piano. This combination of frequencies will not be recognisable as a note of the piano at all, and if it is used to modulate a carrier wave it will be completely unintelligible when received on the ordinary broadcast receiver. However, at the receiving station it is possible to obtain the original piano note in the following manner. The process of modulation is

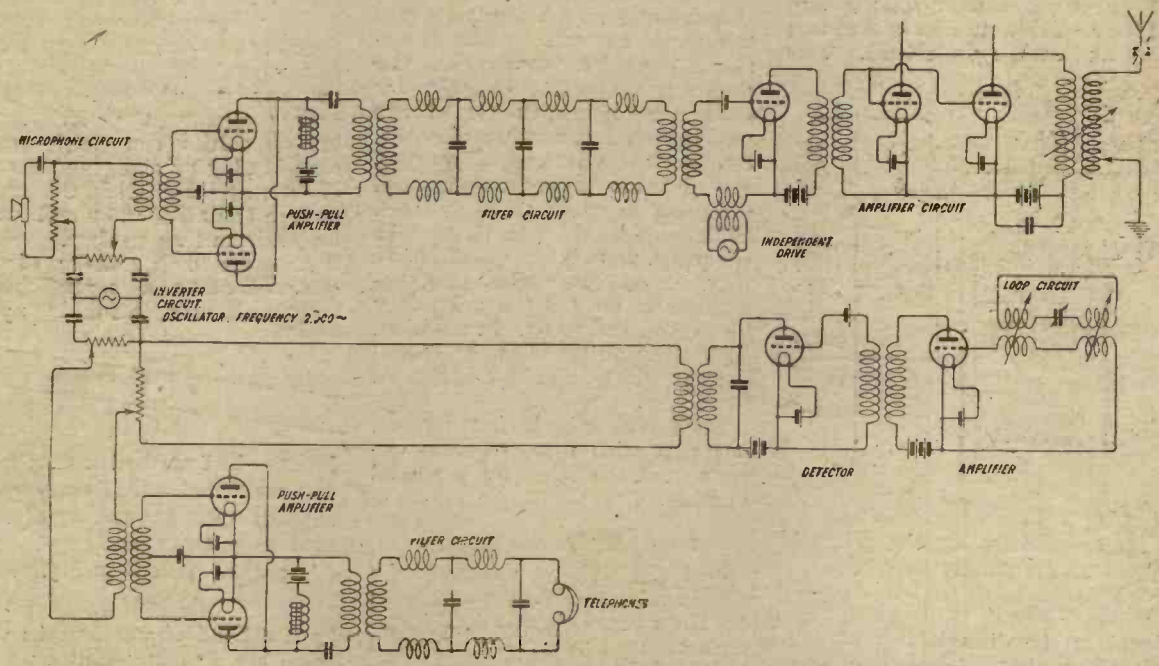


Fig. 3.—The Western Electric Company's system makes use of a "speech inversion" arrangement.

reversed, and the received frequencies are used to modulate a continuous wave of 2,000. Again two side bands result, the lower one being 2000 less each of the frequencies which results in our original combination of 256, 512, 768, 1,024, etc. The upper side band consists of 3,744, 3,488, 3,232, 2976, etc. If we can eliminate this upper side band we are left with our original piano middle C.

This example illustrates the principle of the inversion of speech or music. The inversion gives an entirely different series of frequencies for transmission, and with ordinary receiving apparatus a jumble of sounds would be heard.

This principle has been proposed by the Western Electric Company for secret broadcasting purposes. Inversion is, of course, the simplest

possible form. In this form it would be comparatively easy for many listeners to build additions to their ordinary receiving sets to re-invert the inverted speech. Numerous complications can be added to the simple method of inversion. One method is to divide the acoustic band of frequencies into a number of parts and to invert each part. The essential band of frequencies lies between 25 and 5,000. This might be divided into the three bands, 25 to 150, 150 to 900, and 900 to 5,000, and each band inverted in turn. The divisions into bands of frequencies can be effected by the use of the filters already referred to. In this case it is a much more complicated matter to re-invert the separate bands and to combine them to be equivalent to the original speech or music.

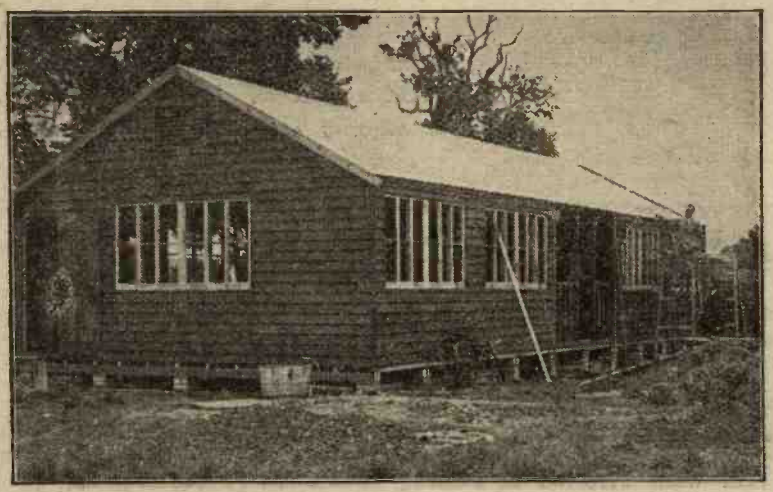
A still further complication can be introduced, which is to divide the acoustic frequency range into bands, and to mix up those bands after inversion.

The Hammond System

Another system of secret broadcasting has been proposed by John Hayes Hammond. This involves the use of a carrier wave of comparatively short wavelength, which is modulated by a supersonic frequency. The telephony modulations are applied to the supersonic modulations; this itself makes it more difficult to receive telephony. Much greater secrecy can be obtained by varying the frequency of the supersonic modulation, and if this were applied for the purposes of secret broadcasting the supersonic frequency would be varied periodically or continuously, according to a pre-arranged plan.

Probabilities

Sufficient descriptions of a few systems for secret broadcasting have been given to show that it is technically possible to transmit programmes which can only be received by listeners with the correct receiving apparatus.



One of the temporary buildings being erected for the Radio Press laboratories at Elstree.

Will it be Tolerated?

Broadcasting is meant for the man in the street, and he is likely to ask "whether secret broadcasting is in his interests."

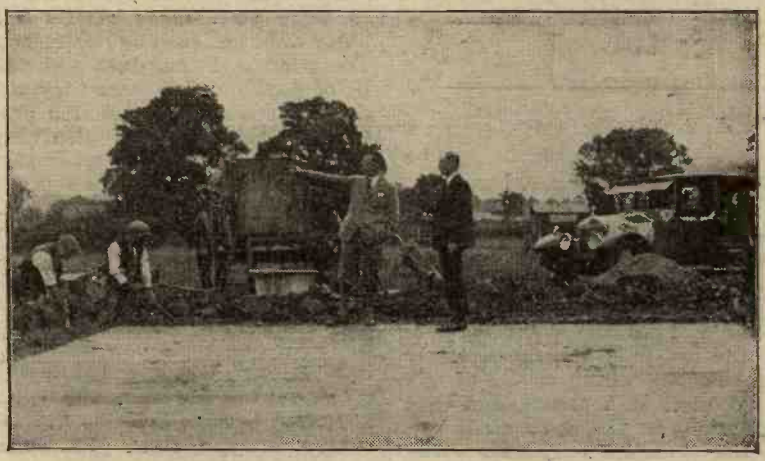
Many objections to any scheme of secret broadcasting are apparent from the preceding description. The cost of the listener's initial installation will be high, and, of course, also the weekly expenditure on keeping the apparatus in good working order. Again, the expenditure of a secret broadcasting company, in order to keep all subscribers informed of the particular codes or keys as they change periodically, and of the programmes, will be very high. Thus from every point of view a scheme of secret broadcasting will be much more costly for the subscriber than the present system. Many people would be entirely shut out from the benefits of broadcasting purely from the question of expenditure. The influence on crystal users would be particularly bad, and the introduction of secret broadcasting would make crystal sets things of the past. The people in this country would never tolerate any tendencies to make broadcasting a luxury for the few. It is essential to keep it democratic.

Wavelengths Available

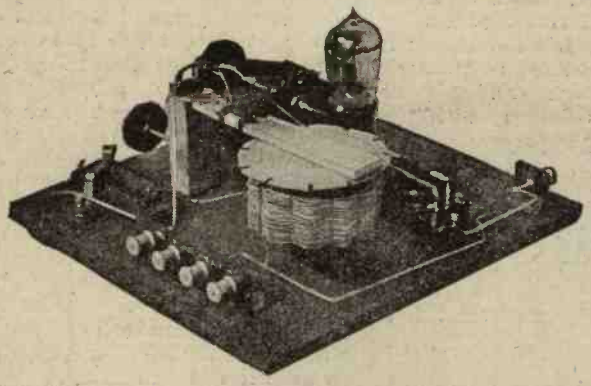
Another very serious point is the question of the number of wavelengths available. There are so many claims on the facilities of wireless that it is absolutely essential to exercise the strictest control in the allocation of wavelengths. Were one company allowed to commence a system of secret broadcasting, other companies would wish to introduce their special systems, and in a short time there would be a jumble of wavelengths, particularly as some systems of secret broadcasting require more than one wavelength.

Present System Economical

On the other hand, the present broadcasting system is economical in the use of wavelengths, although the system might be made even more economical. Thus, though secret broadcasting is technically possible, there are so many disadvantages, from the listener's point of view, as well as nationally, that there is very little prospect of such systems being substituted for our present one.



Mr. Scott-Taggart (pointing) and Dr. Robinson inspecting the concrete foundations for one of the buildings at Elstree.



A Simple Home-Constructed Single-Valve Set

By A. V. D. HORT, B.A.

Many enthusiasts like to make as many parts of a set as possible. Here is a set in which the majority of the components are home-made.

RECEIVERS in which the components used are mounted on a board are attractive in many ways, when appearance is not a serious consideration. Cabinets and large ebonite panels are dispensed with, thereby reducing considerably the expense involved in construction, while there is no reason why a receiver mounted on an open board should not be fully as efficient in operation as a cabinet

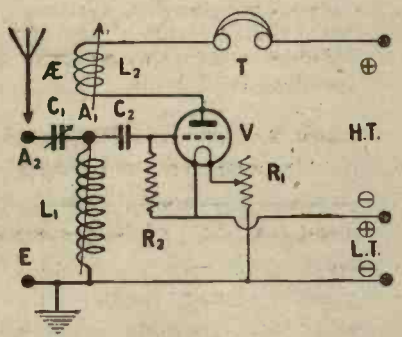


Fig. 1.—The condenser C_1 may be used in series or parallel with L_1.

receiver designed to be a handsome piece of furniture for the drawing-room as well as an electrically sound instrument. Additional advantages from the point of view of the beginner or experimenter are that the wiring of the circuit is apparent at a glance, and that alterations in the connections can be easily carried out, since every part of the receiver is readily accessible.

The Circuit

The circuit used in the receiver to be described, as will be seen from the diagram, Fig. 1, is that of a single detector valve, with reaction on to the aerial. As this method of obtaining reaction effects is capable of causing considerable annoyance to other listeners if carelessly handled, a form of control of the degree of coupling between the reaction and aerial coils is incorporated, which gives what is in effect practically a "vernier" movement of the moving coil. At the same time, if the valve is accidentally set into a state of oscillation, the reaction coil can be lifted well away from the aerial coil in a moment, so that the minimum of interference is caused to others. The constructional work involved in making this coil-holder is extremely simple, and no elaborate tools are required for constructing this or any other part of the receiver.

Bought Components

While constructional details and diagrams are given for making several of the parts of the set, it is recommended that certain components be bought ready made, as more satisfactory results are likely to be achieved by this means. The purchased components should be of good quality, since they can then be relied on to function properly in this receiver; also they will be available to give further good service if it is subsequently decided to incorporate them in a more elaborate set.

The components to buy are as follows:—

One ·0005 μF variable condenser with ebonite end plates. This may be either the square-law or standard pattern. The one used in the set shown was one which the writer happened to have by him.

One ·0003 μF fixed condenser (L. McMichael, Ltd.).

One 2 megohm leak (L. McMichael, Ltd.).

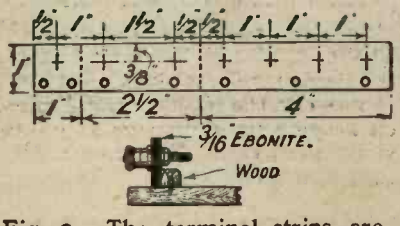


Fig. 2.—The terminal strips are made from one piece of ebonite.

These components are set up in clips on a small ebonite panel, by which means they are easily attached to the baseboard.

Seven 4 B.A. terminals.

One valve-holder for board mounting, with connections to the sockets brought out through the sides of the holder.

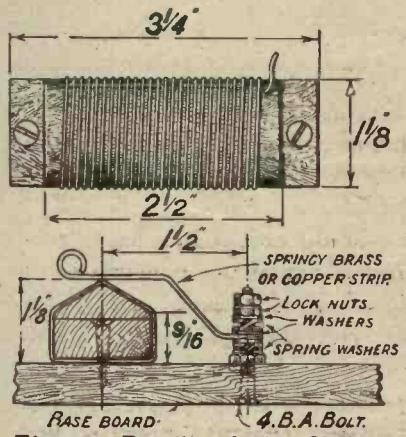


Fig. 3.—Details of the filament resistance.

The other parts which will be required are:—

One board, 10 in. × 10 in. × ½ in. That used by the writer is the bottom of an old Fullerphone case, which is impregnated with damp-resisting material.

Ebonite strip, 7½ in. × 1 in. × 3/16 in.

2 ozs. of 26 S.W.G. d.c.c. copper wire.

4 yards of 24 S.W.G. bare Eureka resistance wire. This is for use with bright emitter valves and a 6-volt accumulator. If dull emitter ·06 valves and a 4-volt battery are to be used, 3 yards of 34 S.W.G. wire will be required.

3 in. of 4 B.A. screwed rod.

One 4 B.A. ebonite knob.

Strip of stiff brass 2¾ in. × ⅜ in.

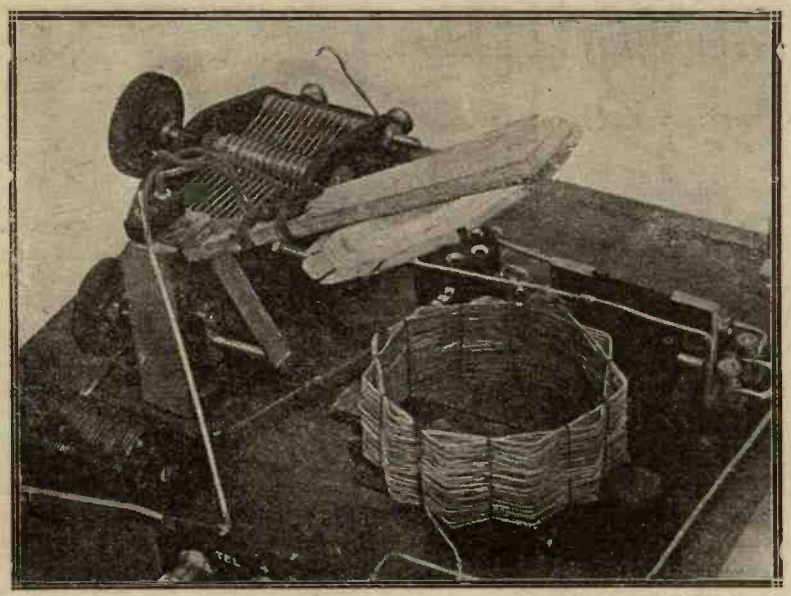
Piece of brass 1 in. × ¼ in. × 3/16 in.

One small brass hinge, and 3 small brass angle brackets.

Various bolts, screws, odd pieces of wood, etc.

Constructional Details

Turning now to the actual construction of the set, the ebonite strip which is to carry the terminals may first be marked out, a sharp-pointed scriber being used to fix the positions of the terminals and screw holes. When the whole strip has been marked out and drilled in accordance with the diagram, Fig. 2, it should be divided up into sections as indicated. Each of these sections is now fastened with wood screws to a strip of wood of similar length and of the approximate dimensions shown, after which it is secured to the baseboard by means of screws through the wooden strips. The single terminal section and the pair are for the aerial first position, and the second position and earth respectively. The four-terminal section provides for the L.T. and H.T. batteries and the telephones. Next the grid condenser and leak on their ebonite panel are secured in position; the valve-holder is mounted with its grid terminal as close as possible to the common connection of the condenser and leak.



A view of the set showing the reaction coil mounting and how its position is altered.

Condenser and Coils

The variable condenser is mounted with the spindle horizontal by bolting two small brass angle brackets to the edge of its top plate, and screwing these down to the baseboard.

We now come to the construction of the coils and their mountings. The aerial coil shown is of the basket-weave type, wound to a diameter of 3 in. on 11 pegs in a board; 26 S.W.G. d.c.c. wire is used, 50 turns being put on, and the ends of the winding brought out to opposite sides of the coil. For use with this size of aerial coil a 60-turn reaction coil is wound in single basket form on a thin card former. These turn numbers may need slight variation for different aerial systems and individual requirements, and more turns on the reaction coil may be found necessary with inefficient aerials; the mistake of using too many turns on this coil should, however, be guarded against, since under such conditions the receiver may become unstable and liable to flop over into oscillation without smooth regeneration when the coupling between the two coils is tightened.

Assembly

The method of assembling the various parts of the reaction coil movement should be clear from the photographs and sketches. The block of wood to which the moving arm is hinged is secured to the baseboard with a brass angle bracket; in addition, a long wood screw passes up through the baseboard into its lower end. A ¼ in. hole is drilled through the block as indicated, to give ample clearance for the threaded control rod. When the whole assembly is complete, the point where the end of this control rod touches the bent brass strip attached to the moving arm should be marked, and a small hole drilled half through the strip to act as a guide for the rod. It may be noted that if a slightly coarser control of reaction is desired, a 2 B.A. threaded rod may be substituted for that shown, the brass bearing piece being tapped to suit.

Reaction Coil

The reaction coil is attached to the wooden arm with short screws; the aerial coil is tied to a strip of wood and screwed down on a block of wood mounted on the baseboard; this coil should be placed so that it is concentric with and close to the reaction coil, when the latter is lowered to the horizontal position.

The former for the filament resistance, which should be of hard wood, preferably treated with a coat of shellac varnish before use, is cut to the shape shown in Fig. 3. The wire is to be wound on this former as tightly as possible. A convenient method of doing this is to secure one end of the wire to one end of the former, by drilling a small hole through one corner and passing the end of the wire through it twice, the other end of the wire being attached to a nail firmly fixed in the wall or gripped in a vice. Then, keeping a constant tension on the wire, turn the former over and over in

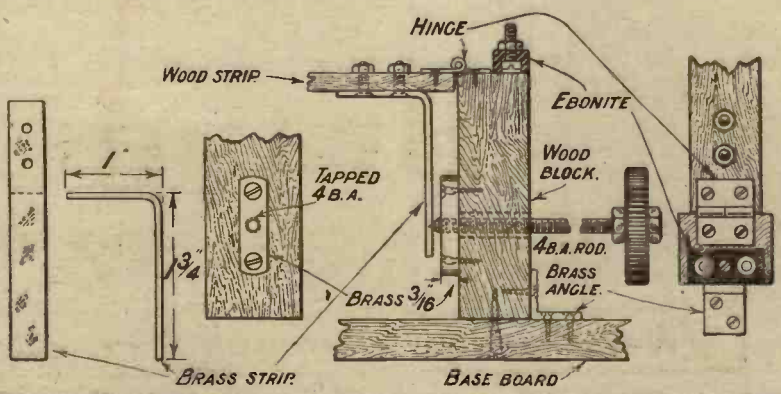


Fig. 4.—Showing how the coil stand is made. The ebonite knob, when screwed toward the upright, loosens the coupling between the coils.

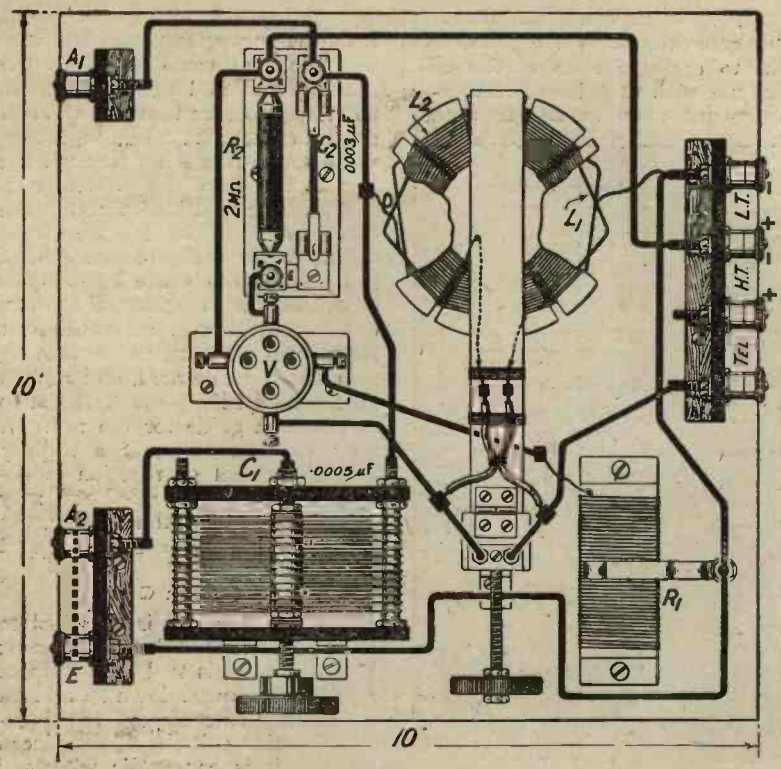


Fig. 5.—When all parts have been mounted in position, wiring is carried out as shown.

the hands while moving slowly forwards; the wire should bite well into the corners of the former, to prevent subsequent slipping of the turns; the finishing end is secured as before, ½ in. of wire being left over for making connection. The former is now screwed to the baseboard, the loose end being placed at the end furthest from the edge of the board. The contact arm should be bent to shape so that it will press firmly on the turns of wire when mounted on its pivot; spring washers on each side of it on the pivot assist in maintaining a good electrical contact at this point. When the arm has been mounted two small screws are inserted, one at each end of the former, to act as stop pins; the screw nearest the edge of the board should leave room for the arm to be moved into an "off" position, out of contact with the resistance wire.

Wiring

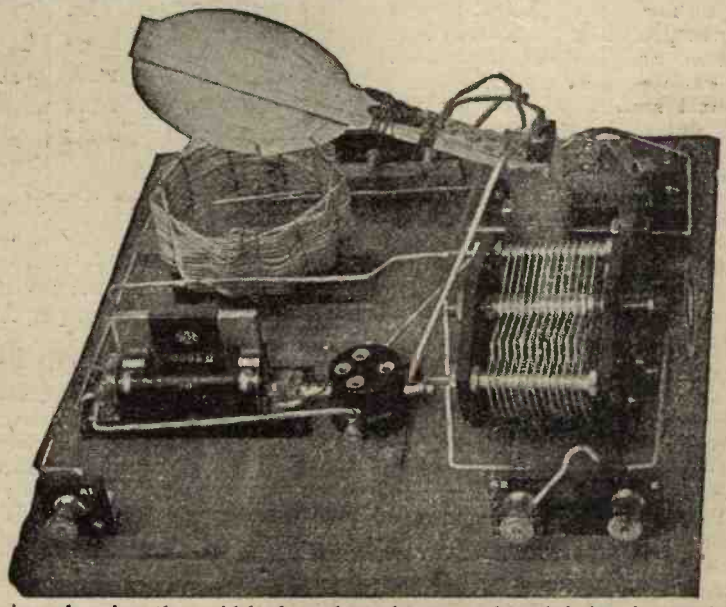
Short lengths of thin flex are used to connect the reaction coil to the two insulated bolts provided as terminating points on the top of the wood block supporting the movement; from these terminating points rigid wires go to the anode connection of the valve-holder and one of the telephone terminals. The ends of the aerial coil winding are soldered to the wire leading from the grid condenser to the fixed plates of the tuning condenser, and to the L.T. negative terminal respectively. The ends of the reaction coil winding should be only temporarily connected to the flex leads, until by a test on actual signals the correct method of connection has been ascertained.

Assuming that these tests have been satisfactorily completed, the batteries and telephones may be connected to their appropriate terminals, and the aerial and earth leads attached, the reaction coil being lifted right away from the aerial coil before switching on the filament current. If no signals are heard when the tuning condenser is rotated over its whole scale, move the aerial to the alternative terminal and try again. When signals are heard, slowly lower the reaction coil; if there is an increase in signal strength, the connections to the flex leads of this coil are correct, and they should be soldered and taped over; if, however, the opposite effect is observed, the connections should be reversed.

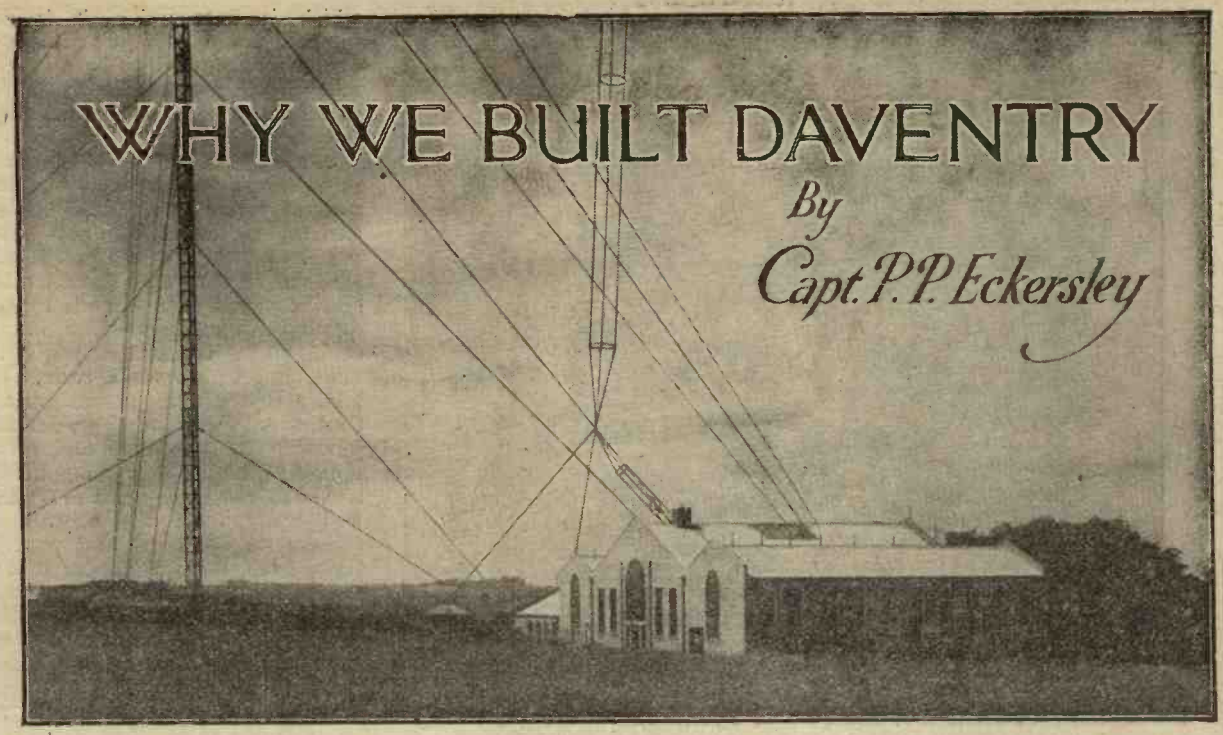
Test Report

Constant aerial tuning may be used by the insertion of a fixed condenser of ·0001 μF capacity between the aerial lead and terminal A_1 or A_2; a convenient method is to attach a fixed condenser permanently to the aerial lead, with a short length of flex to connect its other side to the required terminal. If any difficulty is experienced with the smooth control of reaction, a fixed condenser of ·001 or ·002 μF may be joined across the telephones.

On test on a high though poorly situated aerial in south-west London with an A.R.D.E. valve and 45 volts H.T., 2LO's transmission was of course received at full strength. Birmingham and Radio Toulouse also came in well, with the 2LO transmission as a faint background. Belfast and Frankfort-on-Main were clear, though naturally not very strong, and with careful setting of the reaction adjustment and the assistance of a wavemeter Rome on 425 metres was tuned in sufficiently well to be identified. Some other stations were audible, but could not be identified.



A view showing the grid leak and condenser and aerial circuit terminals.



WHY WE BUILT DAVENTRY

By Capt. P. P. Eckersley

IT is a fact that 85 per cent. of the population of the British Isles can receive broadcasting on a crystal set. This as a bald statement may possibly seem interesting, but not particularly wonderful. On the other hand, it probably gains added weight when it is realised that this record is unsurpassed in any other country—in fact, is hardly approached by other broadcasting organisations which have attempted to make listening a part of the population's daily life.

Then, again, it may be questioned, why this insistence upon a piece of apparatus that, while it has the merit of cheapness, is after all, in the minds of many, practically obsolescent ?

Cheap Listening

In stating this fact that 85 per cent. of the population of these isles can receive broadcast on a crystal, we as a broadcasting company in no way wish to put forward the crystal set as the be-all and end-all of listening, although it must be admitted that such a set as a criterion of judgment is probably unsurpassed.

The statement means far more than this, however. It means that, in the first place, persons with shallow purses can afford to indulge in the delights of listening; it means, secondly—and possibly this is more important—that people who have the money to employ valve sets may be quite certain that one programme, at least, will be available without the annoying interruptions that mar enjoyment when listening to more distant and less robust signals.

The crystal area — which, of course, means the area in which crystal reception may be enjoyed—is an area wherein it is quite certain that nothing else, except the programme, may be heard; unless, indeed, some foolish and misguided person with no knowledge of the art tries to make himself a set, and causes oscillation and interferes with the enjoyment of others.

A Public Service

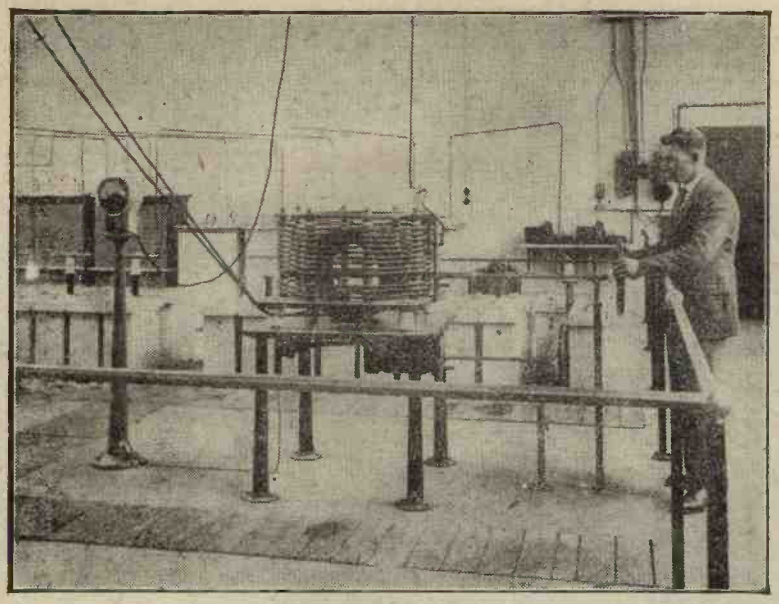
It is, perhaps, interesting to study the way in which this ideal of universal crystal reception—and it surely is an ideal—has been obtained. The British Broadcasting Company was, in the first place, under contract with the Postmaster-General to erect eight main stations. It did so, but interpreting its functions in terms not simply of fulfilling a contract, but more of becoming a real public service controlled in the interests of the public, and the public only, it sought to give a greater democratisation of the art than was implied in the original contract.

Thus it was in 1924 that, to serve the denser areas of population not contained in the crystal areas incident to these eight main stations, eleven relay stations were erected. Main stations and relay stations together gave, at any rate to all the densely populated areas, the ideal service; but still there remained the country user—the listener, after all, who deserves possibly more consideration than his cousin in town, because in the country, as we all well know, there are fewer distractions and therefore more need for the benefits of broadcasting.

Chelmsford

It was in the summer of 1924 that, to supplement our relay station policy, the high power experiments were begun. The Broadcasting Company erected at Chelmsford, therefore, a station of higher power than any used for regular service throughout the world, designed in the main to give the London programme to the country user who, as before mentioned, was probably outside the range of main or relay stations.

The wavelength of 1,600 metres which was chosen for the experiments perhaps needs some justification. We realise very fully that the design of the ubiquitous receiving set is considerably complicated by necessitating inductance or capacity values eight times that of the average 400 metre set. The wavelength was chosen, however, not without due thought. In these islands, in the first place, we have a great "jamming" problem. The narrow waters contain more shipping and more ship signalling than



A view of the aerial tuning coils and aerial ammeter. The latter reads up to 120 amperes!

in any other part of the world, as the listeners in Kent and Sussex will agree. It was necessary to choose either a power so great as to overcome the jamming very nearly on the same wavelength, or a wavelength far removed from the source of interference. A combination of these two factors gave us an ensurance that the jamming problem would die, and thus a good reason can be advanced for the 1,600 metre wavelength on the score of jamming alone.

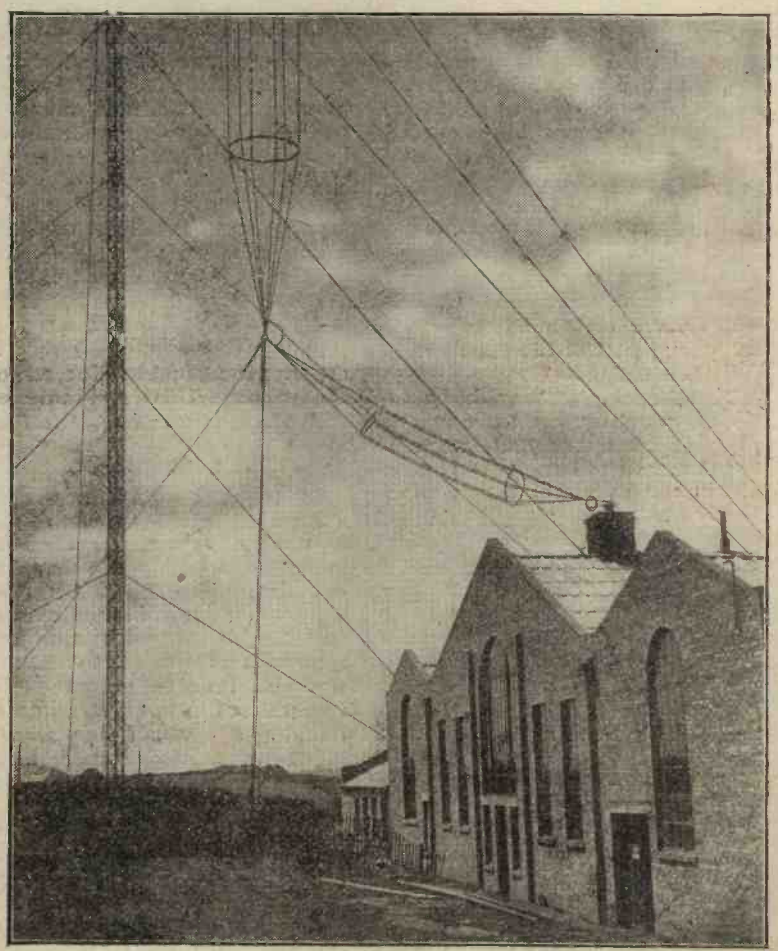
Fading on Short Waves

There is a second point, however. Short waves, as we well know, are subject to all sorts of vagaries. Fading at long distances is a pronounced phenomenon which, so far, is susceptible of no real cure. Shielding by local hills has been known to play a considerable part, and to introduce blind spots in all sorts of country places, and the power needed to overcome some vagaries is out of all proportion to the gain that might be experienced. It is possible that with 50 kilowatts power some results might have been achieved and the jamming problem might have been overcome (the latter is doubtful), but the interference between the high power and existing broadcasting stations experienced with the average unselective receiving set used by the average listener would have been considerable, even though the station were located far away from the centres of broadcasting.

Advantages of the 1,600 metre Wave

The long wave is less susceptible, then, to these troubles of fading and shielding. It has a daylight to night-time ratio of signal strength which is near unity, it is not jammed nor does it jam; in fact, Chelmsford proved to be a stable, reliable source of broadcast, thanks to its long wave and to its high power.

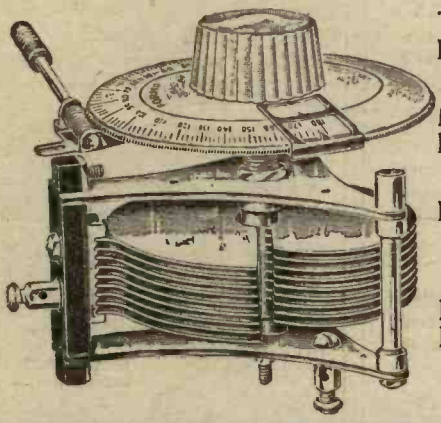
The success of the Chelmsford experiments led us to seek permission from the Postmaster-General to crystallise our high-power policy in a permanent station. After some considerable sacrifices, which were made by the fighting services and others, it was decided that the station might be built, but there was a restriction laid as to the siting of the station. Chelmsford caused considerable jamming to Air Force and other signalling, and it was thought that it was necessary to put the station well away from the centres of training in the south-east part of these islands. An arbitrary line was drawn, therefore, between the mouth of the Severn and the mouth of the Wash, and we were told that the station could not be situated south of this line. Daventry was thus chosen as



This photograph gives a very good idea of the lead-in arrangements at the high-power station.

FAMOUS FORMO PRODUCTIONS

THE NEW FORMO-DENSOR STRAIGHT WAVE, ULTRA LOW LOSS with 200-1 FINE TUNING RECORDING DIAL



·0003μF ·0005μF
FORMO - DENSOR
complete with
FINE TUNING RECORDING DIAL
17/6
FORMO - DENSOR
without Dial
10/6
FINE TUNING RECORDING DIAL
separately
7/6

SEPARATES STATIONS WITH HAIR-SPLITTING EXACTITUDE

A Condenser of Advanced Design, Suitable alike for Laboratory and General Use, and for Super-Het., Neutrodyne and other Circuits designed for Super-Selectivity

GROUNDED ROTOR, INDEPENDENT SKELETON FRAME, JEWELLERS' METAL VANES, NO HAND CAPACITY, STATIONS LOGGED ON THE DIAL

The FORMO PERFECTION L.F. TRANSFORMER

Full, Rich, Mellow Reproduction of Voice or Music, with the Utmost Fidelity.

ITS STRONGEST APPEAL IS TO THE MOST CRITICAL

ONE GUINEA
30,000 Turns of Wire

Correctly proportioned between the windings. On a core composed of the exact amount of iron.

THE EVER POPULAR FORMO SHROUDED MODEL
12,500 Turns
10/6 Formerly 18/-

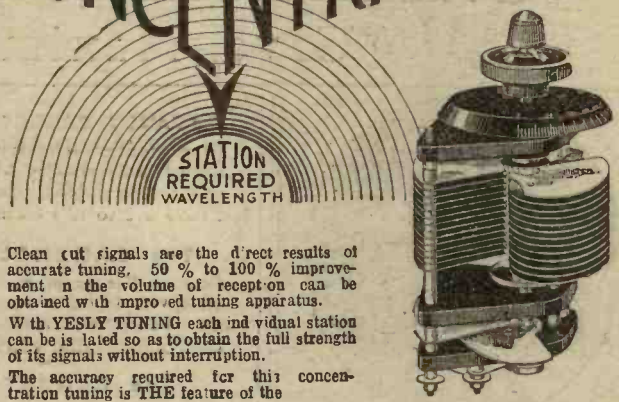
This transformer is increasing in favour by leaps and bounds, and, at the new price of **10/6**, is undeniably the utmost value in Radio that money can buy.

It is giving honest and faithful service to thousands of listeners in every quarter of the globe.

ILLUSTRATED DESCRIPTIVE LEAFLETS ON REQUEST

THE FORMO COMPANY
(ARTHUR PREEN & CO., Ltd.)
CROWN WORKS
Cricklewood, London, N.W.2

Get Yesly Tuning for CONCENTRATION



Clean cut signals are the direct results of accurate tuning. 50 % to 100 % improvement in the volume of reception can be obtained with improved tuning apparatus.

With YESLY TUNING each individual station can be isolated so as to obtain the full strength of its signals without interruption.

The accuracy required for this concentration tuning is THE feature of the

YESLY SQUARE LAW VARIABLE CONDENSER

NOTE

(1) The first-class GENERAL FINISH
(2) The pure EBONITE highly polished plates.
(3) The coiled SPRING MOVING contacts
(4) The ONE HOLE FIXING with embedded nut to eliminate all backlash and spindle play.
(5) The special panel pin to prevent bodily rotation.
(6) The ROBUST CONSTRUCTION
(7) The MODERATE PRICES

Ask for Leaflet C2.

BETTER TUNING GREATER VOLUME

	Plain	*Vernier*
·001	- 11/6	15/-
·0005	- 10/6	14/-
·0003	- 10/-	13/-
·00025	- 9/6	12/6
·0002	- 9/-	12/-

Perfect Control—

A touch of the throttle, the clutch or the steering wheel, and what a world of difference it can make in the running of a car. The whole of the power obedient to the slightest change in control. Radio Valves throb to the pulse of power. They obey the commands of your Rheostats with startling exactness.

THE "YESLY" VELVET TOUCH Rheostat embodies a smooth running contact shoe which results in wonderful flexibility of control. The moulded bakelite and polished nickel case gives great mechanical strength and a sure protection from the loss of efficiency due to dust. The shaft is ¼ in. in diameter and turns in a bearing one full inch in length. This is only ONE feature to ensure strength and safety in control.

6 ohms resistance each	6/6
30 ohms resistance each	7/-
YESLY Potentiometers 400 ohms resistance each	8/-

The highest possible standard in Aerial tuning demands YESLY COMPONENTS

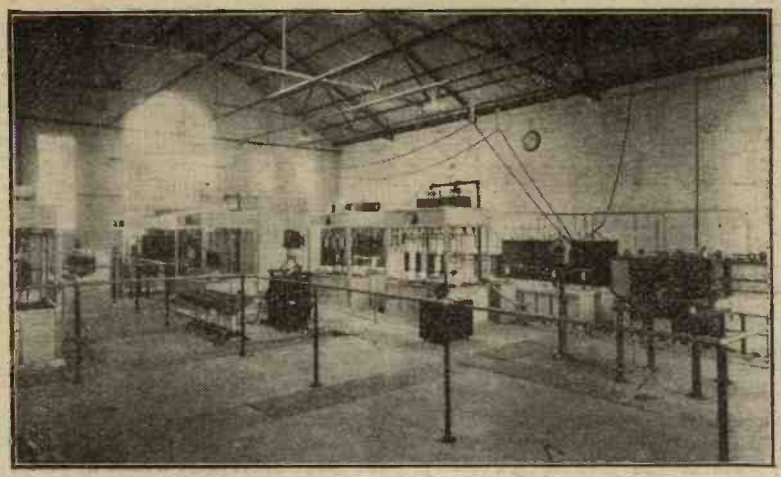
LOOK FOR THE NAME

Obtainable from your local dealer. If you have any difficulty write direct to—

ENGINEERING SUPPLIES, LTD.
235, Blackfriars Road, London, S.E., England

All genuine "Yesly" Components are packed in blue boxes.

REGISTERED
YESLY
TRADE MARK



A general view of the interior of the station. The valve panels are seen in the middle background, while the aerial tuning arrangements are on the right.

the permanent quarters of our high-power station.

The site was chosen somewhat against our will, because we realised that those spark-jammed territories around the area of Kent and Essex would be in worse case than they were when Chelmsford was operating. Our choice for the site to combine a certain amount more land in the 100-mile crystal area than was given by Chelmsford was somewhere, it might have been, 40 miles north-west of London, but, as mentioned before, the Government had to decide otherwise.

Results at Daventry

Results with the Daventry station show that our guarantee of 100 miles crystal range has been fulfilled, and if the reader would take the trouble to get a map of England and draw a circle of 100 miles round Daventry, he will find that very little of the area included contains sea. The station, as far as taking into account the maximum number of listeners, is probably very favourably placed. Complaints, however, come from the area of Chelmsford, where one has heard of a loud-speaker in series with an aerial, without anything else, which has been known to get results. Naturally, this would be so because, obviously, the strength of signal must be considerably diminished with so great a relative removal of the station. An East Kent listener is badly placed, because much of the area so severely jammed by the shipping is left outside a crystal area, and we must take thought as to how to cure the troubles incident to reception in that area.

The high power station, which one may say without exaggeration is the keystone of British broadcasting, puts the final touch to our crystal policy, which again is synonymous with our ideal of the complete democratisation of wireless listening.

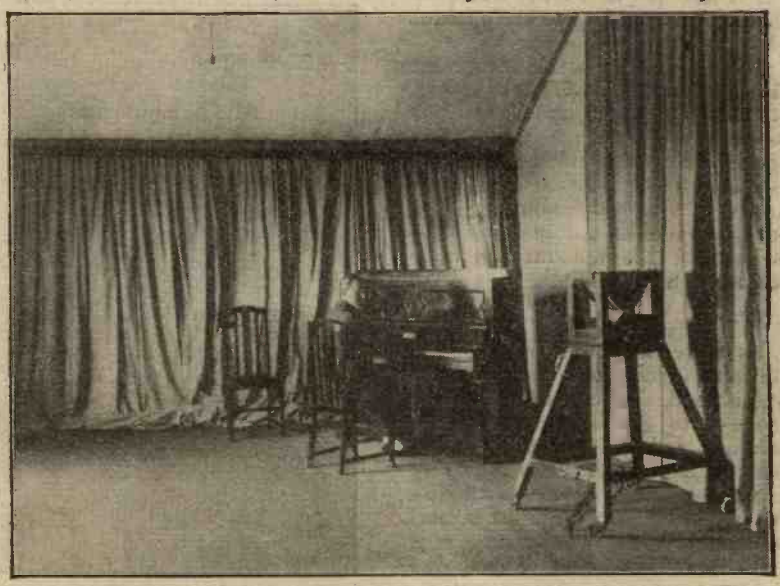
The Next Move

The question may be asked, having built Daventry, and having explained the reasons for its building, what is next to do? The writer has been subject to a considerable amount of criticism, because he has stated that in his own opinion distant listening can never be a finality of enjoyment for the *hoi polloi*, but is rather an ephemera of wireless. This is only a personal opinion, and as such can carry as much or as little weight as the reader desires.

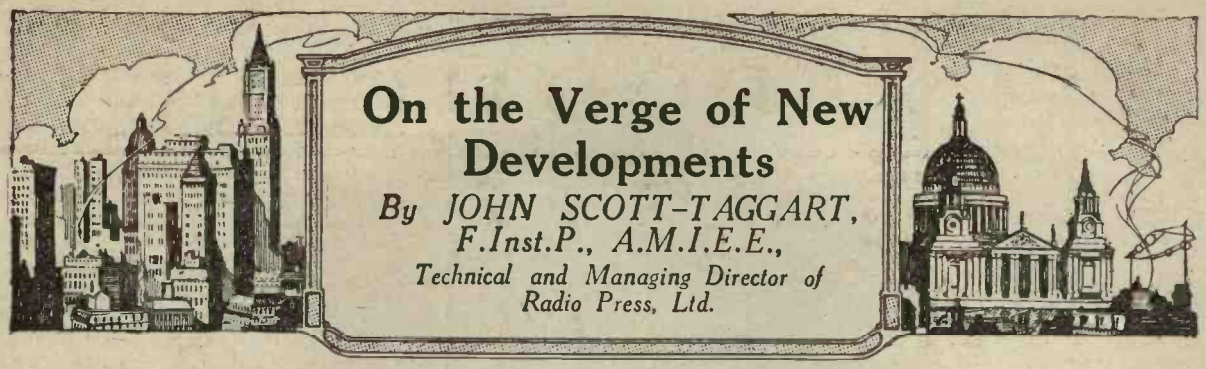
It is obvious that wireless listening has great potentialities in putting us, in our own houses, in touch with foreign lands, and with different programmes that suit our taste better, but I am not sure whether the future will not see alternative programmes given from as robust a source as are the single programmes of to-day, and our ideals must be towards giving not only 90 per cent. of the population the possibility of receiving a programme on a crystal set, but more, giving 100 per cent. of our population the possibility of receiving a choice of programmes on a crystal set.

To link up Europe with many valves, and incidentally many dots and dashes, and many X's, too, would not appear to be the be-all and end-all of broadcasting. Would it not be better when, by exploring all the possibilities of the wire and wireless link, the same conditions that at present apply to Britain will apply to the whole of Europe—indeed, to the whole of the world, and is the day so far distant when one may see printed in the *Radio Times* "S.B. to Europe," or "S.B. from Britain?"

If there are some, perhaps, who do not wish to listen to foreign concerts, they will still have the British alternative. Until the flexibility of the whole is such that a man in his own home, with an apparatus that need not cost him more than a cheap cigarette case, will be able, by the turning of a simple single knob, to annihilate space and tour in foreign lands with less trouble than it takes at present to walk round his own village, broadcasting will not have achieved finality. In the meanwhile we have built Daventry. I trust you will all realise why.



The studio at Daventry, which will be used occasionally. The majority of the transmissions will, however, be relayed from distant studios.



On the Verge of New Developments

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.,
Technical and Managing Director of Radio Press, Ltd.

HAVE wireless receiver designs improved during the last six months, or even during the last year? This is a question I have been pondering over during the last month or two, and I have felt that undoubtedly the improvements, such as have been made, have not been on a large, or large enough, scale.

"Getting distance" is still a matter of considerable difficulty, and the importance of selectivity in relation to increasing the range of receivers is a matter which also has not received the attention it should.

Range

The range of a receiver does not merely depend upon the amplification obtainable, but on the ratio between the desired signals and interfering signals or noises. Almost every experimenter has, at some time or another, obtained signals from very long distances, and he would probably find, if he kept a close record, that many of the cases of excellent reception were on occasions when the amount of interference was negligible.

Special cases, particularly, are those where, say, only one B.B.C. station is working and the others have closed down, or when some special experimental transmission is taking place outside the normal hours. On such occasions excellent reception is often obtained, and this is because the amount of interference is negligible.

Interference

As more and more broadcasting stations are erected in this country and abroad, the tendency for interference to be experienced will increase, and the present situation, bad as it is, will become worse, unless technical developments on the receiving side improve simultaneously.

As a matter of fact, if receiving stations are made more selective, even at the expense of signal strength, greater ranges can now be accomplished, but in the immediate future sets will be designed which will attain the greater selectivity without sacrificing signal strength; on the other hand, the very methods which improve selectivity will simultaneously improve signal strength. These methods will include the cutting down of losses in different parts of the receiving circuit, and the originating of new circuits for the special purpose we have in mind.

Work at Elstree

Very important work is now proceeding in the new laboratories which are being erected at Elstree by the Radio Press, two buildings being already in use. It is realised that in order to further progress in the required direction it is essential for us to have laboratories of our own in which experts will be devoting the whole of their time to the practical problems which affect the wireless constructor and experimenter. New readers will, no doubt, be surprised to hear of the great enterprise which has been undertaken on behalf of the Radio Press journals, but the step has become necessary if the readers of these journals are to have placed before them progressive designs and accurate information.

In many directions American sets are superior to British receivers. In the September double number of *Modern Wireless*, Major James Robinson, D.Sc., Ph.D., F.Inst.P. (who has taken charge of the new Radio Press laboratories, after resigning from the service of the Air Ministry, where he was engaged as Director of Radio Research and Design Work), explains the various directions in which development is likely to take place, and readers of THE WIRELESS CONSTRUCTOR will undoubtedly in the very near future derive the fullest benefit from the work at present being carried out at Elstree.

The Orchestra at 5SC, the Glasgow Station. On the right is seen Mr. Isaac Losowsky, the conductor.

SOLVING AN AERIAL DIFFICULTY

A NOVEL SINGLE-VALVER

BY C. P. Allinson

COME multi-valve, go multi-valve, the humble one-valve set still retains its popularity; and even among the most advanced experimenters few will probably be found who do not possess a favourite "single-valver." Do not think that this is merely kept on a shelf as a relic of old times, far from it—it is used regularly and with affection.

When single-circuit tuning is employed many put their trust in parallel tuning; others, however, swear by series, and this is no doubt due to varying conditions obtaining with different aerial-earth systems. The best results, however, may frequently be obtained by using both together, but this results in an extra control requiring adjustment.

Obtaining the Advantages of Both Methods

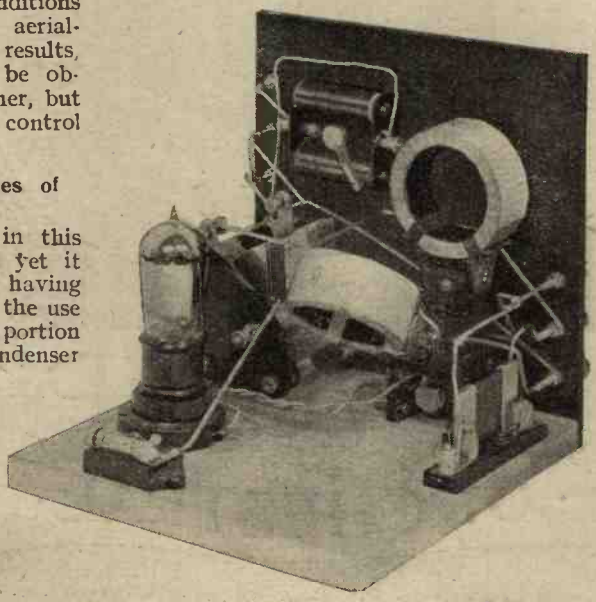
The receiver described in this article employs both, and yet it retains the advantage of having only one tuning control by the use of a dual condenser, one portion of which acts as a series condenser and the other as parallel tuning condenser.

It is thus possible to combine the advantages of both systems of tuning without extra complication, excellent selectivity being obtained, and although it is not claimed that greater signal strength will be obtained, the completed receiver will be found very efficient.

Coils and Valve Enclosed

As will be seen from the illustrations, the set presents a handsome appearance with its moulded top and base, and its simplicity will readily be appreciated. Standard modern practice has been followed in its design by enclosing both coils and valve within the cabinet, so protecting them from any possible chance of damage from idle fingers or too energetic dusters.

All the panel mounting components are of the one-hole fixing type, thus reducing the amount of constructional work to a minimum, and the receiver can be completed in a short space of time. The photographs taken from behind the panel indicate the simple wiring scheme and how the components are mounted in relation to each other.



The valve and coils, being behind the panel, are protected from accidental damage.

The tuning condenser, a double ·00025 μF, gives an excellent wave-length range and enables all B.B.C. stations to be received without the necessity for changing the tuning coil, and the coil holder used has the moving coil controlled by a worm and pinion which gives a very fine adjustment, allowing of close control of reaction.

Extra Fixed Condenser

A clip-in type of fixed condenser is provided, so that should it be found necessary, a small condenser may be connected in parallel with the portion of the dual condenser which is connected in series with the aerial. This is shown as C_1 in the theoretical circuit diagram (Fig. 1). Further, two aerial terminals allow the two halves of the tuning condenser to be connected in parallel for long-wave reception, or where it is desired to use only parallel tuning, as well as the combined series-parallel arrangement.

The clip-in type of grid leak is employed, and, of course, different values of leak should be tried. Not only does this allow of the best results being obtained, as different values of leak suit different valves, but also if an incorrect grid leak is used smooth control of reaction may be difficult or unattainable. It is most important that back-lash be absent in

the reaction control or distant stations will not be received at their fullest strength, if at all.

The dual filament resistance fitted to this receiver allows either bright or dull emitter valves to be used and is a refinement well worth any extra expense that may be entailed. Similarly the shock-absorbing valve holder employed

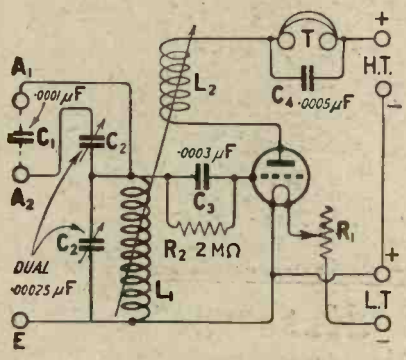


Fig. 1.—Note that the two sets of moving plates of the dual condenser are joined to terminal A_1.

not only eliminates ringing noises being heard when microphonic valves are in use, but also with valves that do not suffer from this trait protects them from damage from shock or serious vibration.

Extension Handle Needed

As the scheme of connections used with this receiver makes it necessary to connect the moving spindle of the tuning condenser to the grid of the valve an extension handle has been fitted so as to avoid any possibilities of hand-capacity effects affecting the tuning. This, however, is easily made, and its use certainly conduces to facility in tuning-in weak and distant transmissions.

Components

I give below a complete list of the components required to construct this receiver, and so that those who wish to may duplicate it exactly, I also give the makers' names. You will want :—

One ebonite panel, 8 in. × 8 in. × ¼ in. (Paragon).

One cabinet with loose base-board, 8 in. deep (Agar).

One dual ·00025 μF square law condenser (Jackson Bros.).

One panel mounting coil-holder (J. & P.).

One dual filament resistance (Radio Instruments, Ltd.).

One "Anti-phonic" valve-holder (Burndept Wireless, Ltd.).

One fixed condenser, ·0005 μF; one fixed condenser, ·0003 μF, and one 2 MΩ grid leak (Dubilier).

One clip-in condenser with mounting, ·0001 μF (L. McMichael, Ltd.).

One piece of ebonite rod for extension handle 3½ in. long by ¼ in. diameter, and an inch of 2B.A. screwed rod (Burne-Jones & Co., Ltd.).

Nine W.O. type terminals, nickelled.

Quantity square tinned copper wire 16 gauge, and a short length of flex for connecting up.

A short length of Glazite.

One set of Radio Press Panel Transfers.

Preparing the Panel

The first proceeding is to prepare the ebonite panel for drilling. If guaranteed ebonite is used this will merely consist of marking it out according to the panel lay-out, shown in Fig. 2. If, however, there is any doubt as to the surface insulation of the panel used, both sides should be thoroughly rubbed down with No. 0 glasspaper to remove the surface skin. A square, a rule and a scriber are all that is required to mark out the panel, but a pair of dividers will be found useful. Fig. 2 gives all the necessary details and dimensions, and having marked out the panel, centre-punch all points at which holes have to be drilled. There will then be little risk of the drill wandering and spoiling the job. All holes of the same size may be drilled first, and it is a good scheme to put a small drill through before drilling the large holes. This will then act as a pilot for the big drill and conduces to accurate work.

Transfers

Next apply the panel transfers, and should it have been necessary to prepare the panel by rubbing it down, the front surface should be rubbed over with a rag and a trace of vaseline to restore the black colour.

As there are only three components to mount on the panel, this will soon be done, after which the terminals will be fixed. Fasten the panel to the base-board with three ½-in. No. 3 countersunk wood screws and mount the components that go on this base-board. It may here be noted that the ·0005 μF fixed condenser (C_4) that is connected across the telephone terminals is held in place by means of the wiring and will, therefore, not be placed in position till that is done.

Wiring

The wiring may now be commenced, and it is advisable if the constructor has the required skill

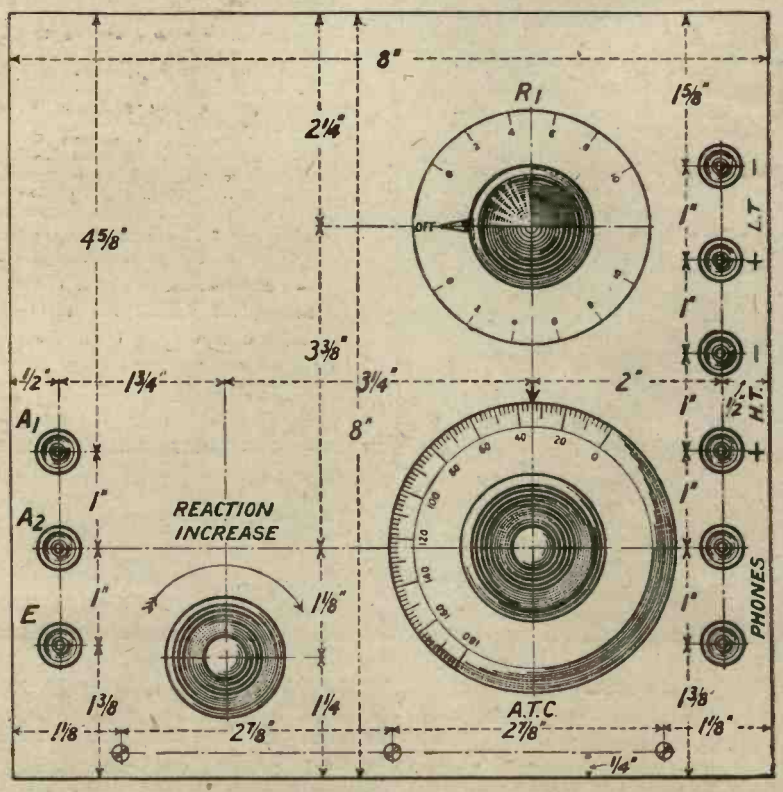


Fig. 2.—A half-size drawing of the vertical panel, showing terminal markings.

to solder all connections. If the wiring diagram (Fig. 3) is followed, no difficulty need be experienced. The two L.T. leads should first be done with Glazite, the remainder being done in any convenient order, finishing up, however, with the three leads going to the fixed condenser C_4, namely, two from the telephone terminals and one from the reaction coil. Care should be taken to see that the connecting wires to the coil-holder allow sufficient clearance not only for the two coils L_1 and L_2 to be plugged in, but also for the reaction coil to swing without fouling any of them. The positions of the wires shown in the wiring diagram permit of the largest commercial coils being used.

The extension handle is made by drilling and tapping a 2B.A. hole in each end of the ebonite rod. One end has a short length of 2B.A. screwed rod inserted, on which the knob is fixed, the other end screws on the condenser spindle and fixes the dial in position.

Valve and Accumulator

The receiver is now ready for test. First insert two coils, say, a 50 for L_1 and 35 for L_2, and the valve in the holder, attach the leads to L.T.− and L.T.+, taking these to the respective terminals of the L.T. battery. With bright emitters taking 3.5 volts a four-volt accumulator will do, though a six-volt one can be used. Valves of the dull emitter type passing ·06 amps may be used either with a dry battery giving three volts, or with a four-volt accumulator. In the former case the bright part of the filament resistance may be used, with the latter the "dull." Instructions will, however, generally be given by the makers as to the correct L.T. battery to use. Turn on the valve by means of the correct winding of the filament resistance and note whether it is burning correctly. In the case of dull emitters this may be rather difficult to determine, as the bulb has usually been "gettered" in order to give a high degree of vacuum; it is usually possible, however, to see if the filament is burning, by looking straight down on the pip of the valve, or failing this, by means of a small piece of looking-glass held at the base of the valve, so as to reflect any light coming downwards out of the valve.

If all is in order, connect the phones and the H.T. battery, plugging in only six volts first in case a short circuit has occurred at some point. If the brightness of the valve does not change, the correct value of H.T. may then be plugged in according to the maker's instructions, or if the valve has already been in use, according to the value you will have found best.

The next proceeding is to ascertain that the reaction coil is correctly connected. Gradually approach L_2 to L_1 by turning the knob controlling the moving coil in a clock-wise direction, and at a certain point a plop or click should be heard, after which a faint hissing or rushing sound is

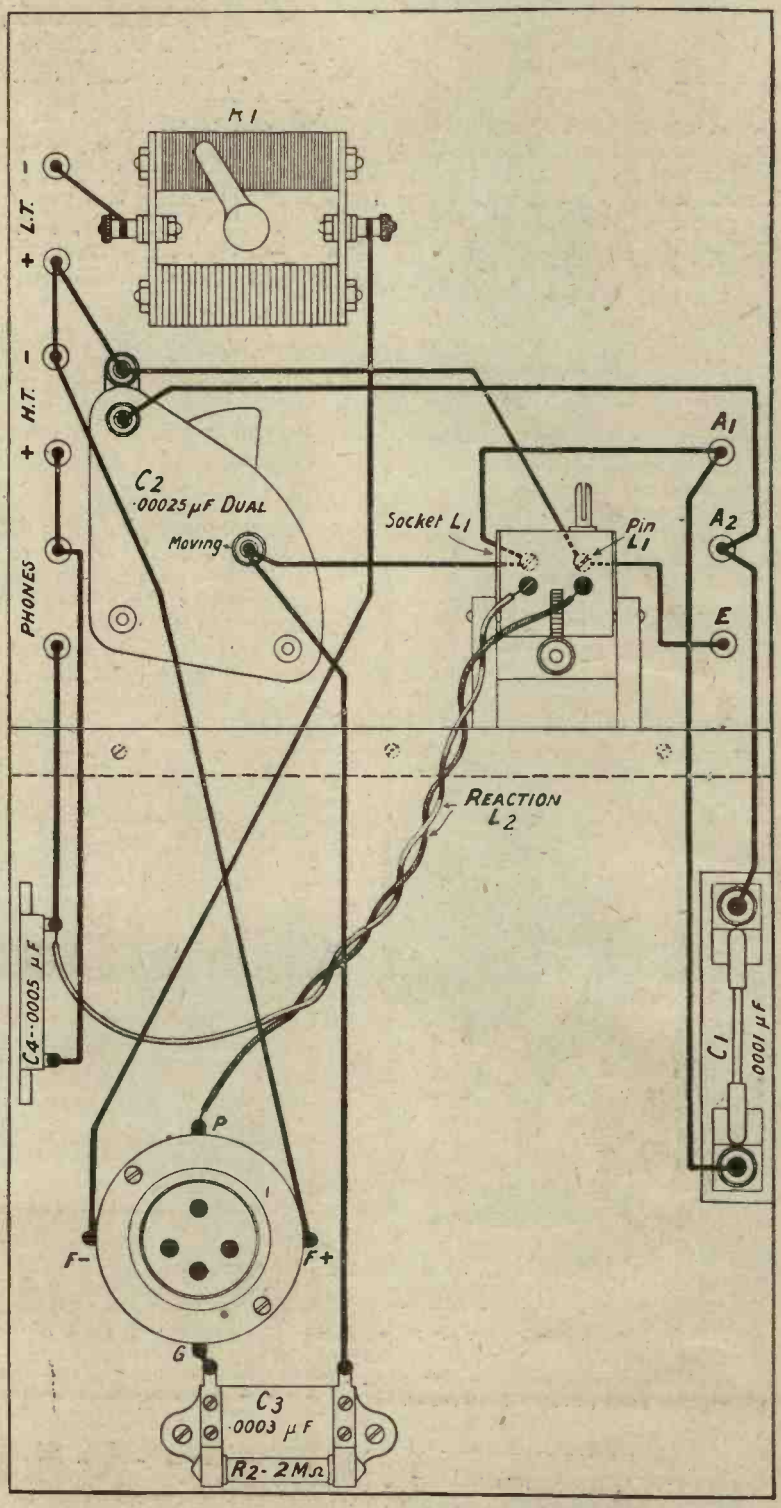


Fig. 3.—The connections given should be carefully followed. Note that the dotted connections on the coil-holder are those to the aerial coil, the reaction leads being shown in full.

See Stand 33 ALBERT HALL

L. F. TRANSFORMERS

All-Purpose Model. Specially designed to serve as first and second stage. In brown metal case, which excludes moisture.

Cat. No. 5152. Price **15/-**

De Luxe Model. Constructed with one primary winding, with a secondary winding on either side; therefore minimum of self-capacity with greater amplification, which remains constant over a wide band of frequencies. Black metal case.

Cat. No.		Price.
5150	High Ratio (first stage)	**27/6**
5151	Low Ratio (second stage)	

STANDARD. Height 22ins.

JUNIOR. Height 18ins.

TOM TIT. Height 13¼ins.

LOUD SPEAKERS

For purity of tone they stand alone.

STANDARD—2000 ohms. Black Satin Enamel. Cat. No. 5016 - - - - - **New Reduced Price 90/-**

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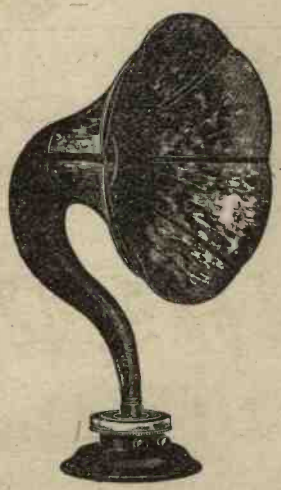
4000 ohms. Cat. No. 5021 **New Reduced Price 100/-**

JUNIOR—2000 ohms. Black Satin Enamel. Cat. No. 5007 - - - - - **55/-**

TOM TIT—2000 ohms. Black Crystalline. Cat. No. 5001 - - - - - **New Reduced Price 27/6**



ALTERNATIVE TYPE OF HORN.

For those requiring a non-metallic horn, we can supply our speakers with imitation tortoise-shell flare as illustrated.

(2000 ohms.)

STANDARD.	Cat. No. 5017	**5:5:0**
JUNIOR.	Cat. No. 5008	**3:5:0**
TOM-TIT.	Cat. No. 5003	**1:10:0**

HORNLESS LOUD SPEAKER

This has been designed for those requiring an instrument to harmonise with the furnishing of a room. It is compactly encased in a richly polished mahogany cabinet, 15½" long, 9½" wide, 9" high. Although comparatively small, it is equal in efficiency to our other types—has excellent tonal qualities and good volume. Cat. No. 5040. Price **105/-**

GRAMOPHONE ATTACHMENT

By utilising the tone-arm of a gramophone for the acoustic amplification of radio reception, a very effective Loud Speaker is provided. This attachment readily replaces the sound-box and produces excellent results.

Cat. No. 5210 2000 ohms Price **25/-**

USE "ACTON" ACCUMULATORS

A new range of low-tension Accumulators composed of separate 2-volt units. Produced at Acton in one of the finest equipped accumulator plants in the world. Note the following prices:—

Ign. Cap.	2-volt.	4-volt.	6-volt.
40 amps.	11/-	22/-	32/6
60 amps.	13/6	27/6	40/-
80 amps.	16/-	32/-	48/-
100 amps.	18/6	37/6	56/-

H.T. 3. The Wonder Wireless Battery.

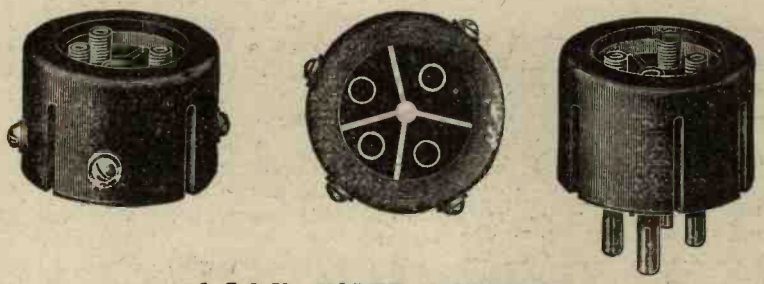
Outlasts dozens of dry cells and gives better results. Fully charged **60/-**

for these New C.A.V. Productions

MULTIPLE FIXED CONDENSER

This has been specially designed to enable a selection of fixed capacities being obtained from one instrument. By connecting up the indicated capacities in parallel as required, any range can be used to suit the individual set

Cat. No.		Price.
5190	.001 to .015 M.F.	5/-
5191	.0001 to .0015 M.F.	



A.C.A.V. VALVE HOLDERS

Of unique design, the A.C.A.V. Valve Holders are unequalled for their achievement of Anti-Capacity and Anti-Vibration results. For adapting to existing valve sockets, it is fitted with split pins as illustrated, whilst it can also be supplied for screw fixing.

Cat. No.		Price.
5200	A.C.A.V. Valve Holder	4/6
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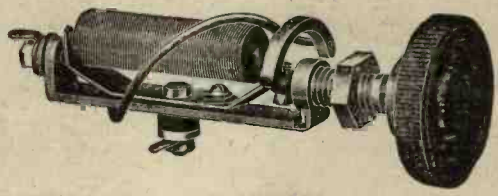
FILAMENT RHEOSTAT

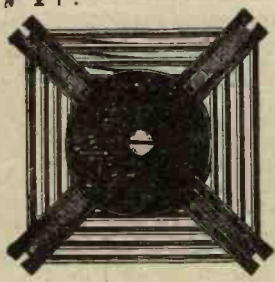
With helical worked arm and interchangeable resistance unit. Very smooth and silent action. By means of a patented construction, the rotation of the contactor causes the resistance unit to revolve with it, thus ensuring smooth and silent action. The resistance unit can be instantly detached when required, to change from bright to dull emitter valves.

Cat. No.		Price.
5220	7 ohms resistance	5/-
5221	30 „ „	



TUNING COILS

With winding totally enclosed, these coils are wound with bare wire on a bakelite former. The illustration below shows the method of interior construction and indicates clearly the ample air space between windings. All coils have the same external dimensions—4" x 1".



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heard in the headphones. This indicates that the receiver is oscillating and that the reaction coil is correctly connected. If this does not occur reverse the leads going to L_2 and try again. It is most important that this point be got right, otherwise it will be impossible to receive anything but the local station.

Some Preliminary Tests

The aerial and earth leads may now be connected under their respective terminals; unless there is any particular reason why it would be preferred to use parallel tuning, these will be A_2 and E, by which the benefit of using both series and parallel tuning is obtained. Before connecting the set up to the aerial, the reaction coil should, of course, be swung well away from the aerial coil. If broadcasting is not in progress it would now be advisable to test for oscillation control. Bring the reaction coil up as before and the set should go smoothly into oscillation; if, however, it goes with a plock or loud plonk, different values of H.T. should be tried, small adjustments of filament current made, and lastly different values of grid leak substituted.

Coil Sizes

When broadcasting is in progress, find out which coil brings in your local station at the correct condenser setting; that is, if it is a relay with a wavelength of about 300 metres, it should come in at a low condenser reading; if Aberdeen, at the top of the scale. Suitable values for the coils to use will probably be a 50 or 75 for the aerial coil when series tuning is being employed as well as parallel, and a 35 or 50 for reaction. With some aerials it may be found that a 50 does not go quite as high as Aberdeen, and a 75 as low as Cardiff, or some of the relay stations working on a lower wavelength; in this case an intermediate size such as a 60, which is obtainable in several makes, will probably be found suitable.

Reception of 5XX

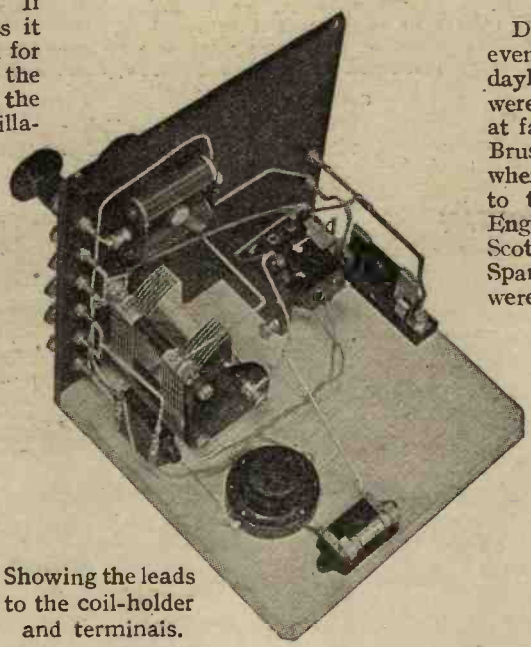
For Daventry the aerial may be connected to A_1, and A_2 and E be connected together and to earth. This will give parallel tuning with both sections of the dual condenser connected in parallel; a suitable size for the aerial coil L_1 will be a 150, with a 75 or 100 for reaction.

With a "stiff" aerial larger reaction coils than those mentioned may, of course, be necessary.

Searching for Distant Stations

Other stations may now be searched for by bringing the receiver into its most sensitive condition, namely, by bringing it to the point just short of oscillation, when carrier waves will be picked up as a slight hiss. If, however, whistling noises are heard which change in note only when the condenser dial is turned, the receiver is oscillating and the reaction coupling should be loosened at once, as you may be causing considerable annoyance to other set users.

A little practice will soon show you how to handle this set and get the best out of it, and it will be found surprising what large distances in reception can be covered with a single valve. If any drop in signal strength is noted when the condenser is nearly all out, it will be advisable to clip in a ·0001 μF, or even in some cases a ·0002 μF condenser in the mount fixed near the aerial terminals. This connects a small condenser in parallel with the series portion of the dual condenser, for if the value of this is too low sufficient energy from the aerial may not reach the tuned circuit L_1, C_2, to operate the valve or to produce any but weak signals.



Showing the leads to the coil-holder and terminals.

Test Report

When tested on the writer's aerial a very convenient size of aerial coil was found to be a No. 60, while a Gambrell B also was satisfactory. It was possible to cover the whole of the broadcast wavelengths with either of these coils, and even with the latter coil it was possible to get down below 200 metres, while its top range was just on the 600 metre mark. This was without using C_1, the clip-in condenser by means of which the series portion of the tuning condenser may be augmented, and the aerial being connected to A_2.

Coils for Daventry

For Daventry and Radio-Paris a 200 coil for L_1 with 100 reaction will be found the correct size when using series tuning. With the aerial at A_1, and earth to E and A_2 joined, a 150 for L_1 will be large enough.

Stations Heard

During a short test in the early evening, when it was still full daylight, three B.B.C. stations were received without difficulty at fair strength in the phones, and Brussels, too, was strong, while when it got dark it was possible to tune in station after station, English (both main and relay), Scotch, French, German, Belgian, Spanish, etc. Over twenty stations were picked up in half-an-hour, notwithstanding serious interference from 2LO working at full blast within about three miles. Even a wave-trap does not completely eliminate this station's transmission, and it comes through on anything lower than 5NO or higher than Petit Parisien. Several stations that were heard could not be identified as they were working on wavelengths not given. They may possibly be new stations, or else old ones that have wandered away from their true wavelength. In view of the poor conditions obtaining at the writer's station (a mansion overshadows the whole of the aerial), results are very good indeed with this receiver, and many an interesting hour can be spent with it doing a little "aether searching."

THE WIRELESS EXHIBITION

Visitors to the Wireless Exhibition at the Albert Hall (Sept. 12th-23rd) should not fail to see the Radio Press stands, Nos. 51 and 52. Members of the industry should also make a point of visiting Stand No. 73, which is allotted to "The Wireless Dealer," the new trade journal of Radio Press, Ltd.

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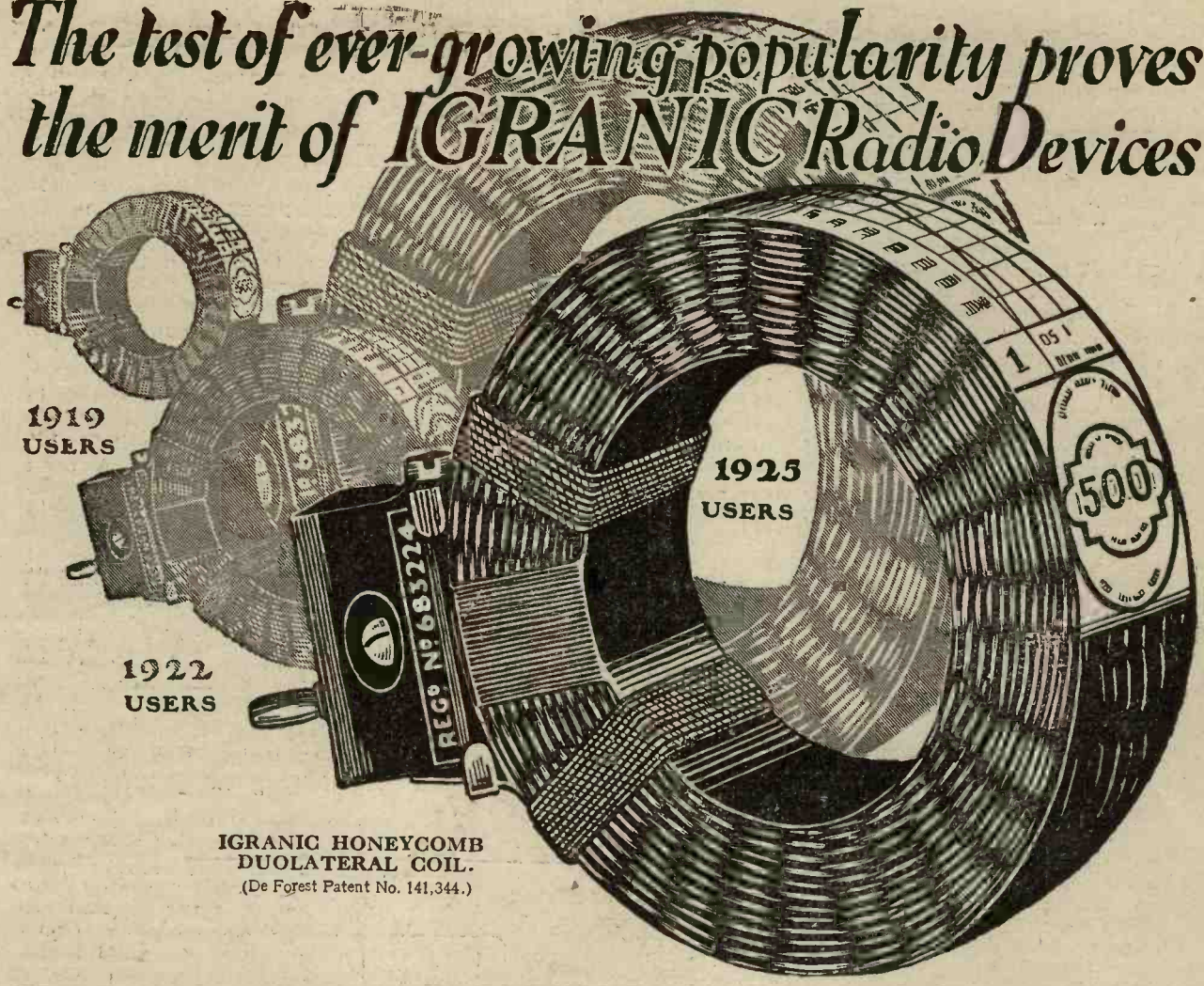

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Experimenting with the Low-Loss Reinartz Receiver

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

Some further notes upon the interesting receiver described in our last issue

LAST month exigencies of space compelled me to compress the account of the operation and general use of the low-loss Reinartz receiver into the absolute minimum of words, and a number of points were of necessity omitted altogether.

The question of the method of arranging the set for reception of 5XX, for example, requires further amplification. To receive the 1,600 metre wave station, the shorting plug is removed from the aerial circuit loading coil socket, and replaced by a coil of size No. 150. The choke coil now becomes the reaction coil in an ordinary single valve circuit, and the adjustment of the angle between these two coils should enable sufficiently strong reaction effects to be produced to enable 5XX to be heard at quite good strength. The right-hand condenser will also serve to adjust reaction on this wavelength, provided that the choke coil is not too large. For example, a 150 or 200 coil should now be used in the choke coil socket, to give the most convenient adjustment with the majority of valves. When such an angle between the coils has been found that by placing the reaction condenser at zero, the set does not oscillate, but begins to do so as the reaction condenser is increased to, say, half scale reading, both the coil sockets can be finally screwed down upon the baseboard.

Size of Choke Coil

The size of choke coil to use upon the ordinary broadcast band is largely a matter of expediency, but in general the larger this coil the better. Certainly, nothing smaller than a No. 150 should be used. A No. 300 is a desirable size, and the type employed should be such as possesses only a small self-capacity, in other words, a "good" type of coil should be employed.

The actual operation of the receiver is a matter which I should imagine most of the builders of the set will by now have grasped. It should, perhaps, be emphasised that the methods of obtaining the necessary fine adjustments of tuning and reaction respectively are for the first the vernier condenser, and for the second the variable grid leak. This latter I find to give an exceedingly fine and smooth control, and this is of considerable importance in receiving weak signals. The procedure should be to find out at what particular value the grid leak should be set to give a smooth and gradual passage into oscillation by means of the reaction condenser, and then final adjustment of reaction should be made when required by slight movements on either side of this grid leak setting.

Wavelength Range

The wavelength range given by the coil is a matter in which individual preference must play a certain part, and it will be remembered that I said that the number of turns for this coil should be about 65. This is the actual number in my own set, and the wavelength range which it gives is from 302 to 634 metres. This, of course, omits certain stations below 300 metres, such as Brussels, which the constructor may desire to hear. I do not recommend in the case of this particular set that the number of turns upon the coil should be reduced so that it should cover such a band as, for instance, 250 to 500 metres, since if this is done a certain sacrifice of signal strength in receiving the longer wave stations will result.

A better method is, in my experience, to make a tapping at, say, the 50th turn upon the coil, and provide some means of attaching the lead which normally goes to the upper end of the winding to this tapping point instead. This is very easily done if the lead in question is made of a short piece of flex, carrying upon its end a Burndept tapping clip. A point should then be scraped bare upon the 50th turn, and to this a short piece of tinned copper wire should be soldered, with an end projecting about half an inch, so as to afford a good grip for the clip. The lead can then be very readily transferred from the end of the coil to the tapping point as required.

Selectivity

We now come to the question of the adjustment of the degree of selectivity given by the receiver, and here a little alteration to our coil will be necessary. This alteration merely consists in preparing some tapping points upon the aerial and reaction winding, which it will be remembered is composed of double cotton-covered wire. What is to be done is to take a penknife, and to prise up slightly a point in the 10th, 12th, 14th, 16th and 18th turns, counting downwards as the coil stands upon the base board. At each of these raised portions the wire is then scraped bare, and a short piece of tinned copper wire is soldered on, the result being shown in one of the

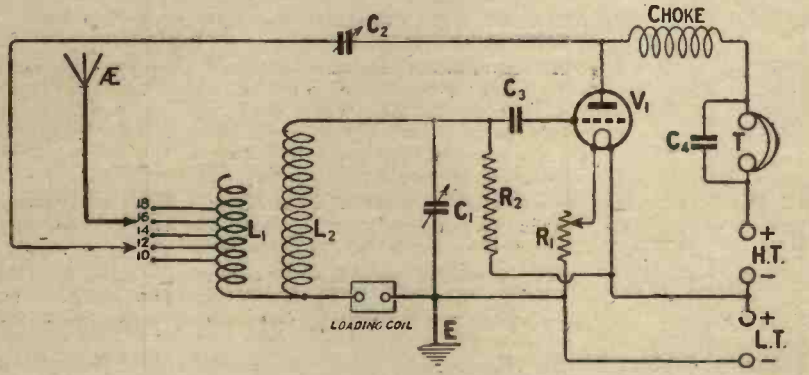
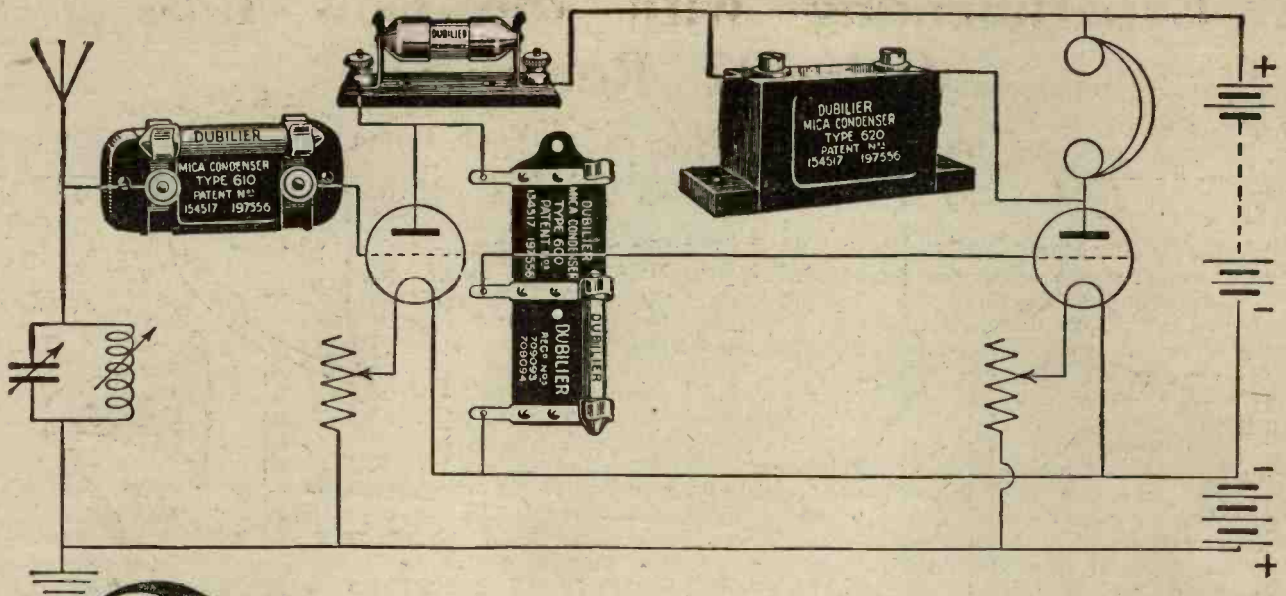


Fig. 1.—The revised circuit, showing the tapping points on the aerial-reaction coil.



Further Small Matters—

THE components illustrated above are small but important. They are the highly specialised products of a notable firm—one which, among other things, was responsible for the introduction of Mica Condensers. Further, these components are characterised by the now well-known Dubilier standards of neatness and finish in construction and reliability in operation.

There is the Type 600 Dubilier Mica Condenser, for example:—a fixed condenser whose capacity is guaranteed by us to be accurate within close limits that are not often met with elsewhere.

A new Dubilier Grid-Leak Attachment is sold for use with it, and is illustrated above. It enables a Grid Leak to be inserted direct between the Grid and L.T. leads simply by clipping in, making use of one of the condenser clips and the clip on the attachment.

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The new Dubilier Type 610 Mica Condenser is also shown. It was dealt with in a previous advertisement of this series—"Little Things that Matter." It is suitable for use everywhere in receiving circuits, and is provided with screw terminals and detachable Grid Leak Clips.

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Grid Leak Attachment, 6d.
(for use with Type 600).

Anode Resistance
complete with holder
20,000—100,000 ohms. 5/6

Grid Leak
0.5, 1, 2, 3, 4 & 5 megohms. 2/6

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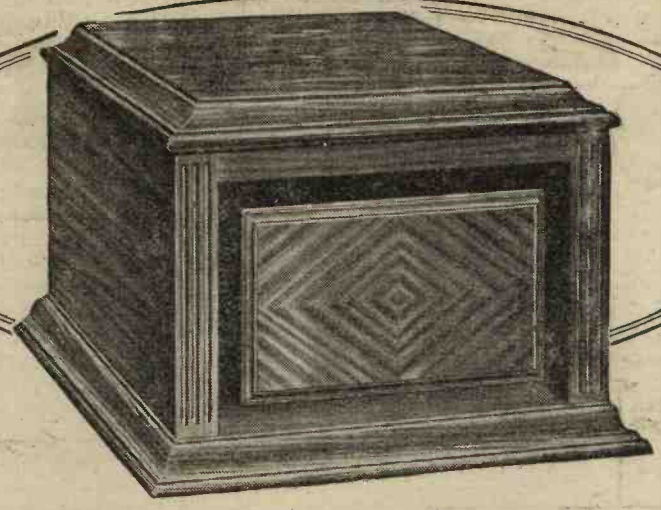
BRITISH THROUGHOUT



As pleasing to the eye as to the ear

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IT has been left to the manufacturers of the first Wireless Loud Speaker to produce the first British Cabinet Loud Speaker. The handsome Instrument illustrated above is a welcome relief to some of the more usual type of Loud Speakers. Beautifully finished in a rich rosewood shade and made of the best mahogany, it will undoubtedly achieve a very wide measure of popularity.

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At last we have been able to produce the new Brown A-type headphones at the sensational price of 30/-. The same famous tuned reed movement is used. At such a low price you cannot afford to be without a pair of genuine Brown A-type Headphones—famous throughout the world. **30/-**

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A new Lond Speaker embodying all the well-known Brown features. Although only 15 inches high it gives the same superb tone as the larger H1 and is equally clear on speech and music. No other Loud Speaker on the market within several pounds of its price can give such a fine volume as the H3. In all resistances. **£3**

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We are proud of being able to offer a real Brown Loud Speaker—British throughout, and a replica in every detail of the larger models—at the amazingly low price of 30/-. Small in size but big in performance it is wonderful value for money. 2000 ohms. Height 10 inches. **30/-**

The New Crystavox

The new and improved horn now fitted to the Crystavox will enable this Loud Speaker to give an exceptional volume of sound direct from a Crystal Set without the use of valves. The powerful Daventry Station will permit thousands of Crystal Set users to get Loud Speaker results direct from a Crystavox. **£6**

small sketches accompanying these notes. To any one of these tapping points it is then possible to attach a Burndept clip carrying a lead, and we shall require two of these clips in addition to the one already mentioned.

It is desirable to be able to vary the number of reaction turns independently of those used for coupling the aerial circuit to the secondary winding, and to do this it is necessary to remove the lead which previously ran from one side of the reaction condenser to the

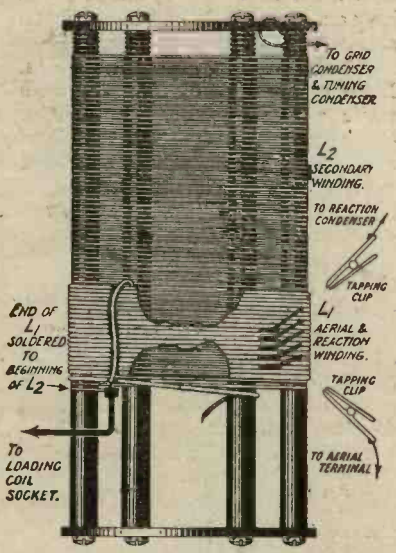


Fig. 2.—Details of the coil showing addition of tapping points.

aerial terminal. Simply unsolder the end which was at first attached to the aerial terminal, and leave this wire sticking out in the air. To the loose end thereby produced solder about 4 in. of flex, whose other end is to carry one of the tapping clips. This clip is then attached to one of the tapping points which have been made, and it will probably be found that almost the full number of turns can be used with advantage, a reduction to, say, 16 turns sometimes being a slight improvement.

To the aerial terminal should now be soldered another short length of flex, again carrying a tapping clip upon its end, and this may be attached to one of the tapping points which we have made, in order to vary the number of turns in use in the aerial circuit. This last adjustment is by far the most important one in the whole set, and a little care and patience should be devoted to it. In general, the smaller the number of turns used in the aerial circuit the sharper will be the tuning of the set, and the less the interference from the local station, but if this reduction is carried too far the signal strength of the distant stations will suffer.

Reduction of Aerial Turns

In my own set I find that, if the number of turns in the aerial circuit is reduced to 10, signal strength is just perceptibly beginning to suffer, but tuning has become remarkably sharp and the distant stations are exceedingly pleasing to listen to, on account of the absence of general spark jamming and the other casual sources of interference which do so much to mar long-distance reception. This, perhaps, is a matter for individual taste, and many people may prefer to have somewhat greater signal strength with a little more jamming.

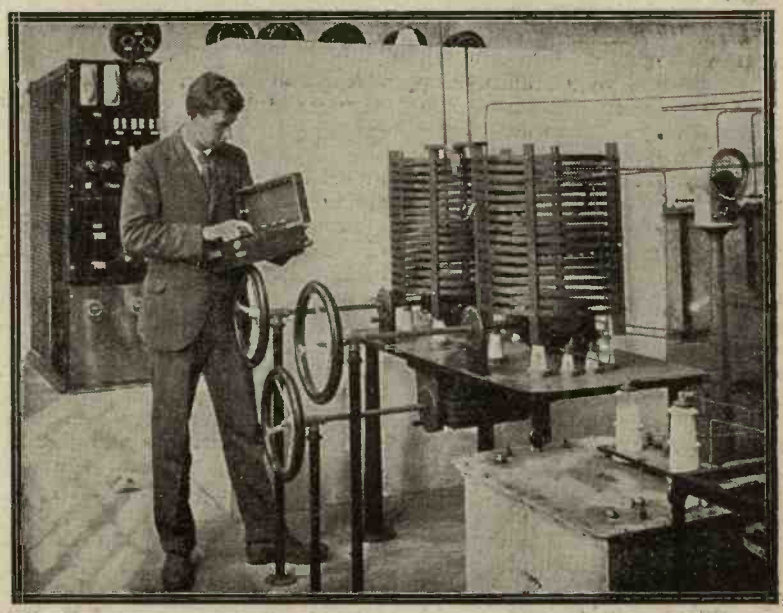
A Wavetrap

The tuning is so sharpened by a reduction of turns in the aerial circuit that interference by a local broadcasting station is very much reduced, but, in cases where such local interference is severe, I would strongly advise the reader to try the type of wavetrap developed by Mr. Cowper for this circuit, and with which I have had really remarkable results. Using a large and high aerial only about seven miles from the new 2LO station, with the aid of this wavetrap I find that, with this particular circuit, the interference problem is perfectly solved, since 2LO simply vanishes off the dial, and there is no perceptible alteration in the signal strength of the distant stations, although their settings upon the dial are changed by the inclusion of the wavetrap. With the trap in use, I have heard Bournemouth without the slightest sound from London, and this without any difficulty or delicacy of adjustment. One simply sets the wavetrap, once and for all, and then proceeds to forget all about it and search for the distant stations in the ordinary manner. The effect is much as though 2LO had closed down and

Fig. 3.—How the tapping points are made.

left one free to hunt for distant signals.

The addition of such a wavetrap is an exceedingly simple matter, and all that is required is a variable condenser of ·0005 μF and a coil in a socket. Connect these two in series, that is to say, take a wire from the moving plates of the condenser to one side of the coil holder. From the other side of the coil holder then take a wire to the earth terminal of the receiver, and from the fixed plates of the condenser take a wire to the aerial terminal of the receiver. Aerial



The new high-power station at Daventry. One of the engineers is here seen checking up the wavelength by means of a wave meter which he is holding.

and earth are connected as usual and the procedure is as follows: Set the dial of the receiver to a tuning adjustment which is fairly close, although not actually upon, that of your local station. Then insert a fairly large coil, say, a No. 75 or a Gambrell "C.", in the coil socket on the wavetrap arrangement and proceed to turn the wavetrap condenser very slowly until you find a point at which the signals from your local station fade down practically to nothing and upon either side of which they reappear. Having done this, simply proceed to search for the other stations in the usual manner with your receiver, being prepared for the fact that their settings will now have altered somewhat.

Size of Trap Coil

I have found this trap invariably successful whatever size coil is used in the socket which I have mentioned—that is to say, any size of coil which covers the wavelength will practically eliminate the local station, but there is definitely a best size so far as the reduction of the alteration in the settings of the different stations is concerned. On my own aerial and earth with the receiver which we are considering the effect of a rather small coil in the wavetrap with a consequently large reading of the wavetrap condenser is completely to upset the wavelength range of the Reinartz receiver. With such a circuit in operation the set will only tune down to about 380 metres, but this I have remedied by the use of a much larger coil and a smaller condenser setting in the trap circuit. The wavelength range is then very little affected.

The number of turns included in the aerial circuit by means of the appropriate tapping clip also affects this matter of range.

Wavetrap Coil

The coil used in the wavetrap must necessarily be one of low high-frequency resistance—that is to say, it must be a "good" coil. I have found the Gambrell "C" satisfactory, and, those who may care to wind their own coil instead of obtaining a number of plug-in coils to try, may do so by winding 80 turns upon a 3 in. diameter ebonite tube, preferably of No. 20 d.c.c. wire. This should be thoroughly dried, and *kept* dry. A tapping should be taken along this coil every ten turns after 50 turns have been wound on—that is to say, at 50, 60 and 70 turns. A little adjustment will then soon enable one to find out the best number of turns to include in the circuit with the wavetrap condenser.

Results

Before leaving the subject, it may perhaps be useful to give a fuller idea of the results which have been obtained with the original receiver. When I first finished the set I was decidedly disappointed with the results, since it was first tested early in August, when reception conditions were at their worst and most summery. Comparison with an ordinary plug-in coil single-valve set, however, soon showed that the low-loss Reinartz was in actual fact giving remarkably good results.

Mr. Kolin Hagen, the chief announcer at WGY, whose voice is familiar to many British listeners.

Since that time, of course, conditions have very much improved, and upon trying out the set on a recent evening when wavetrap experiments were being carried on, I succeeded in obtaining clear and distinct signals from every one of the main B.B.C. stations, with the exception of Cardiff, which was not separable from London with the wavetrap arrangement available. Of the stations heard upon this occasion, Bournemouth, Birmingham, Newcastle and Belfast were really loud. Munster, Hamburg, the School of Posts and Telegraphs (Paris), Madrid, and three unidentified German stations were all also heard at quite good strength.

Results with the Twin-Valve Receiver

(Radio Press Envelope No. 10)

SIR,—I think you might be interested to hear of my results with the "Twin Valve" described by Mr. John Scott-Taggart in THE WIRELESS CONSTRUCTOR for January.

Results are the finest that myself and scores of friends have ever heard, the aerial being about 80 ft. long and average height about 35 ft. single.

All stations in England come in, Birmingham and Bournemouth while 2LO is working, the latter (Bournemouth) on Sterling "Dinkie," perfectly audible at about 7-8 ft. on speech, while music is quite loud. Sunday nights between 5.30 and 8.30 most of the French and German stations are quite audible in the phones. Three Sundays ago conditions must have been very good, or else I was particularly lucky, as Hamburg, broadcasting opera, was heard by all the members of my family on the loud speaker, sitting about 3 ft. away. I have now had sufficient time to judge the capabilities of this set, and I doubt whether there is a more efficient type of set on the market made by an amateur.

London is painfully loud on the speaker, and the set has to be detuned.

I hope this letter will be of some interest, and if only those howlers would give up those "super" sets and build one such as the "Twin Valve" I think there would be more peace during broadcast hours and better results.—Yours faithfully,

E. W. SHEPHERD.

Upton Manor, E.

P.S.—This is no first-set effusion, as I have made four sets from *Modern Wireless* and THE WIRELESS CONSTRUCTOR.

Appointment of Mr. J. H. REYNER, B.Sc., A.C.G.I., D.I.C., to the Staff of Radio Press, Ltd.

A recent portrait of Mr. Reyner.

IN connection with the development of our Research Laboratories at Elstree, we have considerable pleasure in introducing to our readers Mr. J. H. Reyner, who recently joined the staff of Radio Press, Ltd.

Mr. Reyner, although comparatively young, is possessed of high qualifications, his career at the City and Guilds (Engineering) College being a record of successes.

On entering college he went straight into the second year, at the end of which time he obtained the John Samuel Scholarship for the best student of the year.

At the conclusion of the third-year course he obtained the Associateship of the City and Guilds Institute (A.C.G.I.), and again headed the list of successful candidates, thereby gaining the Unwin Scholarship. He further achieved the distinction of gaining the Henrici Medal for the best student in Mathematics.

He followed this up with a fourth-year course in research work, under Professor G. W. O. Howe, on Radio Telegraphy and Telephony, at the conclusion of which he was awarded the Diploma of the Imperial College (D.I.C.).

During the same year he also obtained the B.Sc. Honours degree of the University of London, the special subjects being Electrical Engineering and Mathematics. Perhaps, Mr. Reyner's qualifications can best be appreciated from the following extract from an official college document: "This brilliant record is nearly, if not quite, unique in the annals of the college."

Experience in the Post Office

Since leaving college in 1920 Mr. Reyner has been engaged with the Post Office Engineering Department. He has been responsible for the design of receiving equipment at the various coast and other stations controlled by the Post Office.

This work has been of a varied nature, involving the design and construction of all types of receiving apparatus from simple "one knob" sets up to multivalve highly selective equipment. In the course of the work he has obtained practical experience of the use of transmitting and receiving apparatus in all parts of the country.

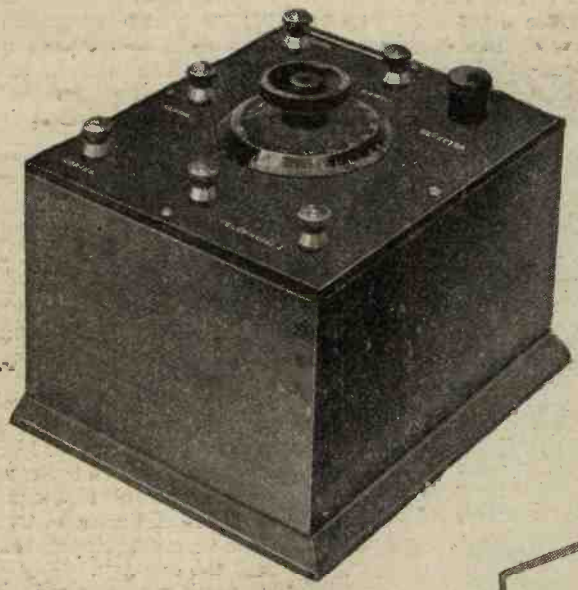
He has further been responsible for the design of complete receiving stations which have been erected under his supervision, including, in some measure, the Direction Finding Service, which is now being rapidly developed, so that he has been able to keep well in the forefront of developments in wireless reception.

Mr. Reyner has already obtained considerable experience in the preparation of articles of interest to the radio public, and has, in fact, written two books on the subject. One of these, "Modern Radio Communication," is fast becoming accepted as the standard low-priced textbook on wireless.

The second book, entitled "Radio Engineering," is a very valuable collection of data, which embraces every phase of the science, and was published by Radio Press, Ltd., on September 1.

Mathematics, as such, are of little interest to the average reader. Mr. Reyner, however, while intimately conversant with the more technical and mathematical aspects of radio, is an expert in the art of investigating problems from a theoretical and practical standpoint, and subsequently placing the results obtained in a very simple form, easily understood by the non-technical public.

Our readers may, therefore, look forward to a series of most helpful articles from Mr. Reyner's pen, many of which will be the result of research work carried out at our new laboratories, and of which a large proportion will indicate, from theoretical considerations, the most fruitful lines of experiment on any given subject.



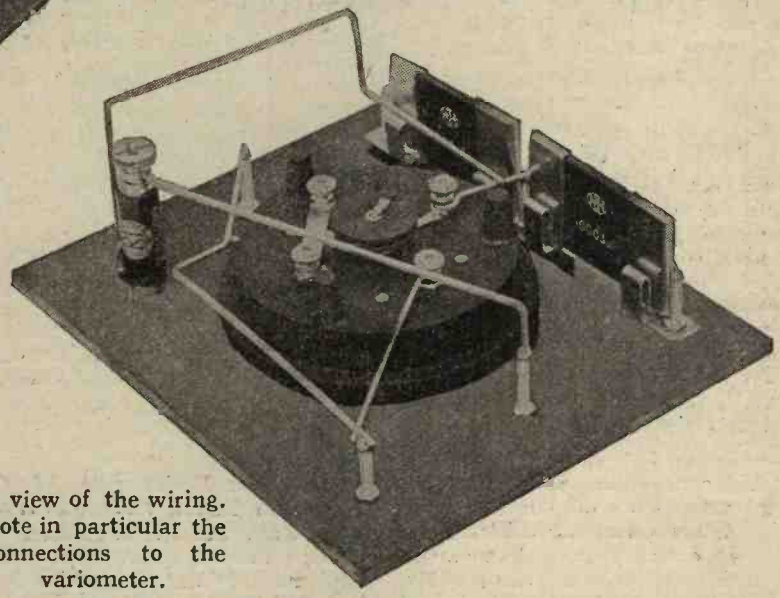
How to Build a Variometer-Tuned Crystal Set

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

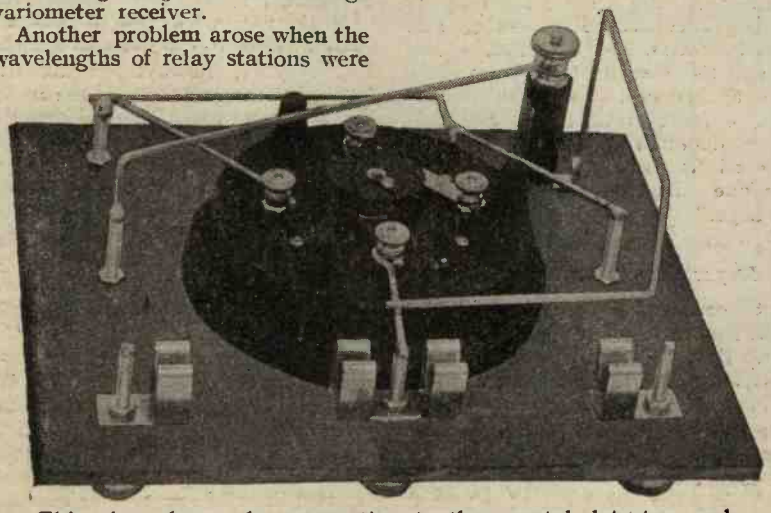
Variometers have not attained great popularity on account of limited tuning ranges, but with the introduction of a new type this difficulty is overcome, and the set described will be made by many readers

WHEN the British Broadcasting Company's stations were first erected, and before the long wave station at Chelmsford came into operation, variometers were quite popular for tuning crystal sets. For the benefit of new readers who are not acquainted with all wireless terms, it may be stated that a variometer consists of two coils of wire, one of which can be rotated either within or close to the other, the tuning effect being such that it varies as the angular relation of the two coils varies, giving a progressive increase of wavelength tuning between the two limits of the scale. The disadvantage of variometers is, however, that they will not generally cover a very wide range of tuning, so that when the 5XX station was started it was found to be beyond the tuning range of the average variometer receiver.

Another problem arose when the wavelengths of relay stations were made so short as to reach the 300 metre mark, for then it was necessary for a successful commercial receiver to be able to tune to any wavelength from 300 to 500 metres. It is difficult for a single variometer, unless it is very efficiently designed, to cover this range with all aerials. Variometers are more sensitive to changes of aerial than most other tuning systems, owing to the great influence of the aerial capacity.



A view of the wiring. Note in particular the connections to the variometer.



This view shows the connection to the crystal detector and fixed condenser clips.

Reception of 5XX

The variometer crystal set described in this article, however, is free from any of the faults mentioned. By the use of two fixed condensers it can be adapted to almost any aerial and will, in addition, receive 5XX satisfactorily. The appearance is neat, and as no loading coil is required, the space occupied by the complete receiver is less than is often the case. The photograph will show the construction clearly, and the wiring diagram will show you how simple it is to join up. The component parts are few, and are as follows :—

One Dubilier Mansbridge variometer.

Six terminals.

One panel of ebonite or other

suitable insulating material, 7 in. by 6 in.

One fixed condenser with clips, ·0003 μF (McMichael).

One fixed condenser with clips, ·002 μF (McMichael).

One crystal detector for back of panel mounting (R.I. Permanent).

Suitable box.

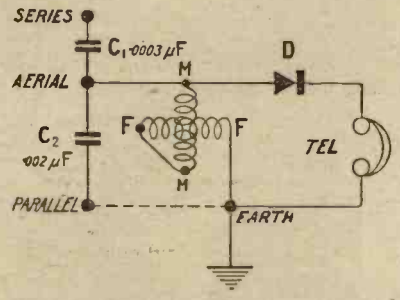


Fig. 1.—The dotted connection is only made when it is desired to receive 5XX.

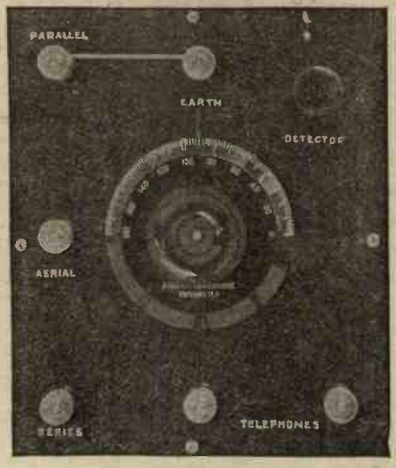
Radio Press Panel Transfers

In the package of the variometer you will find a paper template, which will show you exactly where to drill the holes in the ebonite panel for mounting. It will also tell you the drill sizes. Two screws are provided with the variometer for fixing to the panel, and you will notice that there are two strips to join the terminals at the back. Only one of these strips should be used in this set in the way shown. The permanent detector is of the "one-hole fixing" variety, and is provided with a cover for the adjusting knob. Once a suitable setting of this crystal has been found it can be left for very long periods, if not indefinitely, and should not be changed without good reason.

Condenser Clips

Notice particularly the position of the clips for holding the fixed condensers. Two of these clips are made to overlap, so that the two holes are superimposed. A terminal is passed through these holes, and locked into position with a lock-nut. Be careful to place the two fixed condensers in their correct positions. Wiring up is so arranged as to be simple and short.

The set is very easy to use, and you will soon find the best tuning positions. If you have a very long aerial and the wavelength you desire to receive is on the shorter end of the B.B.C. scale, connect the aerial to the lowest terminal on the front left-hand side of the receiver, and leave the two upper terminals open. The earth is always joined to terminal E. Try, also, connecting the aerial to the middle left-hand terminal instead of the lowest. You will probably receive good signals on both of these arrangements, the only difference being the position on the tuning scale. One of these arrangements will probably be better than the other for your particular aerial, and once you have found it, adhere to this for your local station To receive 5XX, it is merely necessary to place the aerial connection on the middle terminal, and to join the terminal marked "Parallel" to the terminal "Earth." You will then find 5XX on the upper end of the scale.



A straight-on view of the panel.

Extra 'Phones

If you desire to use more than one pair of telephones in this set, you can easily do so. For two pairs place one tag of each pair of telephones under each telephone terminal, and join the other two tags with a connector.

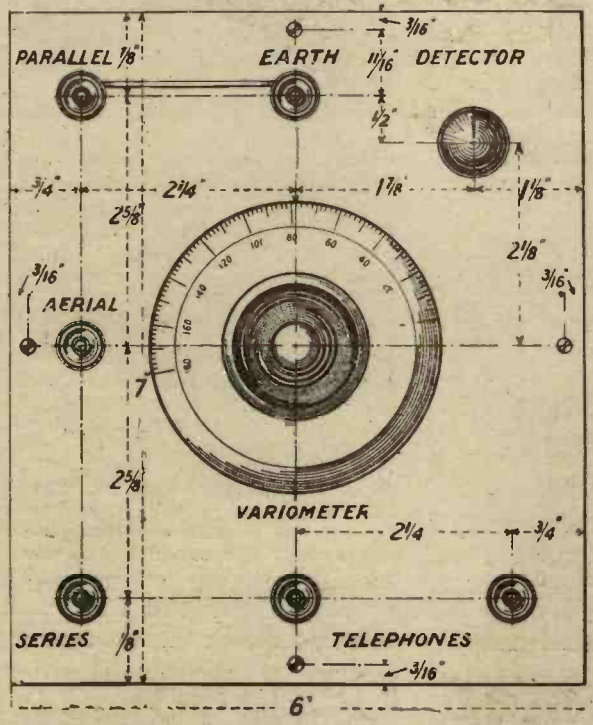


Fig. 2.—How to drill your panel. A drilling template is supplied with the variometer.

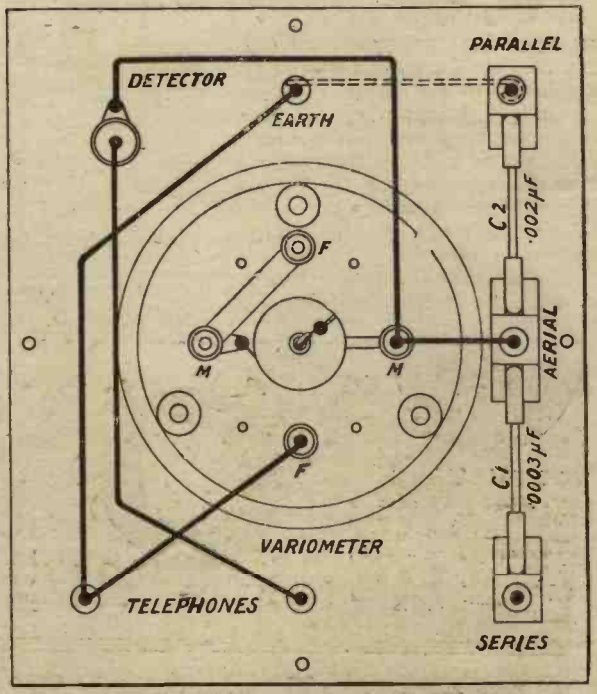
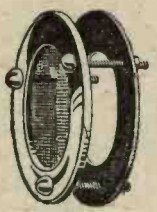


Fig. 3.—The wiring is carried out like this. The dotted connection indicates the strap on the face of the panel.

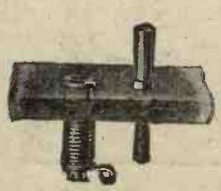
"ANTIPONG" VALVE HOLDER

Low loss, anti-capacity and shock absorbing, this holder prevents all microphonic noises in Dull Emitter Valves and reduces inter-electrode capacity to a minimum. Valve legs are surrounded by air and attached by Phosphor Bronze springs to a bakelite ring that will not melt under soldering iron. Universal fitting, with screws for baseboard or panel mounting **3/-**



VALVE WINDOWS

Superior appearance and finish. Made of heavily nickel-plated brass. Outside diam. 1¼in., gauze covered opening, 1in. Rounded edges. Supplied complete with backing plate and all screws, etc. **9d.**



COIL PLUG AND SOCKET

Three types made. One for baseboard mounting with top connection; another mounted on circular ebonite flange for use on Wood Panels and Cabinets; a third consisting of plug and socket only for panel mounting. Baseboard or Flange Type, 2/6 each. Panel Mounting Type **9d.**

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Reasonably priced instruments for Panel Mounting. Specially made for sets using Dull Emitter Valves. Current consumption at 3 volts, only ·045 amps. Instrument fits hole 2⅛in. diam. Beautifully finished **14/-**

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Every ounce of thought and care you put into building your sets is backed up and encouraged by the sheer responsiveness of Bowyer-Lowe Tested Components.

We expect you to demand from them a high standard of performance. They are made carefully, tested stringently, so that they will give you results which exceed your anticipation.

Every Bowyer-Lowe Product is fully guaranteed for one year, and dealers who stock these Products know they are desired to interpret that guarantee generously.

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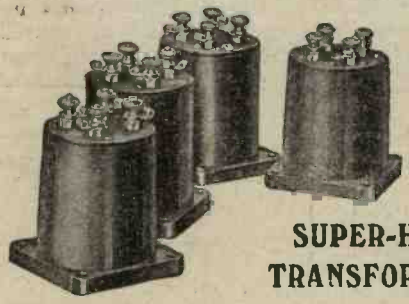


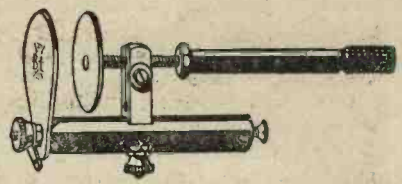
SUPER-HET. TRANSFORMERS

Built expressly for use with British Valves. These Transformers give unusually high amplification with purity of signals. Amateurs who have made the Seven Valve Receiver described in the brochure accompanying the Transformers say it surpasses any they have heard in selectivity and freedom from noisy background. The complete set of Transformers, individually matched and tested **£4**

OSCILLATOR-COUPLER

£1

MODEL II., a late development of Super-Het. design. Operates on direct coupled system without a pick up coil. More sensitive than older types of coupler. Covers 260 to 550 metres when tuned with Bowyer-Lowe ·0005 Square Law Condenser.



NEUTRODYNE CONDENSERS

Designed for use in Neutrodyne circuits, this instrument has also proved exceedingly valuable as a vernier when used in parallel with a larger condenser. It is invaluable in Super-Het. circuits. Fitted in panel with single screw and ⅜in. hole for spindle **5/-**

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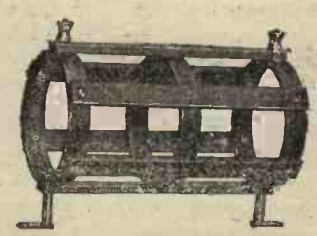
These components are very useful where it is desired to short circuit a reaction coil or to transfer connections from a coil holder to some other part of a circuit. Made of best ebonite, highly polished, and solid brass.

Short Circuiting Plug **1/6** Transfer Plug **2/-**



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Skeleton Formers should always be used to ensure efficiency, especially on short wavelengths. The series made by Bowyer-Lowe covers most needs of the amateur for both reception and transmission.

3⅜ diam. by 6in. long	5/-	4½ diam. by 8in. long	8/6
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4½ " " 6in. "	7,6	For A B C Wavetrap	2/6

A BALL-BEARING CONDENSER

If you have not had particulars of the new Condenser made by the Bowyer-Lowe Co., you should write for descriptive leaflet at once. The FOUR-SQUARE Condenser has balanced vanes, soldered in position and mounted on ball bearings. Each condenser has four available capacities, and its losses are appreciably lower than has ever previously been possible. Enquire about this instrument to-day.

Wireless Exhibition, Albert Hall, Sept. 12-23

Bowyer-Lowe Tested Components

RADIO WORKS [Wireless Exhibition, Albert Hall, Sept. 12 to 23] **LETCHWORTH**

Builds His Set

By "BROADCATCHER"

IT is quite a long time now since I told you anything of the adventures of Mr. Gumplethorpe, but that does not mean to say that he has not had any. Far from it. Life with Mr. Gumplethorpe since he took up wireless has been one long adventure. He knows now quite a lot about this great science. He has discovered (practically) something about voltage by placing his fingers inadvertently upon the output terminals of a set using a power valve; he knows what a difference aerial height makes, having fallen from both a high mast and a low one; he knows all about the effects of deep and shallow

He has discovered something about voltage!

earths, having dug the holes for both; he knows what it is to live at the rate of £10,000,000 a year, having blown up five valves in a fraction of a second through a misunderstanding about the high-tension leads. His knowledge, then, has increased by leaps and bounds since we last met him. But until quite recently he had never undertaken anything very ambitious in the way of building a set. His earlier efforts were what he called hook-ups, though to the casual observer they looked as if he had forgotten to do up most of the hooks. He did his wiring, too, in the cat's-cradle, Clapham Junction, Hampton Court Maze, or go-as-you-please style. But all this kind of thing is now passed. After a long and strenuous apprenticeship Mr. Gumplethorpe decided last week that the time was ripe for him to make something that was really worth calling a receiving set.

His Choice

As an earnest student of Radio Press publications he drank in the details of every set designed, and at one time had thoughts of making them all. As, however, he started rather late it occurred to him that he would never be able to catch up, and he did not like the prospect of being about two years behind. After much consideration and cogitation he narrowed down his selections to two. The choice lay between the "Flannelly Four" and the "Fan's Own Frantic Six," both of which were designed and produced by Mr. Hercy Parris in his happiest moments. Has it ever occurred to you to notice what beautiful names Mr. Parris chooses for his sets? Some time ago he produced one with a name so touching that no one could read it or speak it without a tear in his eye and a catch in his throat. This was the "Old Folks'" Receiver. Just say "old" to yourself, and you will find that you simply cannot help picturing granfer and grandma, toothless and bent but still smiling, sitting by the fire with the head-phones on. Granfer smokes his pipe, and chuckles and slaps his thigh every now and then, whilst grandma is so carried away by what she hears that she quite forgets to turn the heel of the sock which she is knitting for granfer, and makes the foot about a yard and a half long.

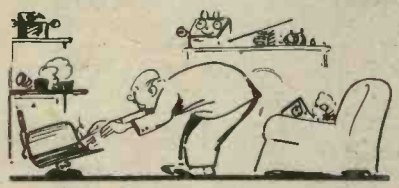
Economy!

But to return to Mr. Gumplethorpe. The Flannelly Four appealed to him very much, since with only four valves he could not do in more than thirty-four shillings' worth at a time should he happen to make any mistake with the high-tension connections. On the other hand, Mr. Gumplethorpe does like to have a set with some juice behind it, so that he can let the loud speaker rip when he wants to. It took him some time to make up his mind, but eventually he fixed upon the Fan's Own Frantic Six. And now began a very sad time for Mrs. Gumplethorpe. He began to suggest to her that times were rather hard, what with rates and taxes and one thing and another, and could not she possibly do with a rather smaller housekeeping cheque each week? Mrs. Gumplethorpe said that she could not. Mr. Gumplethorpe said that she must. And she did. In hard times when business is bad the only thing to do is to take up a hobby, and immerse yourself in it, so as to take your mind off worries. Mr. Gumplethorpe explained all about this to Mrs. Gumplethorpe, and proved to her most ingeniously that he was really economising tremendously by spending money like water upon valves and condensers and rheostats and grid leaks and coils and B.A. thingmejigs. He explained, too, when he arrived home evening after evening bearing his purchases in a taxi that it was quite impos-

The "Old Folks'" Receiver.

sible for him to travel by trams or buses or tubes or trains, because they always made him worry so. Mrs. Gumplethorpe wanted the drawing-room repapered. Mr. Gumplethorpe said that the old paper would do quite well, and that anyhow it was no good putting on a new one, because if they did it would be just his luck to splash his accumulator all over it or do something awful of that kind. He said that he always felt uncomfortable when there were new papers and things of that sort about: for real comfort give him old paper, old paint, an old carpet, old furniture, because then you felt that you could do what you liked, and had not always to be thinking about the awful things that might happen if you were not careful. Having been shorn of her housekeeping money, Mrs. Gumplethorpe cut down the menu considerably. Mr. Gumplethorpe strongly approved of this manifestation of economy, and showed his approval by lunching in the City and dining at his club.

Meanwhile, the store of gadgets that he was collecting in his study was growing vastly as the days came and went. In every chair, upon the writing-desk, and the table and the floor and the mantelpiece and the window-sill, and even in the coal-scuttle, which, being empty since it was summer time, formed a good storing place, there were parcels and boxes, and crates and paper bags and all sorts of things. He began the work of construction by tidying up his writing-table. This was quite easily done by placing its contents upon the floor. To the top of it he fixed his vice with four stout screws. The screws were rather long and he had forgotten all about the drawers underneath. To open one of them he now has to remove the vice, but he does not mind little things of this kind. Such was the array of



Even the coal-scuttle . . .

tools that he purchased that he felt that he could tackle every single job himself with every hope of making a real success of it.

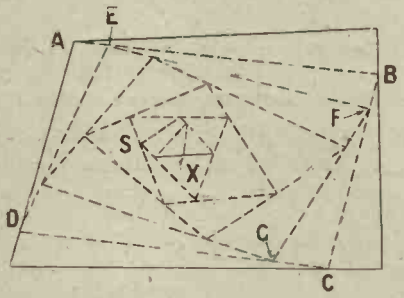
Squaring the Panel

The first business was to square up the shiny ebonite panel that he had brought home with him. For some reason unknown at present, no small wireless shop is ever able either to square a panel or to cut it to the correct measurements. When he ran his brand-new setsquare over the ebonite, Mr. Gumplethorpe was horrified to find that it was a long way out. Measurements with a ruler showed him that he had a great deal to worry off it somehow. Setting manfully to work, he selected the straightest-looking edge and used that as the starting point. With the help of his square, he ruled the line AB in the diagram, which I give you herewith. Next, making use of AB and of the square, he ruled BC. With BC as reference line, he ruled CD. Careful tests showed that the figure ABCD had by no means right-angled corners. Nothing daunted, Mr. Gumplethorpe went on ruling DE, EF and FG. And still things did not look as they ought to, so he continued until eventually he came to X. As it was a panel and not a point that he required, Mr. Gumplethorpe took the ebonite next morning to a clever friend, who said that he would do the job in two twos, whatever that may be. When Mr. Gumplethorpe called for it that evening it was quite ready.

Another Friend

When he measured it out he found that it was $\frac{3}{4}$ in. longer at the top edge than at the bottom. He therefore took it round to a second friend, who was even cleverer than the first. He said that he would do it in a jiffy. When he finished it the two long edges were of equal length, but the short ones were not. Mr. Gumplethorpe smiled a little sadly and took it round to a third friend, who said that he would do it in two ticks. Mr. Gumplethorpe said that he hoped that that was something different from two twos and a jiffy, since he had had some of these. When the third friend had finished all four sides were of different lengths. When it came back from a fifth friend it had five sides instead of four, and the sixth brought it back to four once more, but, as he was a disciple of Einstein's, all his straight lines had bends in them. The tenth really expert friend finished the job and got the panel perfectly square, but, as by this time it measured only 3 in. by $2\frac{1}{4}$ in., it was hardly big enough for the job.

"After all," said Mr. Gumplethorpe, to himself, "squaring up a panel is no part of home set construction. I will get a big firm



How the panel was "squared."

to send me along one that is guaranteed correct." And he did. When it turned up, he at once tackled the job of marking it out for drilling purposes. But he found that his setsquare was not long enough for the job, so he sent it back and had it marked out for him, since this, again, as he said, is not really an essential part of amateur construction. Centre punching is quite a different matter. Some people have difficulty in getting the point of the punch on to the intersection of the cross lines and holding it steady there whilst the hammer delivers its blow. It occurred to Mr. Gumplethorpe that the usual method of holding the punch by its barrel between the thumb and forefinger of the left hand was a poor one, and simply made for inaccurate marking out. Grasping the punch between the fingers and the palm of his hand he placed its point in the right position, and held it perfectly steady by pressing hard upon its top with his thumb. Then he raised the hammer, and smote shrewdly. Then he decided that centre punching was a waste of time, and that one had much better get it done by somebody else.

When the panel returned, centre punched, Mr. Gumplethorpe leapt to the task of drilling; but as there were about nineteen $\frac{3}{8}$-inch holes to drill, and his left thumb was still giving him trouble, he took it

He raised the hammer and smote shrewdly.

round to the garage to be drilled. Fixing the components upon the panel or baseboard is a job that anybody can do once the drilling has been done. "Very well," said Mr. Gumplethorpe, after he had rammed the screwdriver into his still seedy thumb, "let anybody do it." So the handyman at the garage got that job, too.

Our hero decided that he would reserve his strength for the job of wiring. When he had covered the set and his table and the carpet an inch thick in flux and little blobs of solder, and still had not made the first joint, it occurred to him that wiring was no job for a man. He therefore borrowed his neighbour's very handy son, promising him five bob for doing the work, but warning him not to attempt to do it in two-twos, a jiffy or two ticks. So speedy was the lad that Mr. Gumplethorpe's home-made set was finished the next day. It refused to work, and he despatched it at once to the Test Department to have it put right. When it returns in thorough working order, Mr. Gumplethorpe will display proudly to his friends the set which he constructed entirely by himself, and when those boys of his brag about things that they make he will just point to it, and say, "When you can make as good a set as your father, my lads, you will be entitled to talk a bit."

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REGULAR AND CONSISTENT PERFORMANCE

The Times, Los Angeles, California on Loud Speaker in Scotland

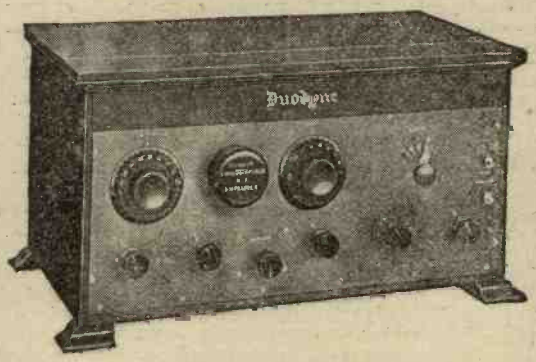
". . . . As mentioned in my previous letter to you, wonderful results are still regularly and consistently received on my Duodyne V at home. The latest result to hand, the writer being at sea, is up to August 3rd, the loud speaker reception of KFI, Radio Central, and KHJ, THE TIMES, PACKARD MOTOR-CAR BUILDING, LOS ANGELES, CALIFORNIA. Time of reception, 05.15 G.m.t. to 05.50 approx. G.m.t. Loud speaker medium strength, signals then weakened, but excellent phone reception was possible from Los Angeles until 06.30 G.m.t., which is 7.30 a.m. standard time and full daylight. Other stations heard were WTAM, WJL (special test?), KGO and XAD, two latter stations unknown—possibly American.

The above-mentioned results were obtained on the ordinary £18 18 0 Model of your manufacture.

Hope I am not boring you with this long account of results, but anyone wishing to receive long-distance broadcasting—specify the Duodyne V, and extreme satisfaction and many hours of enjoyment will result.

F.V., s/s————."

Duodyne



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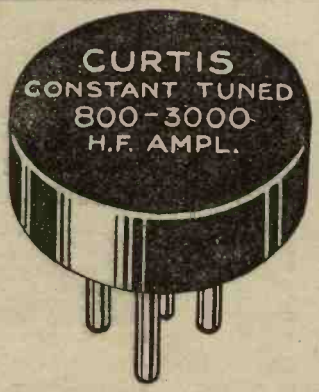

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Type C is specially designed for the aperiodic stages in the Long Wave Amplifier of Super Heterodyne Receivers.

What are these Kilocycles ?

By J. H. REYNER, B.Sc., A.C.G.I., D.I.C.,
Staff Editor

THERE has recently been considerable discussion on the use of kilocycles instead of metres in wireless nomenclature, and the question therefore arises as to what kilocycles are, and why they should be used.

Should Pillion Riding on Kilocycles be Permitted ?

The office boy, who is a keen motorist (on paper) was very perturbed about this new development, and enquired anxiously as to the seating capacity of these new machines. He was obviously greatly relieved when I explained that a kilocycle was not a motor vehicle, but a unit of frequency.

As a matter of fact, a kilocycle is 1,000 cycles or alternations.

Frequency

An alternating current is one in which the current periodically changes its direction, flowing first one way and then the other. The number of complete reversals which take place in any one second is called the frequency, and is referred to in terms of the number of "cycles" or alternations per second.

Wireless Currents

The currents in a wireless circuit (such as is used for broadcasting) reverse their direction many hundreds of thousands of times in one second, so that in this case the frequency is a very large number.

For example, the frequency of Newcastle's carrier wave (403 metres) is 743,950 cycles per second.

In order to deal with such frequencies the kilocycle is used (1 k.c. = 1,000 cycles), and 5NO's frequency is then 744 kilocycles per second (to the nearest kilocycle).

The frequency should, strictly speaking, be specified in kilocycles per second, but for convenience it is often referred to simply as so many kilocycles.

Wavelength

When these high-frequency currents flow in a wireless aerial a series of disturbances are set up in the aether. These disturbances, or pulses, follow one another in rapid succession, there being one pulse for every complete alternation or cycle.

Now the pulses which are set up by this means travel outwards through space with the velocity of light (299,800,000 metres per second approximately), and it is this succession of pulses, travelling at this tremendous speed, which constitutes an electro-magnetic wave and ultimately affects the receiver

It will be clear that when the second pulse is produced the first will already have travelled some distance. This distance is termed the *wavelength* of the electro-magnetic wave.

Wavelength Classification

In the early days, when wireless phenomena were first investigated, the wavelengths of the disturbances produced were very short (one or two metres only). Moreover, as the phenomena obtained were similar to those of light, which is nearly always referred to in terms of wavelength, wireless waves were also classified in terms of their wavelength.

The need for this has now ceased,

At WRNY, the Radio News Broadcasting Station in New York, everything is ready at hand for instant use. We see here the tool rack in the repair department.

and, in fact, the use of wavelengths means very little.

Use of Frequency Preferable

There are many reasons why the use of frequency is to be preferred to the continued classification of stations by wavelength.

The tuning circuits employed must be designed to tune to the same frequency as that of the pulses in the wave being received. It is true that charts and formulæ have been provided enabling the results to be expressed in terms of wavelength direct, but these are only derived from the frequency calculations. Any calculation other than that of simple tuning properties has to be carried out in terms of frequencies.

Interference

Another important point is the interference between two stations. There is a limit to the frequency difference between any two stations below which the stations will interfere by heterodyning each other with a receiver of the maximum permissible selectivity.

This means that each station requires a definite band of frequency (which in the case of a telephony station is about 10,000 cycles per second).

If the stations are classified in terms of wavelengths it is not easy to see at a glance whether the frequency separation is adequate; *e.g.*, two stations having frequencies of 750 and 800 k.c. will not interfere. The wavelengths radiated by these stations would be 400 and 375 metres approximately, giving a 25 metre difference.

Two stations 1,600 and 1,625 metres apart, however, would have frequencies of 187·5 and 184·6 kilocycles. These are only 2·9 k.c. apart—*i.e.*, 2,900 cycles—so that the stations would interfere. Hence the wavelength separation required between two stations is not constant.

A Cycle a Day Keeps the Doctor Away

There are many other arguments for the use of frequency rather than wavelength, but space forbids further discussion of the subject.

Suffice it to remark that, as Herodotus said (or would have done if he had lived to-day), "A cycle a day keeps the doctor away."

For the future, therefore, references will, where convenient, be given in terms of kilocycles as well as metres.

A Few Hints and Tips

By W. H. BERRY

A COMMON method of rejuvenating the plates of not too badly sulphated cells is to send them for an extra long charge at a slightly lower charging rate than normal. This is greatly facilitated in its function of reducing the accumulated sulphate if some sodium sulphate (commonly known as Glauber's Salt) is added to the electrolyte.

* * *

Where a crystal used in the set is of the type which requires a very light pressure of the whisker on its surface for the most efficient results, it is very annoying to find that the slightest vibration, such as a person walking across the room or a jar on the table with one's elbow, upsets the adjustment. This can be very easily and satisfactorily avoided if a little muslin cap be stretched over the face of the crystal and drawn tight at the back of the cup. The whisker is then moved into contact with the surface of the crystal as usual, but now penetrates the muslin, the fine mesh of which prevents the whisker from being jerked.

* * *

Frequently after wiring and soldering a panel thin layers of flux will remain spread over the adjacent surfaces. These must be cleaned if no leakage is to result. It is very useful in such cases to keep a small bottle of benzene or methylated spirit, together with a small paintbrush, such as is sold for water-colour work on paper, costing about 2d. This enables inaccessible positions such as exist between valve pins and coil sockets to be thoroughly cleaned.

* * *

If a perfectly safe flux which does not corrode is required, and where joints are made with the intention of lasting good and clean for some time, it is a good way to use the solder known as hard solder used in conjunction with a flux of resin dissolved in methylated spirit. A useful paste flux for any purpose of soldering is made thus by dissolving resin in methylated spirit.

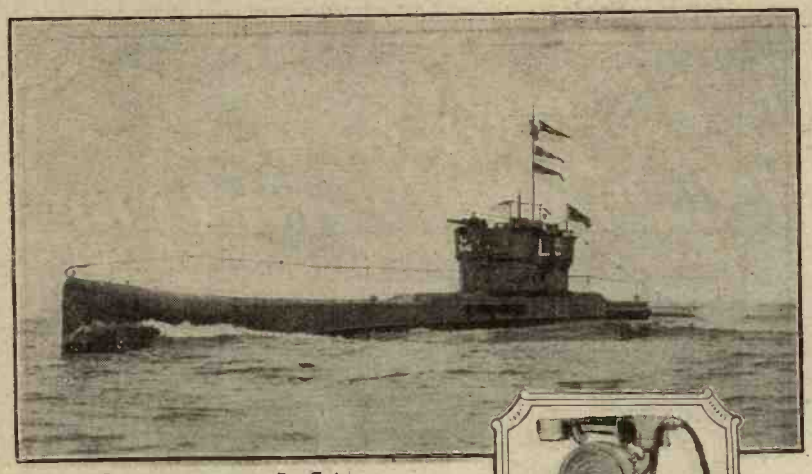
* * *

We frequently find difficulty in deciding the polarity of two leads, and unless we are possessed of pole-finding paper or some other commercial pole-finding apparatus we usually resort to trial and error. This is unsatisfactory and may be expensive. A certain and cheap pole-finder is to bare the surface of a potato by cutting off a piece of skin. If now the two wires be touched to the surface of the potato a green stain will be clearly seen where only one of the wires has come into contact. This is the positive pole.

* * *

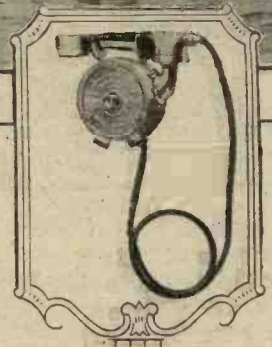
Crystals may usually be resensitised by giving them an alum bath. About a dessertspoonful of alum should be put into about a wineglassful of water. This should be left overnight, and in the morning there should still be a little alum left. If this is not so, a little more alum should be added. When the water has dissolved as much alum as it can and still a little remains we then know we have what is termed a "saturated solution." The crystal should be placed in this solution and left for from 10 to 20 minutes. Now lift out with a pair of tweezers (on no account using your fingers) and put to dry in some cool, dry position. When completely dry the crystal will have turned dull where previously it was bright. This is no deterrent, as it is only a thin layer of alum which has now covered the crystal surface. The crystal can now be used and will be found to be re-sensitised.

A BRITISH SUBMARINE



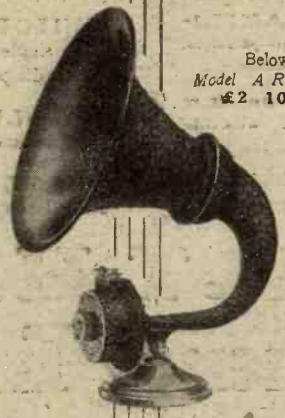
H.M. SUBMARINE L 54.

On Land and Sea



Above.
A typical Graham Patent Loud Speaking Naval Telephone as fitted in British Submarines.

Below.
Model A R 111 at £2 10 0



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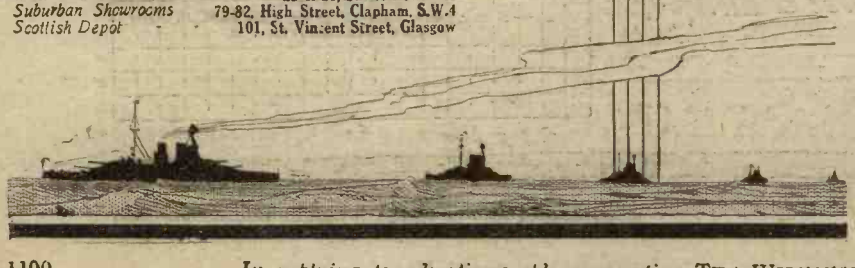

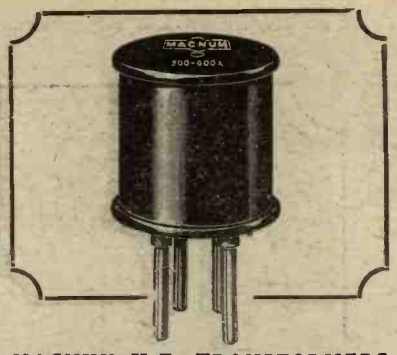

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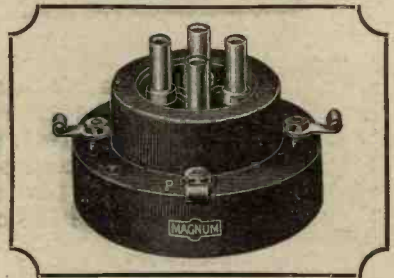

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"A NEW CRYSTAL-VALVE CIRCUIT."

SIR,—I am writing to report that I have constructed a receiver with the "New Crystal-Valve Circuit" described by Mr. John Scott-Taggart in the March issue of THE WIRELESS CONSTRUCTOR.

I have built one or two single valve receivers from this journal, but I have never before used a circuit which gives such excellent results as this one.

It was stated that the circuit would probably work a loud speaker up to five miles, but, as you will observe, I live at New Southgate (which is about seven or eight miles from 2LO), and I obtain perfect loud speaker reception. I am using a Cossor bright emitter valve and a Sterling "Dinkie" loud speaker. The coils are 25 aerial and 120 reaction.

Last Thursday (August 13th) I was listening to the first edition of "Radio Radiance," and the signals were so pure and loud that it was just as though I was in the studio. Such results as I have obtained with only one valve are both surprising and satisfying.

Hoping this letter may be of assistance to other readers and wishing every success to THE WIRELESS CONSTRUCTOR,

Yours faithfully,
H. E. MARCHANT.

New Southgate.

THE "FAMILY TWO."

SIR,—Knowing that letters of appreciation are always welcome, I feel I ought to let you know how satisfied I am with the "Family Two" Loud-speaker Set, which I made up from Mr. Percy Harris's instructions in the March issue. It is certainly the ideal set for the local station. Using two D.E.R.'s off a 2-volt accumulator, with a Dulcivox loud speaker, the volume is quite sufficient for a room of about 16 ft. by 12 ft., and the purity of tone is remarkable. Except for slight crystal adjustment, the set is never touched, and is always reliable. I have no hesitation in recommending anyone who wishes to build an economical set for broadcasting only to select the "Family Two," providing they are within the correct range.

Yours faithfully,
WM. DUNCAN.

Sydenham, S.E.26.

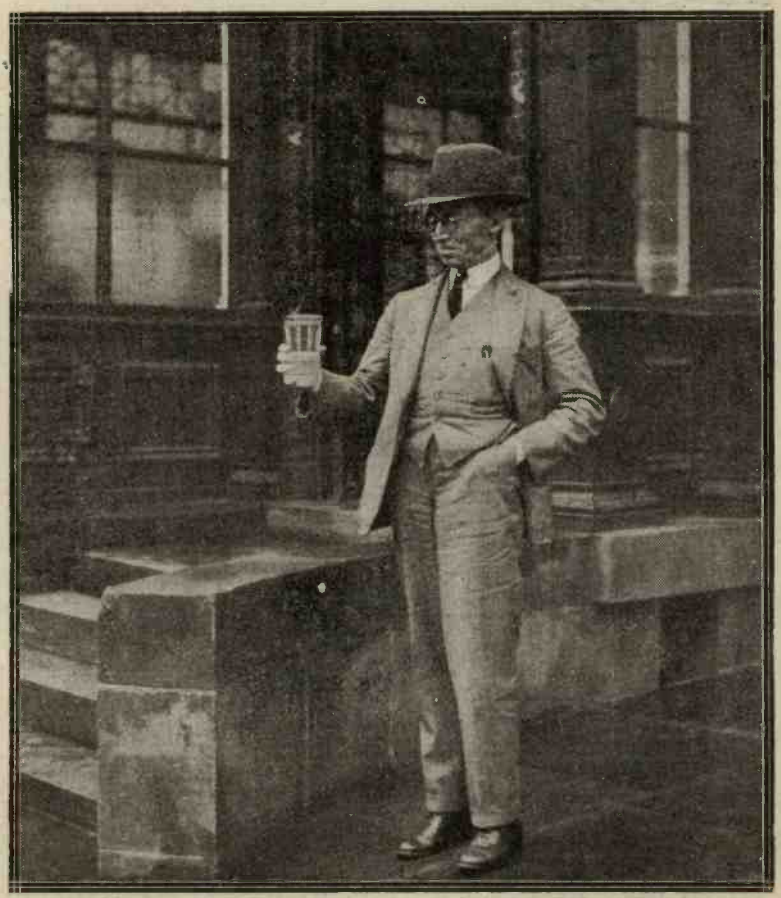
THE "SHORT-WIRE" VALVE PANEL.

SIR,—A few months ago I made up the "Short-Wire" valve panel described by Mr. A. S. Clark in the January issue of THE WIRELESS CONSTRUCTOR and the corresponding tuner described in the April issue, and the good results have prompted me to write this letter. To-day a friend lent me a Sterling "Baby" loud speaker, and the set worked it loud enough to be clearly heard in an average-sized room. I can also get Liverpool, Leeds-Bradford, Stoke and Daventry comfortably in the 'phones, and I have heard Birmingham, Newcastle, Belfast, London, Bournemouth and Brussels at various times.

I am situated about 2½ miles from the Manchester station, and the aerial consists of four wires stretched across a bedroom, so I think the results speak wonders for the set. I am only fifteen years old, and have followed the lay-out exactly, but have used different parts. Many thanks for designing such a wonderful set.

Yours faithfully,
H. WALTON.

Manchester.



John Henry, the famous comedian, is here seen partaking of the sulphur waters at Harrogate.

K. RAYMOND

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Anode Choke..... 10/-
L.F. Transformer 25/-
Permanent Detector, 7/6 & 6/-

"R.I."

L.F. Transformer, New Model. To avoid clever imitations see you buy in a SEALED BOX. None genuine without, 25/- post free.

RE-ECHO.

Crystal Receiver.
(One with a name behind it.) All usual wavelengths covered by inserting suitable coils. Fitted Shaw's genuine Hertzite. A truly wonderful set. Handsome design in well finished sloping cabinet. Price, 17/6. Post 6d.

REFLEX COILS.

"Made under licence Burndept Patent No 168249."
No. 35 150/200..... 8d.
No. 50 200/500..... 9d.
No. 75 300/750 ..... 1/-
No. 100 400/1,000 ..... 1/2
No. 150 600/1,500 ..... 1/8
No. 200 800/2,000 ..... 2/9
No. 250 900/2,500..... 3 3
Post 2d. each.

STERLING.

Triple Coil Holder..... 20/-
Ditto, on Standards..... 22/6
Square Law Condensers, with Vernier.
'00025... 23/- '0005..... 25/6
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Square Law Triple..... 35/-
Non Pong Valve Holder..... 4 3
Potentiometer, 250 ohms .. 6/6
Headphones, 4,000 ohms..22/6
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Gold Floral "Baby" 55/-
Exhibition models as soon as on market.

T.C.C. MANSBRIDGE.

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L.F. Super (All Black) 21/-
Standard, 1st Stage ..16/-
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Anode Capacity Reactance 50/-
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2-way 5/6
Success Tuner..... 21/-
Audio Choke..... 10/6

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Rheostats
7, 30, 60 ohms 3/-
600 ohms Potentiometer 4/-
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3-Way Cam Vernier.... 7/6

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Coil Stands.
2-Way Long Handle ..2/9
3-Way Long Handle ..4 6
2-Way Cam Vernier.... 3.6
Do., Geared (Nickel).. 4/6
3-Way Geared (Nickel) 6/11
Polar, Shipton, Burndept, Igranic, Lotus, Goswell, under respective heading.
Coil Plugs, Ebonite.
Plain, 2 for 1/3
Panel Mounting, 1/- 2 for 1/8
Fitted Fibre 101. 2 for 1/6
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Nickel Sides, 2 for 1/2
Brass Sides, 2 for..... 1/4
Edison Bell, 2 for 2/-
Spade Terminals, etc.
Brass Screwed doz.... 1/-
Pin do. doz.... 1/-
Red or Black doz.... 1/8
Spade Tags 3 doz.... 1/-
Flex, etc. Red and Black Twin, per doz. yds. .. 2/-
Maroon Twin..... 1/9
6 feet 'Phone Cords ..1/11
Loud Speaker Cords..1/11
Terminals, Complete
Brass W.O. .... doz. 1/3
Nickel 1/10
Brass Pillar ..... doz. 1/3
Large W.O. or Pillar (Ormond) doz. 1/9
Nickel, Large .... doz. 2/-
Brass, 'Phone .... doz. 1/1
Nickel, 'Phone .... doz. 1/9
Flush Panel Socket and Nuts, Brass doz. 1/-
Ditto, Nickel .... doz. 1/3
Plug and Socket (Red or Black), 6 pairs.... 1/-
Nickel Panel Switches DPDT, 1/3; SPDT .. 1/
Loud Speaker Cords, 20 feet 3/6
Ditto, 12 feet 2/3
'Phone Cords, 6 feet ..1/9
Detectors.
Micrometer Detector (Enclosed), New Design, Trigger movement 2/-
Nickel (Enclosed), High class article 2/-
Tumbler Switch..... 1/6
H.T. and L.T. Battery Cords, Four Colour Leads 3/-

T. C. B.

Filament Resistances, 6, 15, 30 ohms each . 4/-
600 ohms Potentiometer 5/-

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Ferranti 17/6
Pye (650), 1st Stage .. 22 6
Pye (652), 2nd Stage ..22/6
Burndept, 1st and 2nd Stage..... each 24/-
Silvertown 21/-
"Supra (Wates) 12 6
Portland (good value) 10 6
Ormond Standard .. 14/-
Ericsson 2—1 or 4—1..17 6
Cosmos 4—1 ..... 15/-
Royal Shrouded 21/-
Igranic, 1st Stage 21/-
Igranic, 2nd Stage ..19.6
Lissen T.1 ..... 30/-
Lissen, T.2 ..... 25/-
Lissen, T.3 ..... 16 6
Eureka Concert Grand 30/-
Eureka, 2nd Stage 22/6
Powquip Standard .. 12/6
Success Super (Black) 21 -
Success, Silver..... 17/6

L.F. TRANSFORMERS-cont.

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1st or 2nd Stage each 27/6
"Croix," 3—1 ..... 9/6
"Croix," 5—1 ..... 9 6

UTILITY.

Variable Condensers.
Square Law and Vernier, Knob and Dial.
'0005 ... 13 - '0003 ....11 3
Anti-Cap Switches.

	Knob.	Lever.
2-way	4/-	5/-
4-way	6/-	7 6
6-way	8/-	10/-

Nickel, 6d. extra.
Coil Changing Unit 7/6

"UNIDYNE."

THORPE K4 VALVES.
Guaranteed genuine. Owing to great demand please place your orders early.
Thorpe K4 5-pin 14/-
5 pin Valve Holders 1 3
Complete Set of Parts (excluding Box and Panel), but including Valves.
1 Valve Set 46 6
2 Valve Set 66/6
All high quality articles.

VALVES 8/- each.

Mullard "Ora" H.F. Red Ring.
L.F. Green Ring.
Cossor P.1, P.2.
Ediswan "A.R." H.F and L.F. "A.R."
B.T.H. "R."
Marconi "R4," "R5." 14/- each.
Mullard D.3, White Ring, D.3 L.F., D.3 H.F.
Cossor W.1, W.2.
Ediswan "ARDE" g.p., H.F. Red, L.F. Green.
B.T.H. B3.
Marconi DER. 16/6 each.
Mullard D6 '06, D3, H.F., D3 L.F.
Cossor WR1, WR2
Ediswan AR '06 g.p., '06 H.F., '06 L.F:
B.T.H. "B5."
Marconi DE3. 18/6 each.
Cossor Wuncell W3.
Marconi DE5. 20/- each.
Marconi "Y24" "QX." 22/6 each.
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Ediswan PV 1, 2, 5, 8.
B.T.H. B4, B6.
Marconi DE4, DE5, DE5B. 24/6 each.
B.T.H. B7.
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Marconi LS5 and LS5A.

MET. VICKERS "COSMOS."

D.E. 11 Valve 12/6
Use with 2-volt Accumulator or 2 Dry Batteries.
Bright Emitter A. 45.... 7/6
P.V. 4.5, F.A. 0.65.
SP16 unobtainable.

VALVE HOLDERS.

Solid Rod Standard 1 3
Barrie's Anti-Vibrate .. 1/9
Aeamonic 1/6
Burndept, Sterling, Bowyer-Lowe, Goswell, etc.

WATMEL.

Variable Grid Leak..... 2/6
Anode Resistance 3/6
Fixed Condensers..2 6 & 3/6
Grid Leak and Condenser 3/-
Super Selective 10,000/100,000 ..... 3/6

WOODHALL.

Vernier Rheostat Coil Holder..... 10/6
60 ohms, 2/6; 30 ohms .. 3 6
L.F. Transformer, 1st .. 27.6
Ditto 2nd Stage 18/6

"WONDER" AERIAL.

Multi 49 Strands, Phosphor Bronze, Indoor, Outdoor Frame, 10 feet **3/3**

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K. RAYMOND

7, Grape St., Shaftesbury Ave., W.C.2

Full address other page

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It is **One** minute's walk from **Tottenham Court Rd. Tube.**
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Make out your list of what you have to sell, and I will offer you best prices. This applies to post or callers.

Very Important — Space costs MONEY. To avail yourself of our very special offers which mean **POUNDS** to you, just send us a **postcard** with your name and address and our lists follow immediately.

VERY IMPORTANT.

This list is a fairly comprehensive one, but if you will make out your requirements, giving goods actually wanted, makers' names, etc.,
I will Quote You Lowest possible inclusive Prices.

VALVES.
To encourage you to use British Valves I am willing to purchase one burnt-out valve for each valve you purchase.
Prices given range from 1/3 to 4/- according to valve you buy.

POST PRICES.
3/16 EBONITE stock sizes.

8 x 6	2/-
9 x 6	2/3
10 x 8	3 6
12 x 9	5/-
12 x 12	6/6
14 x 10	6/6

Cut to size 1d. per sq. inch.

RAYMOND'S VARIABLE CONDENSERS

SQUARE LAW LOW LOSS.
ONE HOLE FIXING.
EBONITE ENDS.

With Vernier

.001	8/6
.0005	7/6
.0003	7/-

Without Vernier

.001	7/6
.0005	5/9
.0003	5/3

Including knob and dial.
Post 3d. set.

ORMOND "AMERICAN"
Square Law Low Loss. Skeleton Ends, Knob and Dial.
.001. 9/-: .0005, 8/-
.0003, 7/6: .00025, 6/6
With Vernier, 1/6 each extra.
Post 3d. set.

JACKSON BROS. "J.B"

Square Law.		Square Law with vernier	
.001	9,6	.001	13/6
.0005	8/-	.0005	12 6
.0003	6/8	.0003	11 6
.00025	6 6	.00025	11 3
"J.B." .001 ..	8/6	.0005 ..	7 -
Standard .0003 ..	5 9	.0002 ..	5 -

ALL with knob and dial. Post free.

ORMOND "No. 3." Ebonite Ends.

Sq. law with vernier	
.001 ..	10 6
.0005 ..	9/6
.0003 ..	9/-

Also without vernier, 1 6 each less.
All with knob&dial

WARNING

A certain firm in the vicinity of my address is copying my advertisement in detail, in my opinion it is an attempt to mislead the public. Will customers carefully note the name

K. RAYMOND

on premises to ensure their getting the actual goods advertised both for quality and price. NO USE COMPLAINING WHEN IT'S TOO LATE.

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7, GRAPE STREET, Shaftesbury Avenue.
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ALL POST ORDERS FROM OTHER COLUMNS.

Terminals, Nut and Washer W.O., 'Phone, Pillar	1d
Extra Large ditto .. .. 3 for	4d
Nickel, 2d. each .. .. doz.	1 6
Valve Sockets .. .. 2 for	1½d
Valve Pins and Nuts .. 2 a	1d
2, 4, 6, BA Nuts .. .. 6 a	1d
2 or 4 BA Washers .. 12 a	1d
2 BA Rod, best .. .. foot	2½d
4 BA Rod, best .. .. foot	2d
Spade Tags .. .. 6 a	1d
Soldering "Nickel" .. 3 a	1d
Screwed Spades .. .. 2 for	1½d
Screwed Pins .. .. 2 for	1½d
Battery Clips .. .. 5 for	2d
Copper Foil, 6 in. .. foot	3d
Large Sleeving .. yard	3½d
Screw Wander Plugs .. pair	2½d
Extra Quality Plugs .. pair	4½d
Contact Studs, complete 2 a	1d
'Phone Connectors	1d
Spade Terminals (red or black)	1½d
Plug and Socket red or black)	3d
Flush Pane. Sockets, with 2 nuts	1d
Twin Flex, 12 yards	1/5
Red and Black ditto, 12 yards	1/6
'Phone Cords, 6 ft. rubber ins.	1/6
Loud Speaker Cords, 20 ft. ..	2/11
Ditto, 12 ft.	1/11
Valve Templates	1/10
Ribbon Aerial, 100 ft.	1/10
7.22 Hard Drawn, 100 ft. ..	1/10
Adhesive Tape .. 5d and	3d
Empire Tape, doz. yds.	6d
Breast Drills, with double pinion cut gears.	4/6
Valve Windows	6d
Ormond Machine Screws stocked	
Enclosed Detector	8½d
Ditto Large Brass	1/-
Ditto, Terminal Fitting ..	1 3
Ditto, Half Opal	1/-
Ditto, Half Opal Nickle ..	1/6
Ditto, Micrometer	1 6
Micrometer, trigger movement	2/-
Climax Earth Tubes	9/-
"Opera" Earth Tubes ..	2 1
Twin Silk Flex Miniature, 6 yds.	6d
'Phone Connector Boards ..	1/11
Brownie ditto	3/6
Ebonite Coil Plugs, plain 4½d	6d
Ditto, wedge 6d	7d
Fitted Fibre 7d	9d
Edison Bell	11d
Basket Holders .. 8½d. 10d.	1/3
Spike and Plug	9d
Bus Bar Square.	
1/16 in. 12 ft., 6d. 18 gauge	5d.
Ins. Hooks .. .. 2 for	1½d.
Ditto, Staples .. .. 6 a	1d.
Variometer, 250-650 metres ..	1/8
Lead-in, 10 yds.	1/-
Extra Heavy, .. yd. 2d.	3d.
Coil Formers, with handle ..	1/6
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Twin Bell Wire .. .. yd.	2d.
DCC, JRC Bell Wire 10 yds.	5d.
DPDT China Base, 1/3. SPDT	10½d.

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Nickel DPDT, 1/- SPDT,	10½d.
Telefunken. Adjustable 'phones, 4,000 ohms, guaranteed genuine,	14/11 pr.
ERICSSON EV (Continental). 4,000 ohms, per pair, 10 6.	
N. & K. Genuine, 4,000 ohms.	12 11
Daventry, 1,600 Coils	1/-, 1.3, 1/6
Ledion New Model	2/-
Airspace ¼ in., set of 5 BBC	1 9
Ledion New Model	3 6
2-way Coil Stands ..	2/3, 2 3, 1/11
3-way Coil Stands ..	4/6, 3/9
2 way Cam Vernier ..	4/6, 4/-, 3/3
2-way Geared	4/- /6
3-way Geared	5/11
Shaw's Genuine Hertzite ..	8d.
Wonder Aerial, 49 strands.	
100 ft. best qualit 3/- 2nd qual.	1 6
DCC Wire, ½lb. reels. Best English.	
18 .. .. 9d. 20	9d.
22 .. .. 10d. 24	11d.
26 .. .. 1/- 28	1 1

STOCK EBONITE, 3/16.

Cut to size 3/16 per sq. in. ..	1d.
" " ¼ " " ..	1½d.
6 x 6 or 7 x 5	1 6
8 x 6 or 9 x 6	1,11
10 x 8 or 12 x 6	3 3
12 x 12 or 14 x 10	6/-

ACCUMULATORS.
Two High-Class Makes.

2 v 40 amps.	7/6	8,6
2 v 60 amps.	10 6	11 9
2 v 80 amps.	14 6	14/-
2 v 10 amps	15/-	16 6
4 v 40 amps.	13/11	15/11
4 v 60 amps.	17/11	19 6
4 v 80 amps.	22/6	23 6
6 v 40 amps.	25 6	27/6
6 v 80 amps. ..	33/-	35/-

Made by Rotax, Radiocell, etc.

SEE YOU ARE AT RAYMONDS.

ORMOND Rheostats .. 2/6 and 1 8
Square Law Variable Condensers. Callers only.
.0005 .. .. 4/11
.0003 .. .. 4/6
With knob and dial.

I BEAT THE WORLD FOR VALUE.

VALVE HOLDERS.

Solid Rod Ebonite	1/-
Anti-cap and Baseboard ..	9½d.
Various 9d., 1/-,	1,3

All makes stocked.

High-Class H.T. BATTERIES.
All best possible quality.

60 volt 5/11,	6,3, 6 11
60 volt BBC	8/11
36 volt BBC	5 11
9 volt BBC	2/-
Famous 66 "K"	6/6
Eveready, 66 volts	12/6
Ditto, 108 volts	20/-
Flash Lamp, 4.5	each 4d

Eveready Stocked.
NO RUBBISHY BATTERIES SOLD.

ABOVE TWO COLUMNS FOR CALLERS

No. 1 of Important Radio Press Weekly

OUT SEPTEMBER 15th

Some preliminary details regarding "WIRELESS," the one-word weekly

ALL readers of THE WIRELESS CONSTRUCTOR will, no doubt, be interested to hear that the Radio Press, Limited, are bringing out on Tuesday, September 15th, an entirely new periodical, which will be entitled *Wireless*, the price of which paper will be 2d. (two pence).

The effect of the production of a 2d. weekly paper by the Radio Press will be to create the greatest interest throughout the world of wireless. Hitherto, the Radio Press have not catered for the wide public interested in wireless by means of a weekly paper. Although they possess *Wireless Weekly*, a 6d. periodical having a high-class circulation and appealing to the more technical section of the public, they have never attempted, as yet, to compete with the cheaper weekly wireless papers, or to cater for the large public which buys no technical wireless paper at all.

Practically all WIRELESS CONSTRUCTOR readers buy, in addition, a weekly paper of a popular character. Many of these have said to us: "Why cannot Radio Press, with all their resources, experience and staff, produce a weekly paper on broad popular lines at a cheap price?"

They are now going to, and on Tuesday, September 15th, you will find on every bookstall and in every newsagent's shop a copy of *Wireless*—meant for *you* to buy.

For 2d. weekly you will receive remarkable value—value which you could never get unless a great wireless publishing organisation were behind the paper. The new Radio Press laboratories are now in operation; two of the buildings are up and several new brilliant engineers have been engaged, as announced elsewhere in this issue.

The organisation of the Radio Press has been strengthened enormously by the great Elstree enterprise and by the acquisition of new engineers who will write for the Radio Press journals.

The contributors to *Wireless* will include the most able writers in the country, including, apart from the laboratory staff, all the well-known Radio Press authors, and also outside contributors of outstanding ability.

Mr. Percy W. Harris paid a special visit to the United States in order to obtain the very latest information regarding American radio designs. We have heard so much about the superiority of American radio apparatus, its greater range and its greater selectivity, that we felt it essential to investigate the position at first hand, and Mr. Harris has returned with data and information of extraordinary value and importance. Many articles have appeared, dealing with American methods, written by semi-technical and non-technical authors. Mr. Harris, however, has enjoyed, for several years, a very high reputation in this country as a designer of wireless sets, and he has returned with information which will undoubtedly change, in large measure, the whole trend of apparatus design. He knew exactly what to look for and made very careful comparisons and investigations.

He frankly admits that American sets are, generally speaking, far in advance of British designs, and he is going to tell his story, week by week, commencing with No. 1 of *Wireless*.

These articles, if they appeared in THE WIRELESS CONSTRUCTOR would take months to complete, but by publishing them weekly the whole extremely valuable information he has gained will be completely available to the wireless public in time to derive the fullest benefit during the winter.

Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., will be contributing, at intervals, to *Wireless*, and in No. 1 will appear an article by him of intense interest to all who have built, or read of, the ST.100 receiver. Since this was first designed, in the summer of 1923, great strides have been made as regards general design and circuital improvement. The new ST.100 has been built in the Radio Press laboratories, under the direction of Mr. Scott-Taggart, and full details will be given in the first issue of *Wireless*.

A striking article of universal interest will appear under the name of Major James Robinson, D.Sc., Ph.D., F.Inst.P., Council P.S.L, and there will be innumerable other features of extreme interest.

Suffice it to say that the best that money can buy, or brains can produce, will find its place in No. 1 and in subsequent issues.

The price, 2d., is so small for the value which will be given that only the fullest support by readers and

AN ANNOUNCEMENT REGARDING

The New Radio Press Paper entitled

"WIRELESS"

THE ONE-WORD WEEKLY.

Edited by PERCY W. HARRIS, M.I.R.E.

Editor-in-Chief: JOHN SCOTT-TAGGART, M.C., F.Inst.P., A.M.I.E.E.

Research Editor: MAJOR JAMES ROBINSON, D.Sc., Ph.D., F.Inst.P.

No. 1 Out Sept. 15th

trade alike would justify it. If it were produced by any other organisation than the Radio Press, the surprise exhibited would not be so great, but the great welcome which the preliminary announcements of this paper have received indicate that there will be a huge demand on publication.

Mr. Percy W. Harris will be the Editor of *Wireless*, and Mr. John Scott-Taggart will be Editor-in-Chief. It will be whole-heartedly a Radio Press production, and the entire organisation of the company is going to make it the greatest and most successful enterprise they have yet undertaken.

Wireless will be in a class by itself; although eminently readable and interesting, and of lighter character than some of the other Radio Press periodicals, the same soundness as regards technical facts and policy will be there. The stamp of the Radio Press will appear on every page, and this is what will make the new paper different from any existing wireless weekly.

September 15th will be a red-letter day, not merely for the Radio Press, but for those masses of expectant readers who have had to buy some other weekly simply because the Radio Press have had nothing suitable to offer them.

We are out for an entirely new public, but we are confident that the readers of our monthly periodicals will, to their own advantage, become supporters of *Wireless*—the new Radio Press weekly.

ENGLISH ARTISTS AT WRNY.

The Volga Trio, who are well known to the 2LO audience, are here seen broadcasting from the Radio News Station in New York. Ivan, the Cellist, is only eleven years old.

Hints and Tips on Metal Working

By C. P. ALLINSON

THE wireless amateur who makes his own apparatus may frequently be called upon to make special parts for himself out of brass or copper, and a few hints on how to set about such work are given here.

The first point to consider is that relating to cutting these metals. A hacksaw is generally used, and the teeth of the blade should be coarse, otherwise they will clog up easily, and, of course, no lubricant should be used. Thin sheet may be cut with a pair of shears, but if so thick that the hacksaw has to be used, the work should be held in the vice so that there is no "spring" in it. The portion being cut should, therefore, be within an eighth of an inch of the jaws of the vice, and it may have to be shifted after every three or four cuts. If this is not done it will be found that the hacksaw blade is soon minus teeth.

Cutting Sheet Metal

Another method of cutting sheet metal that is just too heavy to be cut by a pair of "snips" is to place it on a metal plate (a piece of iron or mild steel ¼ in. thick, or the back of the vice will do), and having marked the outline of the piece required, to go all round it with a sharp-edged cold-steel chisel and a hammer. It may be necessary to go round two or three times before the metal is cut through, and enough metal should be left outside the marking line to allow the piece to be trimmed up afterwards with a file.

When thick metal is being worked and an irregularly-shaped piece is required, or when a slot or large hole has to be cut in it, the best procedure is to drill a series of holes round the marking line, run the holes together with a small cross-cut chisel, and file up to shape. The cut edge has now to be finished off, and it should therefore be filed to within about 1/64 in. of the marked line. A handy size file for this is a 9 in. second cut, or even a coarse cut may be used. The surface, if discoloured or rough, may also be

filed up, and the file should receive frequent dressings of chalk and be cleaned frequently with a file card (sometimes called a wire brush or scratch-file), so as to prevent it clogging up, and to give a good surface. This should be done especially when a fine-cut file is being used, such as a smooth or dead smooth. If a coarse-cut file has been used for the first trimming, a second cut should be used next, and after this a smooth, and if required, a dead smooth last of all. The surface may finally be "drawfiled" to give it really high-class finish. This is done by grasping the file by both ends, one in each hand, and drawing it across the work, backwards and forwards, at right angles to the length of the file. The sketch shows more clearly how this is done. Care must be taken to keep the file clean, as if the cut gets clogged in the least degree scratches will be left on the work.

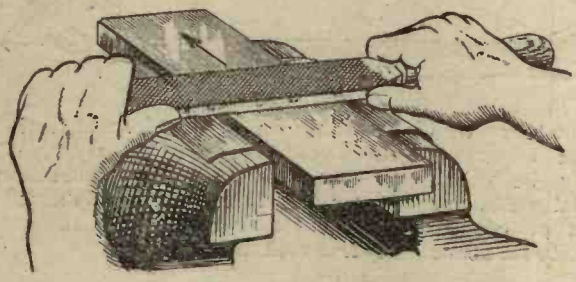


Fig. 1.—This method of "draw-filing" gives the metal a good finish.

Flat Surfaces

Great care must be exercised when filing flat surfaces to keep them not only flat but square. Skill with a file is only acquired by practice, but you should not let yourself be discouraged by the workshop saying that "it takes a man five years to learn to file flat!"

Cutting Tubing

When you have to cut brass or copper tube a little care is required, and it should not be cut right through, or the hacksaw teeth will suffer. Take several cuts, rotating the tube thirty or forty degrees after every cut, till it is through everywhere except in one place; the piece wanted can then be easily separated from the stock. Should the surface be so rough as to require filing, the file must be rocked, as shown in the illustration, the work being turned thirty or forty degrees to present a fresh surface to the file after every cut. Finally, a high polish may be given to it with a piece of emery cloth by tearing off a long strip and pulling it up and down rapidly over the work, which should be held in a vice.

It should here be noted that when working with any soft metal, such as copper or brass, it should never be put in the vice without a pair of jaw guards being used. These are made of sheet lead about ⅛ in. or ³⁄₁₆ in. thick, bent over the jaws of the vice so as to prevent pieces of soft metal being marked by the jaws.

Lacquering

Should it be desired to lacquer the finished piece of metal, this is preferably done hot. The work should be carefully cleaned with a drop of petrol or turpentine to remove all grease from the surface, and then heated above a gas flame till it is about blood heat. The lacquer is then applied with a very fine brush and the piece hung up to dry. Where a rich lacquer colouring is required several coats may be given till the desired shade is reached, each further coat being applied only when the previous one is quite hard.

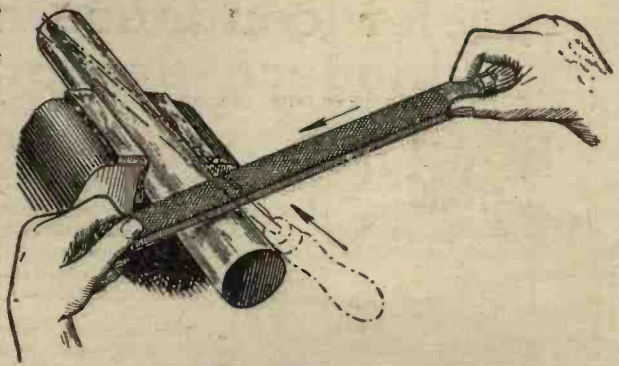


Fig. 2.—How tubing is filed. The file is rocked to and fro, while the tube is turned round during working.

Riveting

A job that frequently has to be tackled is to join two pieces of metal, and the method to be

employed will depend on circumstances, such as whether they are large or small pieces, thick or thin, whether a flat surface is a *sine qua non*, etc., etc. Three methods that may be used are riveting, bolting or soldering (sometimes

Fig. 3.—Two forms of rivet, namely cup-head and countersunk-head, respectively.

called sweating) them together. Many amateurs are rather shy of riveting, but once it has been tried and accomplished its terrors will be found to be greatly overestimated. Two forms of rivets are shown in Fig. 3 at "a" and "b," which are cup-headed and countersunk respectively. The method to be followed in riveting is as follows: Suppose the two pieces of metal (Fig. 5) are to be joined, with an overlap between the edges AC and BD. Determine the amount of overlap that is to be allowed (this should be about twice the thickness of the metal) and scribe a line on one of them showing where the edge of the other is to come. We will suppose that three rivets are going to be used at the points marked in the figure. Larger pieces might, of course, require more rivets, according to

Fig. 4.—Rivets may be filed flush to preserve a neat appearance.

what use the finished piece is to be put and how strong the finished job has to be. The rivets used are to be countersunk so that a smooth surface will result. The size of rivet will again depend on the weight of the work, and we will take them as being $\frac{1}{8}$ in. rivets, which is a fairly useful all-round size.

Drilling the Rivet Holes

The pieces of metal are clamped together with the edge of the one piece along the scribed line on the other, and three $\frac{1}{8}$ in. holes are drilled right through with a small brace and twist drill. Both sides are then countersunk with a $\frac{1}{4}$ in. drill, but if cup-headed rivets are used, only one side need be countersunk, and even that is not necessary if the surface does not have to be flat on that side. The rivets are now driven through the holes and they should project about $\frac{1}{8}$ in. on the other side. The work is then placed on a heavy piece of metal, such as the jaws of a vice, with the head of the rivets downwards and the projecting end of the rivet hammered over with the ball of a ball-pene hammer. The hammer should be "pulled" slightly so as to spread the metal, and if the rivet is being countersunk it should be hammered well in to the countersink. This will make a good strong joint, and when countersunk rivets are used both sides can be filed flush so as to

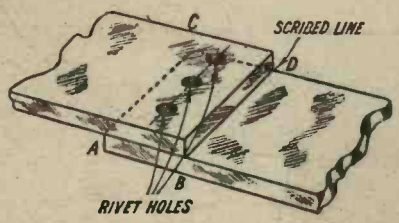


Fig. 5.—Illustrating the procedure when two pieces of metal are to be riveted.

make a neat job, and the rivets will be barely visible. A section of such a joint is shown in Fig. 4, and will help to make this clear.

Another Method

Another method is to fix the two pieces together with screws. In this case the holes through the one piece of metal will be clearance holes, and those in the other tapping holes tapped out with the correct thread for the screws that are to be used to hold the two pieces of metal together. The screws are put in tightly with a screwdriver, and the projecting ends may be burred over with a hammer so as to prevent their slacking off. Alternative methods are to employ thin lock nuts or to file off the ends of the screws on the side that they project and make a number of centre punch marks round the edge of the screws so as to prevent

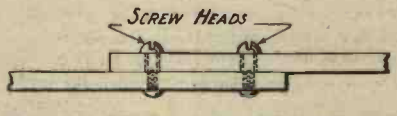


Fig. 6.—Screws may be used as rivets.

them from turning. If a lock-nut is used you can do away with the need to tap the holes in the one piece of metal and the nut can be prevented from slacking back either by the burring or centre punch method. A little shellac varnish applied to the threads of a screw will also prevent it getting loose.

Drilling Brass

We may now consider the question of drilling and tapping brass or copper. No lubricant should be used, except a little "monkey juice," as the workshop mechanic calls it, otherwise saliva. This may be applied if the drill or tap runs hot. The chief thing is that the drill should be sharp, or else it will push its way through instead of drilling, it will get excessively hot and may lose its temper. Also when the drill comes through there will be a nasty burred edge which has to be filed off. For those who are used to sharpening drills it may be stated that the correct angle for the cutting edge is 59 degrees and that the clearance required when drilling brass is greater than that required for working with mild steel or iron. When drilling thin brass or copper sheet it should be clamped between

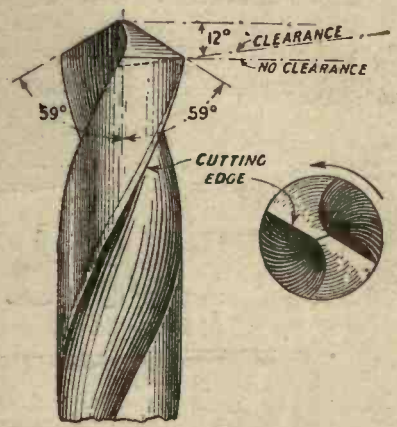
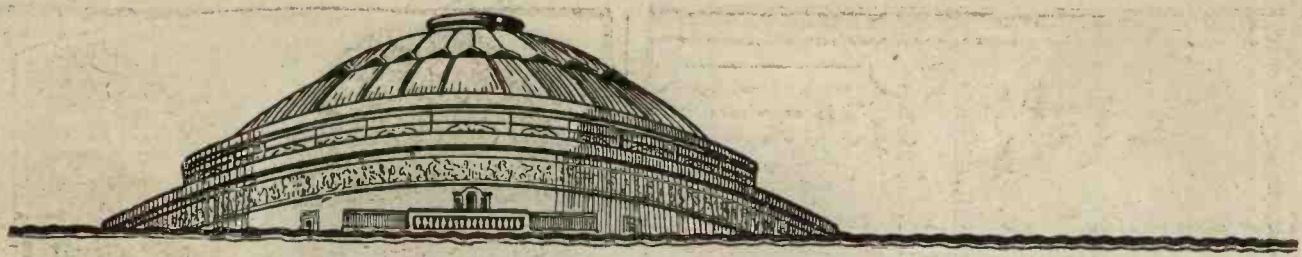


Fig. 7.—Showing the clearance and cutting angles for drilling brass and copper.

a couple of pieces of wood, so that it cannot move and the drill revolved rapidly with fairly light pressure, otherwise the metal may tear.

Drills and taps in brass should be run at a fairly high speed, if possible, but when tapping a hole by hand care should be taken to see that the tap enters straight, or else the tap may jam and break, or the thread you are trying to cut may be entirely stripped. When tapping copper it may be found advisable to remove the tap after every few cuts and clear it, as the copper is so soft that it may clog the cutting edges of the tap and tear the metal, thus stripping the thread.



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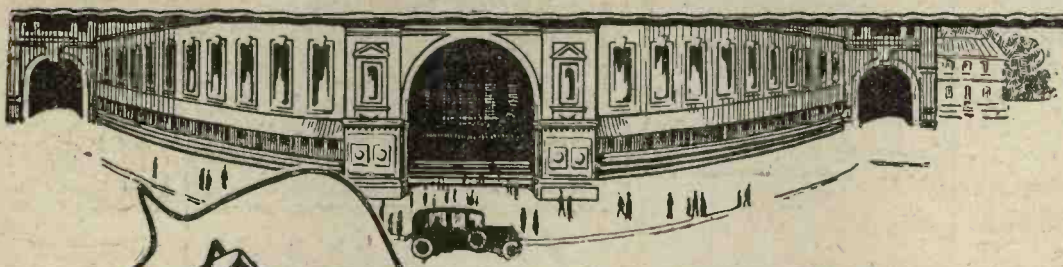

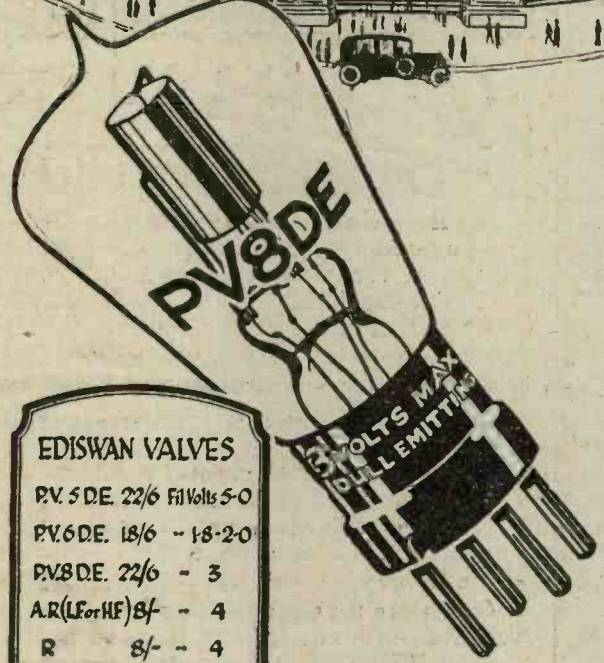

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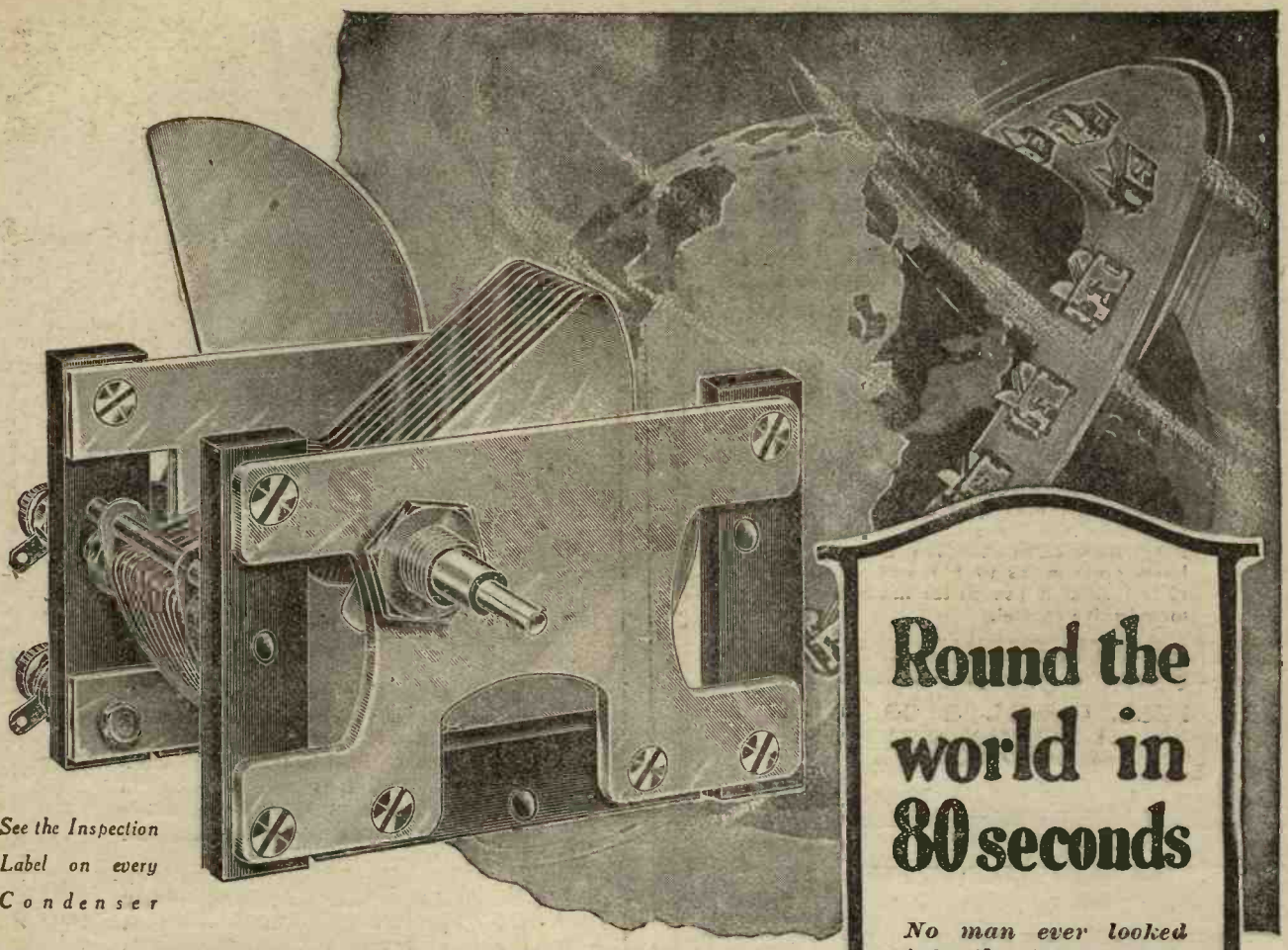

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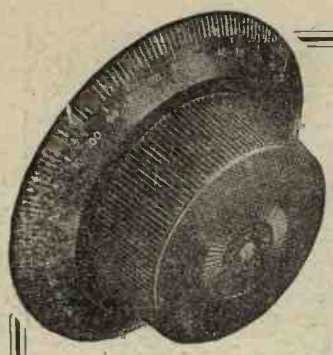

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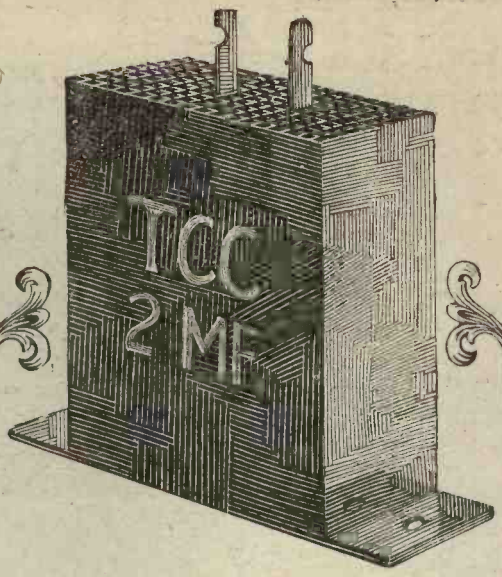

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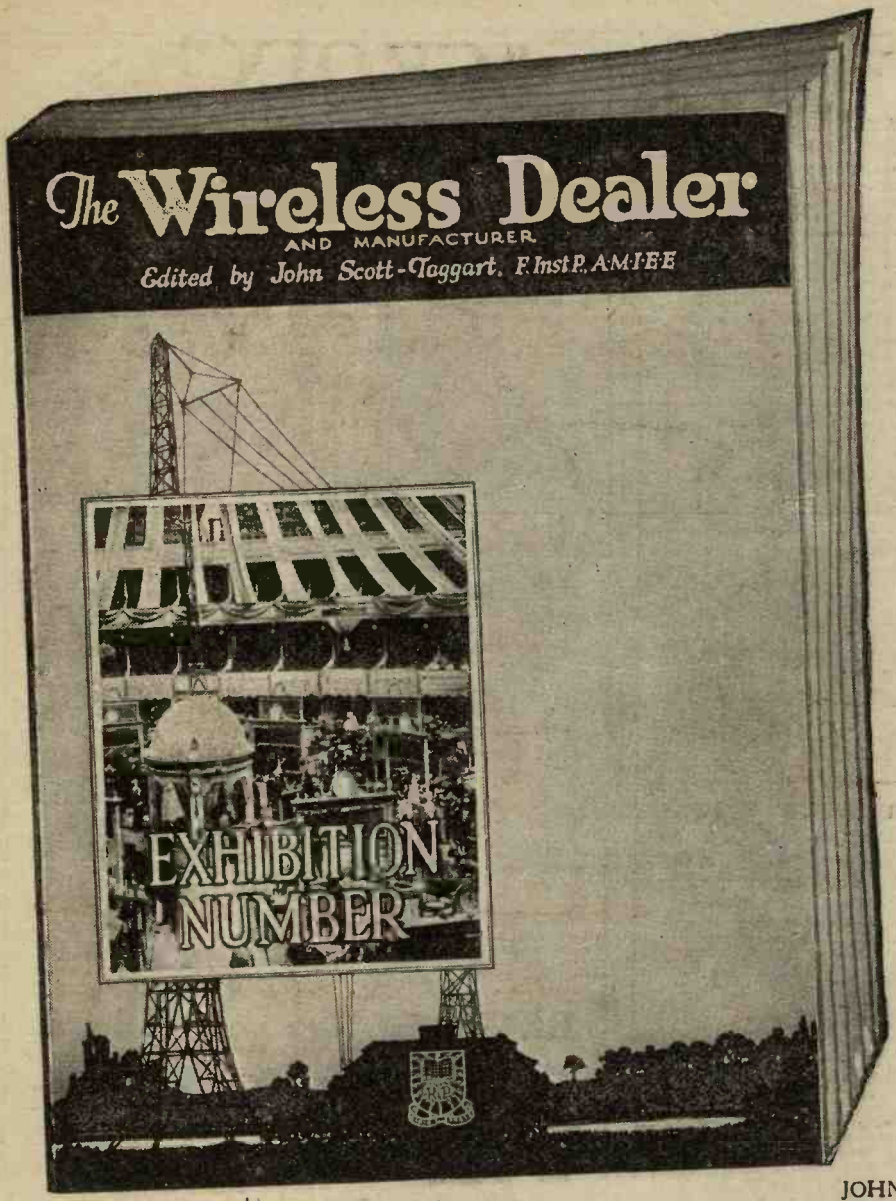

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