The Wireless Constructor

6D MONTHLY

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

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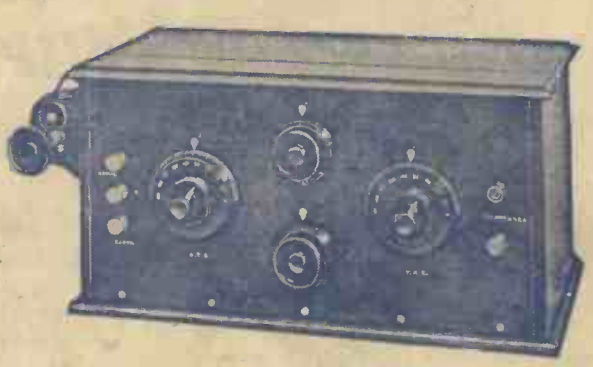
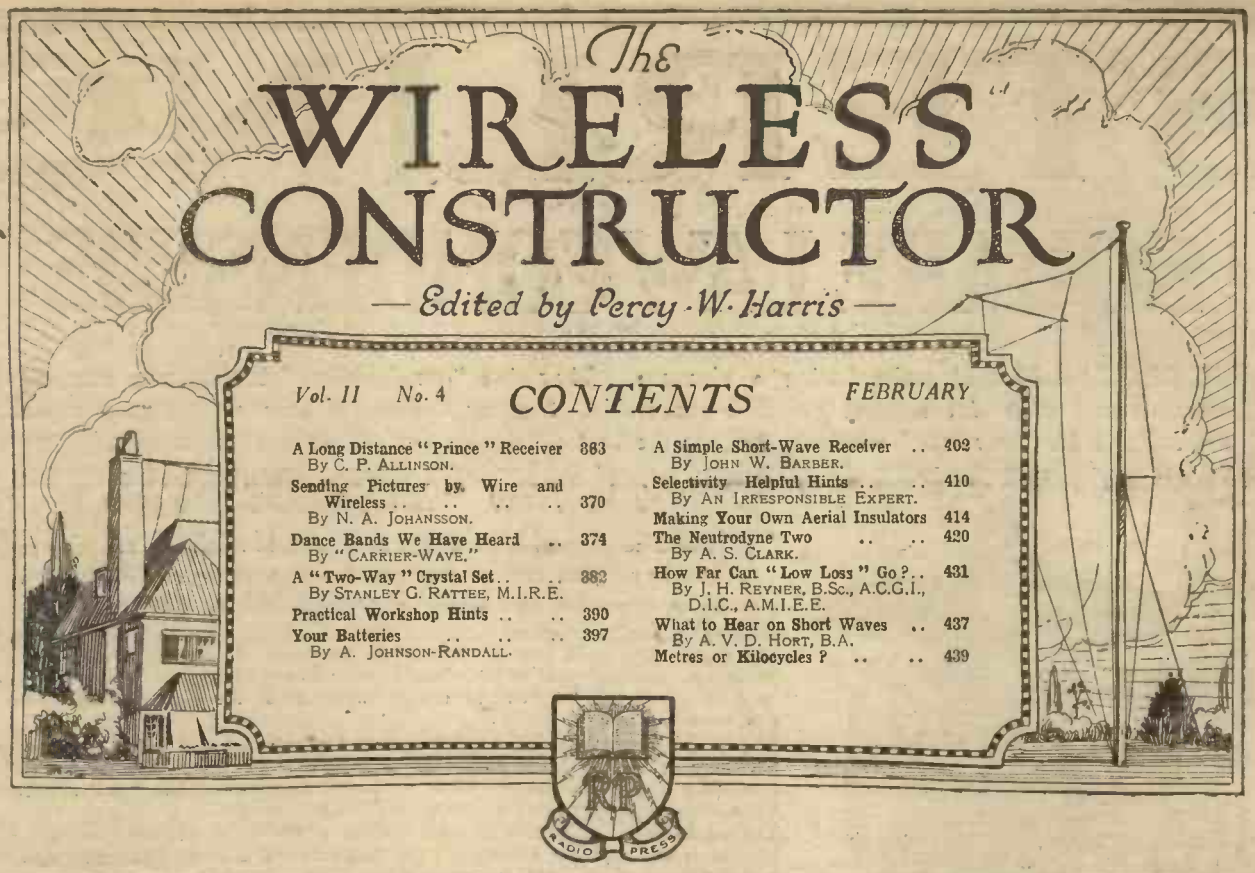


Free Blueprint inside



The WIRELESS CONSTRUCTOR

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Vol. II. FEBRUARY, 1926 No. 4.

Long Distance Work with a "Prince" Receiver

A Three-Valve Set Employing a "Trigger" Circuit

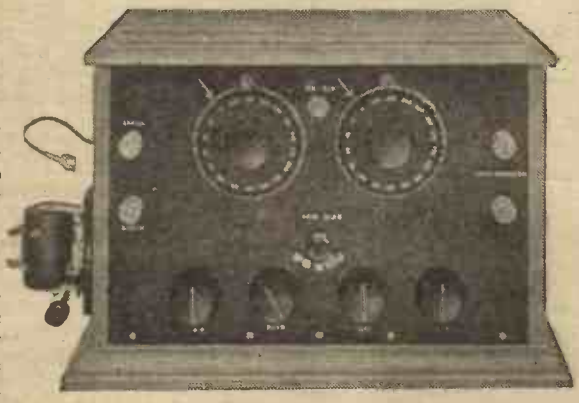
By C. P. ALLINSON

THE writer has been so struck by the extraordinary quality of tone and faithful reproduction given by Major Prince's "trigger" circuit, that it was decided to build a receiver with which distant stations could be received as well as the local transmission.

A number of experiments failed to produce the slightest reaction effect by which its range might have been increased, and it was therefore clearly necessary to add high-frequency amplification.

Panel Layout

The completed receiver is shown in the photograph, and it will be seen that it forms a very compact set for a 3-valve receiver. The special battery, which is connected between the plate of the detector valve and the grid of the L.F. valve, is carried inside the cabinet. The disposition of the controls on the panel will be seen to be symmetrical, the left-hand tuning condenser being the H.F. grid-circuit condenser, the one on the right being the detector grid-tuning condenser. The small knobs at the bottom of the panel are the H.F. filament resistance, potentiometer, detector filament resistance and L.F. filament resistance respectively. The two terminals on the left are for aerial and earth, and those on the right for the loud-speaker leads, while the purpose of the small stud-switch in the centre will be disclosed later. The small knob at the top between the two condenser dials is the on-and-off switch for controlling the low-tension supply.



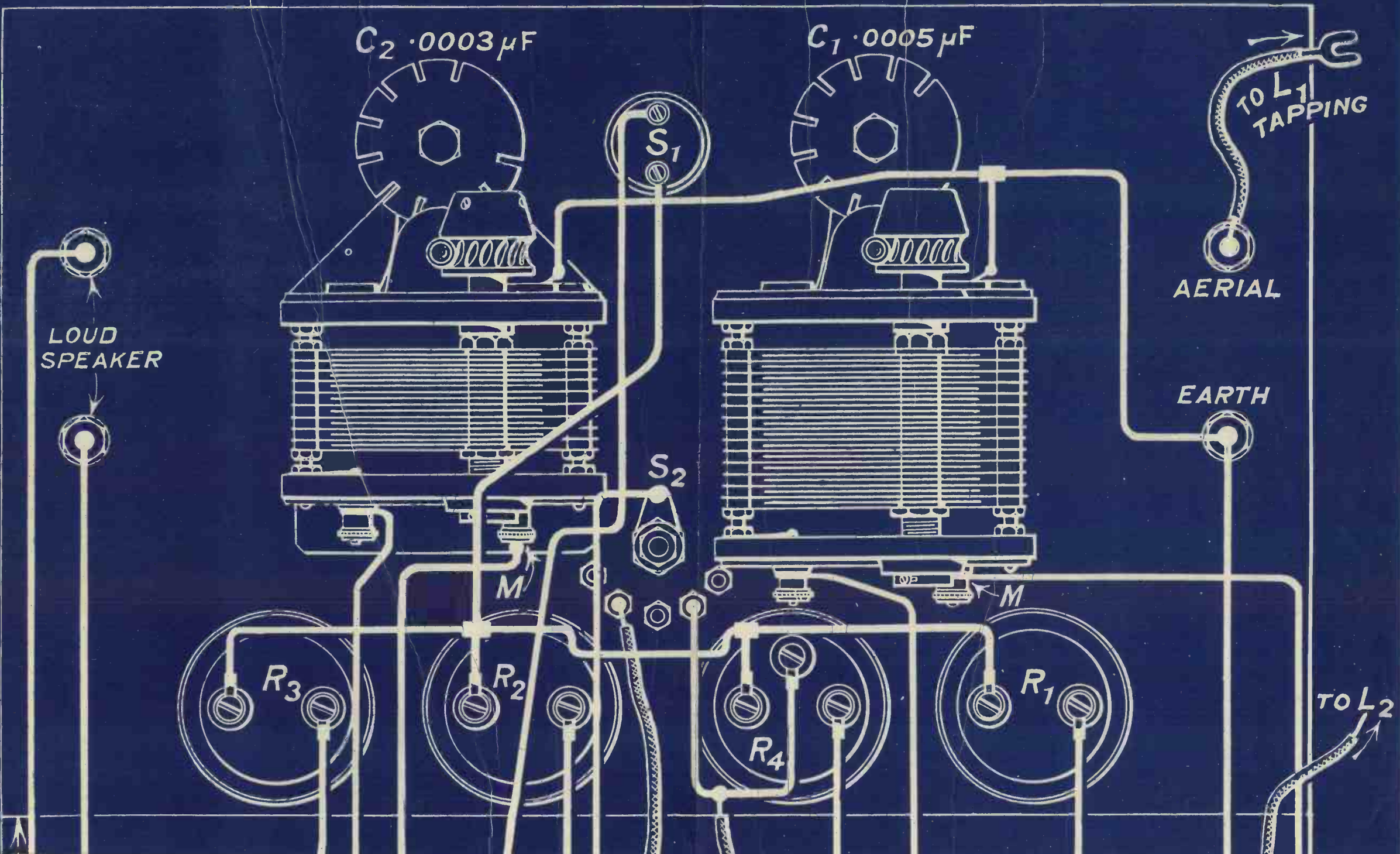
The terminals to which the high and low-tension batteries are connected are mounted on an ebonite strip at the rear of the instrument, so that these leads can be kept out of sight when installing the receiver in the drawing-room.

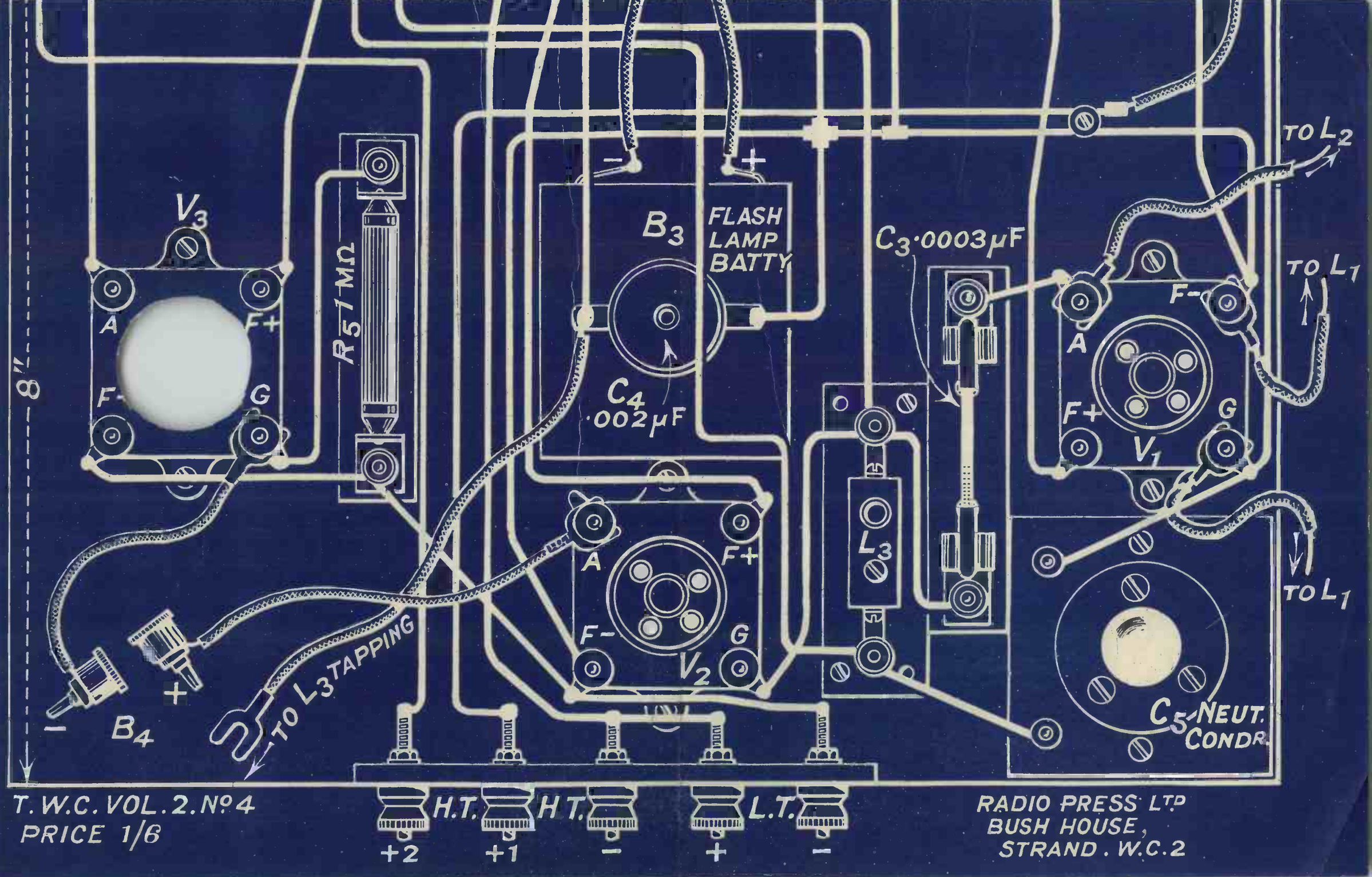
The Circuit Explained

The circuit, which was finally arrived at after a considerable amount of experimenting with various forms of H.F. amplification, is that shown in Fig. 1. An auto-coupled aerial is used, this being obtained by use of a Lissen X coil L_1. This is tuned by a ·0005 μF variable condenser C_1, the grid return and earth leads going to low-tension negative. In the anode circuit of the high-frequency valve is a choke L_2, which is variably coupled to the grid coil L_1. The anode of the H.F. valve is coupled to the grid circuit of the detector valve by means of a fixed condenser C_3, which may have a capacity of ·0003 μF. The detector grid coil L_3 is tuned by a ·0003 μF condenser C_2; and up to this point it will be seen that the circuit bears a resemblance to that used by the writer in a 3-Valve Stable Receiver, described in *Wireless Weekly*, Vol. 5, No. 11. This circuit is shown in

A LONG DISTANCE "PRINCE" RECEIVER.

B.P. No C.1028 B.





T.W.C. VOL. 2. No 4
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STRAND. W.C.2

Fig. 2, and apart from the fact that leaky grid-condenser rectification was employed, the chief difference between this and the circuit evolved for use with the "Trigger" circuit is the fact that a centre tapping is taken from the coil L_3 to oscillate without the application of reaction, it was found that when used with the "Prince" circuit it would oscillate freely, and the neutralizing method shown was therefore adopted.

It may be noted here that a true neutralizing effect is obtained with the circuit shown, since a definite adjustment of C_5 (which is not too critical) will be found to give stability. The increase or decrease of this condenser beyond those limits results in the set breaking into oscillation.

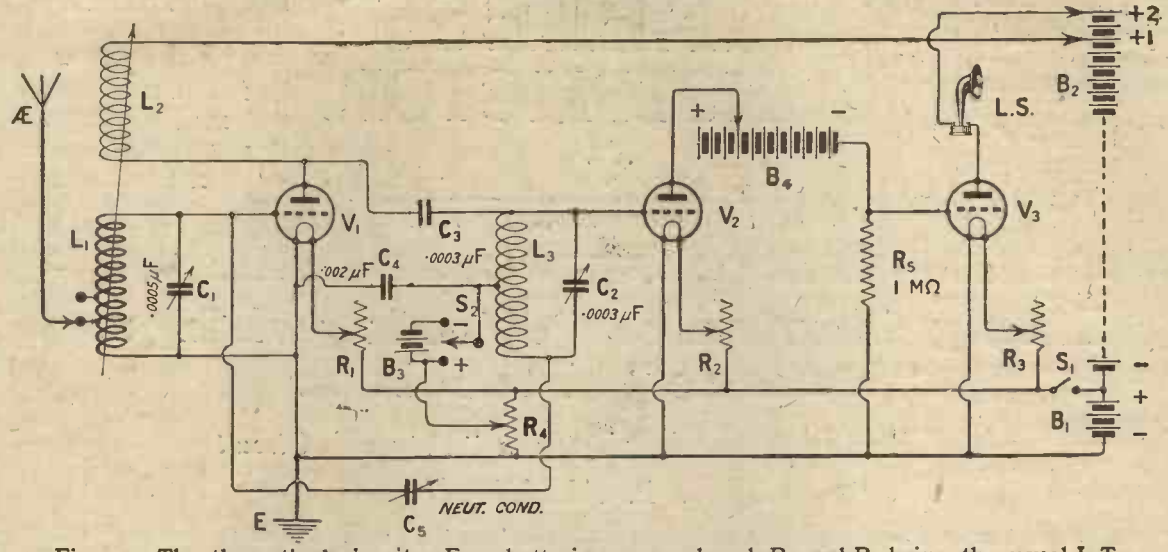


Fig. 1.—The theoretical circuit. Four batteries are employed, B_1 and B_2 being the usual L.T. and H.T. batteries respectively.

in the Fig. 1 circuit which is connected to low-tension via the grid battery and potentiometer, while the end of the coil is connected to one side of a small variable condenser C_5 for neutralizing, the other side of the condenser being connected to the grid of the H.F. valve.

Although the original circuit as shown in Fig. 2 was found to be so stable that it could not be made

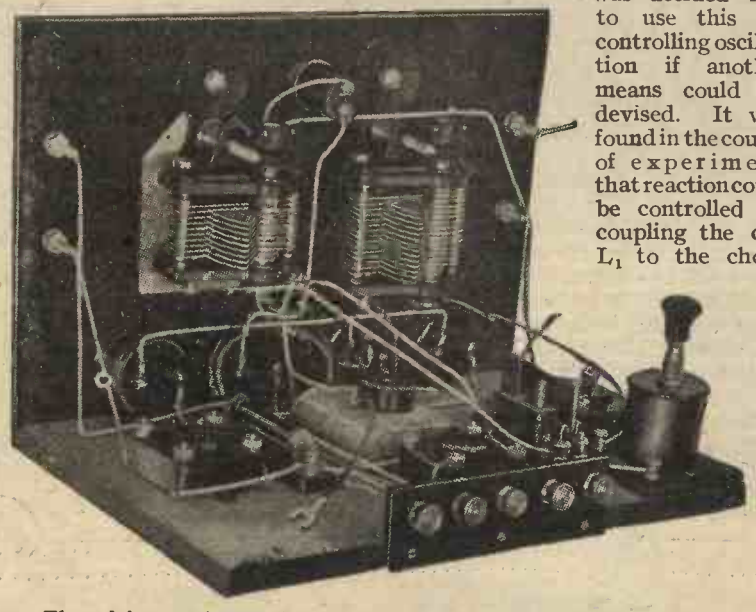
Reaction Control

Owing to the fact that both sides of the condenser C_5 are at H.F. potential with respect to earth, it was decided not to use this for controlling oscillation if another means could be devised. It was found in the course of experiment that reaction could be controlled by coupling the coil L_1 to the choke L_2 once the neutrodyne condenser had been correctly adjusted, and this method was finally adopted.

Grid-Bias

Returning to Fig. 1, we see that the centre tap of the coil L_3 is connected to a small grid battery B_3 through a switch S_2 (which enables it to be cut in and out) and thence to the slider of the potentiometer R_4. In the ordinary way, the switch S_2 will be set over to the right, so that the whole of the grid battery is in circuit. This enables the correct negative potential which is required for the correct functioning of the detector to be applied to the grid by means of the potentiometer. It was found, however, during the experimental work devoted to this receiver that with some valves or under certain conditions the reception of the local station appeared to have the effect of imposing a very large negative potential on the grid of the detector valve, which resulted in its choking up. A switch was therefore incorporated so that the grid battery B_3 might be cut out under these conditions.

With the switch turned over to the left, the centre tap of L_3 is connected direct to the slider of the potentiometer and to the positive of the battery—the latter thus being completely cut out. The central stud of the switch is merely a "dead" one, to prevent short-circuiting when the switching is carried out.



The wiring to the condensers can be seen in this photograph. The neutrodyne condenser C_5 is on the extreme right.

Potentiometer Adjustments

In most cases, however, it was found that the circuit would function perfectly satisfactorily on both local and distant transmission with

the whole of the grid battery in, only a slight adjustment of the potentiometer being necessary for the reception of the local station. It should definitely be noted, however, that a different setting of the potentiometer will be required for the nearby station than for distant transmissions. The condenser C_4 merely acts as a bypass condenser, and providing it is in the region of ·002 μF its value is not of great importance.

The battery B_4, which is connected between the plate of the detector and the grid of the amplifying valve, may have a value of about 20 volts. The battery actually used in the receiver is a small 36 volt unit, and by means of wander plugs any desired voltage up to 36 volts may be obtained in 3-volt steps. Here again the value of this battery is not critical, but it will be found that any alteration in its value will require the re-setting of the potentiometer for maximum signal strength and greatest purity of tone.

The value of the grid leak R_5 again may vary within fairly wide limits and different leaks may be tried out of values between ¼ and 2 megohms. The value used by the writer is actually 1 megohm. Its value no doubt depends to a certain extent on the valve used and the value of high tension applied to it.

Selectivity

Owing to the fact that no positive bias is applied to the grid of the H.F. valve, while a comparatively large negative bias is applied to the grid of the detector valve, together with the fact that an auto-coupled aerial is employed, this receiver gives a high degree of selectivity. Not only does this assist in cutting out the local station when desiring to receive distant transmission, but also it improves the background when interference from mush and spark is present. In fact, distant stations are received with amazing purity of tone, and on a night when interference was very slight quality of distant transmission was very nearly equal to that of the nearby station. Radio-Clichy on the longer waves was particularly good, in strength uncomfortably loud in the headphones, its purity was quite equal to that of the local station, 2LO.

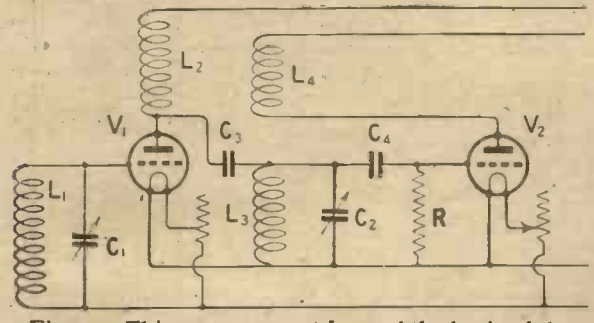
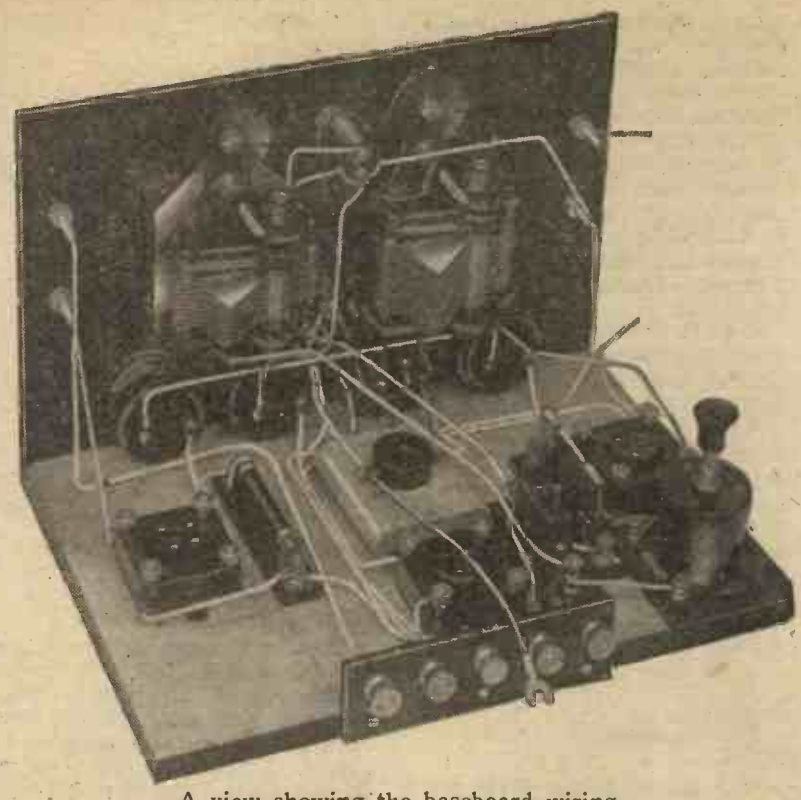


Fig. 2.—This arrangement formed the basis of the Fig. 1 circuit, aerial and earth being suitably connected to L_1.

Position of Rheostats

It will be noticed that all the filament resistances have been placed in the low-tension positive leads, and this has been done specially so that adjusting the temperature of the valve filaments shall in no way affect the bias on the grids of the various valves. This applies to the detector as well as the amplifying valves, since the correct functioning of the detector valve depends on the correct negative bias being applied to the grid. Under these circumstances, if the filament resistance were in the negative leg, every adjustment of the detector filament rheostat would necessitate the potentiometer being re-set, while any variation of potential on the grid of the H.F. valve would probably influence the reaction setting.



A view showing the baseboard wiring.

Components Required

Following the usual practice, I give below a full list of the components necessary to build this receiver, and it should be noted that, although the makers' names have been given for the convenience of those who wish to duplicate this receiver exactly, other parts may of course be used, provided that they are of the same quality or by makers of repute. You will require :—

One Radion panel 12 × 8 × 3/16 ins. (American Hard Rubber Co.).

One cabinet with loose baseboard 12 × 8 in. (W. H. Agar).

One ·0005 μF. Colvern geared variable condenser (Collinson Precision Screw Co., Ltd.).

One ·0003 μF. Colvern geared variable condenser (Collinson Precision Screw Co., Ltd.).

One two-way geared coil-holder (Lissen, Ltd.).

One baseboard mounting single-coil socket (Beard & Fitch, Ltd.).

Three Clearer-tone valve holders (Benjamin Electric, Ltd.).

Three 30 ohm filament resistances (Yesly.)

If it is intended to use bright emitter valves, 6 ohm resistances will, of course, be more suitable, though the 30 ohm resistances have been used successfully for the purpose.

One ·0003 μF clip-in condenser and mount (L. McMichael, Ltd.).

One ·002 μF fixed condenser (Watmel Wireless Co., Ltd.).

One clip-in grid-leak, 1 megohm (L. McMichael, Ltd.).

One neutrodyne condenser, baseboard type (Burne-Jones & Co., Ltd.).

One stud switch (Bowyer - Lowe Co., Ltd.).

One on-off switch (Rothermel Radio Corporation).

One No. 60 Lissen X coil.

One 60-turn centre tap coil (Burne-Jones & Co., Ltd.).

One 36-volt battery for C_4.

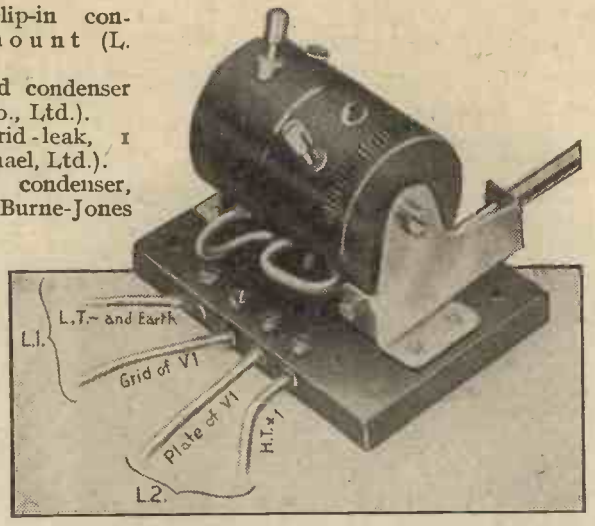
One 4½-volt flash lamp battery for B_3.

Four large lacquered brass terminals.

Five small terminals and a strip of ebonite, 5 × 2 × ⅜ in.

One set of Radio Press panel transfers.

Quantity of Glazite wire and some flex for connections.



A photograph which completely explains the coil-holder connections.

Construction

The construction of the receiver presents no difficulty. The lay-out of the panel is perfectly symmetrical, and may be obtained from the dimensioned drawing in Fig. 3. The two variable condensers, three filament resistances, the potentiometer and the on-off switch are all mounted by means of ⅜ in. holes. The four large terminals require ⅛ in. holes, the stud switch a ³⁄₁₆ in. hole and the studs ⅛ in. holes. The size of the holes for the wood screws, by means of which the panel is mounted to the baseboard, will depend, of course, upon the size of the screws used.

In any case, it will be seen that only a few sizes of drills are required for mounting the components for this set.

The positions in which the components are mounted on the baseboard can be ascertained from the free blueprint. Although this is not dimensioned, it is drawn full size and strictly to scale; and since the baseboard measures 12 in. by 8 in., it is a simple matter to make use of this blueprint for obtaining the positions of the various components.

Wiring Up

In wiring up this receiver the writer has, as far as possible, bunched the L.T. and H.T. leads, the use of Glazite making this possible, as would, of course, any other well-insulated wire.

When wiring up the receiver, the L.T. circuits should preferably be done before the tuning condensers C_1 and C_2 are mounted on the panel. It will then be found that it is a very simple matter to make connections to the filament

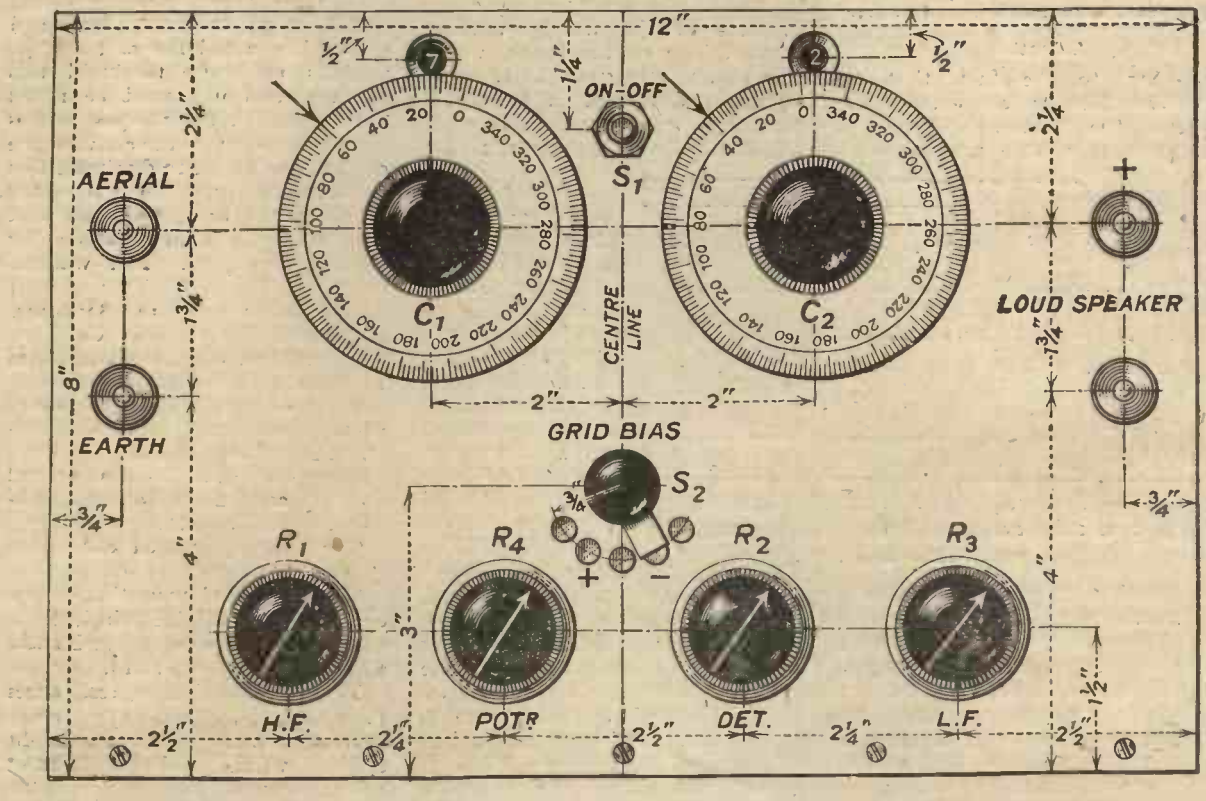


Fig. 3.—The panel layout. Readers may obtain a full-size drilling blueprint, No. C1028A, price 1/6, post free.

resistances, and the stud switch. These leads should, therefore, be put in first and run along the baseboard wherever possible. After this is completed, the two variable condensers may be mounted on the panel and the rest of the wiring done as found convenient. It will be noticed that the lead which goes to the centre of the tapped coil L_3 is flexible and fitted with a spade tag, while the five flexible leads which go to the coil-holder are taken through small holes drilled in the side of the cabinet. Flexible leads are also used for connecting the plate of the detector valve V_2 to the battery B_4, and also the grid of the L.F. valve V_3 to this battery.

Necessity for Switch S_1

Should the constructor not desire to use a switch in the low-tension circuit for cutting off the battery, this battery should be disconnected when the set is not in use, otherwise a small current will be taken from it by the potentiometer, which, although not amounting to a great deal, will in time run the battery down.

A Warning

It should be noted that the lead which connects the two tags on top of the variable condensers together and to earth *does not* make any connection to the variable condenser *vanes*; it merely makes contact to the *spindle* which carries the dial and the *shield* which is between the condenser C_2 and the panel and connects them to earth, by this means eliminating hand-capacity effects when tuning-in distant stations. This is particularly important in the case of the condenser C_2, for the centre of the coil L_3 being connected to low-tension, the two ends of the coil must necessarily be at H.F. potential to earth, and hand-capacity effects will be noticed unless a metal shield of some kind is used which is connected to earth.

Coil-holder Connections

The two-coil holder is fixed on the side of the cabinet, the leads which go to it, four for the sockets and one for the tap, are taken through small holes drilled in the side of the cabinet. The exact order of these connections, using the coils which were employed by the writer, are given in another figure. In the case where the choke coil has its winding reversed, the leads to this coil should be reversed in order to get the connection correct. On no account should the connection to the aerial coil be reversed, owing to the fact that with a Lissen X coil the plug of the coil-holder and not the socket should always be connected to low-tension negative and earth.

Testing Out the Battery Circuits

Having completed the wiring, it should be carefully checked over for any possible errors, and the set should then be tested out. Set all the filament rheostats in the off position and push the L.T. switch *in*, which is its "off" position. Connect up the low-tension battery to the correct terminals, and insert the valves, one in each valve holder. Switch the battery on by means of switch S_1, and then light the valves by adjusting the filament resistances, seeing that they burn at the correct brightness and are correctly controlled by the resistances. Next connect the high-tension battery,

The completed receiver is both compact and pleasing in appearance.

first plugging-in a small value of H.T. only and noticing whether the brightness of the valve filaments alters at all when this is connected. If this does not occur, it may be taken that H.T. and L.T. connections in the set are correct and that no short-circuit has taken place.

Operation

The set may now be tested on the aerial. For this purpose insert the Lissen X coil into its correct holder and a 250-turn coil into the other socket of the two-way coil-holder. The 60-turn coil with the centre tap (a Gambrell centre-tap coil may also be used here) is placed into its holder and the flexible lead connecting the tap is taken to its terminal. B_4 is next connected, the negative end being connected to the grid of V_3, while appropriate tapping of about 18 volts is taken to the plate of the detector valve V_2. The coil L_2 should be swung well away from L_1 and the neutrodyne condenser C_5 screwed well down. The adjusting knob should be set on the spindle so that the condenser will screw well down without actually shorting, and it will probably be found necessary to work with the plates fairly close together.

H.T. Values

Next turn up the valves and plug in the right values of high tension. A suitable value for the H.F. valve will be about 50 volts, while the L.F. valve may take about 100 or 120. If the local station is not very close, it may be desirable first to tune in on the headphones. The first adjustment is to get the correct position of the potentiometer slider, and the knob should therefore be turned until a scraping sound occurs. This sound will probably only be heard over a small part of the slider's travel, and the centre point between the two spots at which the noise disappears is approximately the correct position for the slider. The station should now be searched for by varying the tuning of the two condensers till it is heard. Having picked it up and found that the set is functioning correctly, the thing to determine is whether the coil L_2 has been correctly connected. This test should preferably be done at some time of the day or night when broadcasting is not in progress so that tests may be carried out to prove that the receiver will oscillate, and that oscillation is correctly controlled by varying the coupling between L_1 and L_2. If this is done during the broadcasting hours nearby listeners may be interfered with.

The Oscillation Point

The procedure to employ is to bring the coil L_2 gradually closer to L_1 and note whether at a certain point a slight hissing noise is heard, after which the set becomes quite dead. This noise denotes just

when the set begins to go into oscillation. When actually oscillating it becomes dead, and it will be found that it is impossible to pick up a carrier while in this condition. If, however, the set is just kept off the oscillation point, it will be found fairly simple to pick up distant transmissions by turning the two condensers C_1 and C_2 together in the same direction in such a way as to keep the set always in the same sensitive condition.

It may be found that, on starting with the coil L_2 well away from L_1, the set does not appear to be "live," but that, on bringing it closer to L_1, it comes to a position at which the slight hissing noise is heard; the set then appears to be "live," and then, on tightening the coupling still further, the hissing noise would be repeated and the set will again go dead. When this occurs it means that the coil L_2 has been connected the wrong way round and the leads to it should be reversed.

Potentiometer Adjustments

Having tuned in a distant station, the potentiometer R_4 should be adjusted until the signals are strongest and clearest, this being done with the reaction coil L_2 fairly loosely coupled so that the set is well off the oscillating point. The strength of the signals may now be increased by bringing up reaction a trifle. The position of the potentiometer for distant stations should carefully be noted so that it may be returned to after having listened to the local station.

At first it may be found that this receiver is somewhat difficult to handle, but a little practice will soon give the required knack and enable the receiver to be used as successfully for distant reception as for nearer stations. The use of geared condensers enables stations to be tuned in very accurately, and will be found of great advantage in tuning in weak or distant transmissions.

Arrangements for 5XX

If it is desired to receive Daventry as well as the higher frequency broadcast transmissions, L_1 will be No. 250 Lissen X, the choke coil L_2 may be a 400 or 500 plug-in coil, and L_3 will be a 250-turn coil with a centre tap. A suitable coil for this is the Gambrell F or G with centre tap, or a special coil made for the purpose for the writer by Messrs. Burne-Jones & Co., Ltd. The use of these coils will not only enable Daventry to be received, but Radio-Paris should be heard as well, while one or two other Continental transmissions within the region of 1,000 metres may be heard on some nights.

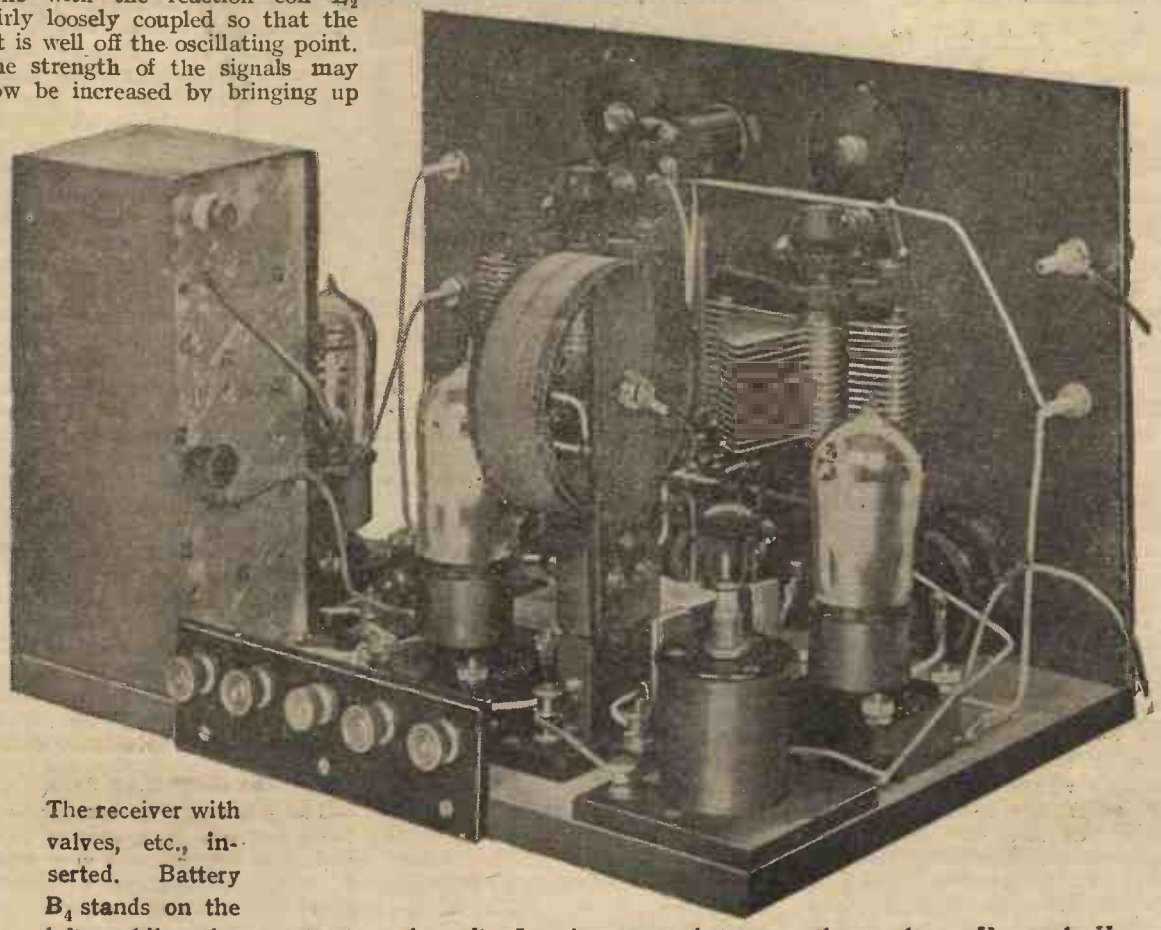
The Higher Frequencies

A point that may be mentioned is that on the lower wavelengths in the region of 250 metres a considerable increase in reaction may be required on some aerial-earth systems, in some cases more than can be obtained by coupling the choke coil tightly to the aerial coil. Under these circumstances it may be necessary to readjust the neutrodyne condenser slightly. This can be the final adjustment for this condenser, as on the high wavelengths it will be possible to control oscillation by sufficiently loosening the coupling of L_2 to L_1.

Test Report

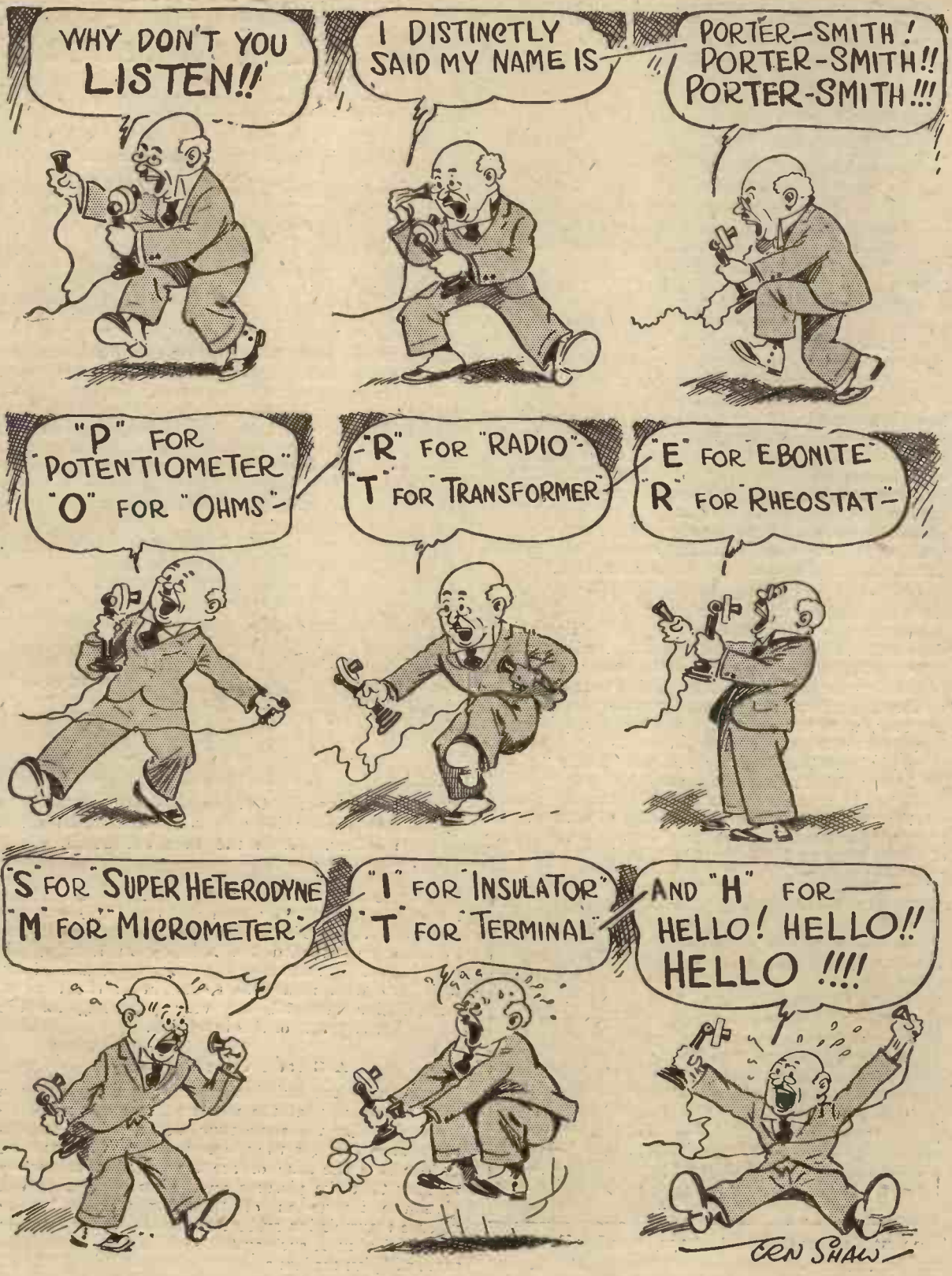
Tested on a small aerial not three miles from 2LO, the set is found to be considerably more selective than the usual straight H.F. and detector. When using an ordinary set such as a tuned anode and detector without a wavetrap, it is found difficult to receive Birmingham without interference from 2LO on this aerial. With

(*Concluded on page 440.*)



The receiver with valves, etc., inserted. Battery B_4 stands on the left, while the centre-tapped coil L_3 is seen between the valves V_1 and V_2.

THE BROADCASTING HABIT!



Part of the transmitter used for sending pictures by wireless

Sending Pictures by Wire and Wireless

By N. A. JOHANSSON

(These interestin gparticulars have been received from "Radio," the Stockholm wireless periodical)

AT the time when broadcasting started to become more general, there were prudent people who intended to delay every purchase of radio-receivers until it would be possible to see as well as hear broadcasting. A very flattering opinion of the ability of the radio-engineers to produce results quickly! Even if the time is far off when one will be able to see broadcasting (*i.e.*, to receive at home pictures or even moving pictures by means of simple and easily-managed receiving apparatus) a great step towards the goal has already been made by the realization of the present commercial picture transmission by wire and by radio in America.

Early Experiments

The first experiments with picture-telegraphing date relatively far back in the past. As long ago as 1907 Professor Arthur Korn, in Germany, succeeded in sending pictures by a telegraph line over a distance of 600 kilometres. The results of these experiments, however, were not up to the minimum requirements as regards sharpness of the picture and speed of the transmission. The book by Professor Korn, "Handbuch der Phototelegraphie und Teleautographie," published in 1911, may now be put among the classics on the subject. Rather good results with picture transmission have lately been obtained according to different systems by Edouard Belin, in France, and J. Francis Jenkins, in America. The practical utilisation of picture transmission has, however, been possible only since the big firms of the world, with their economic resources, have taken the matter into their hands. In the United States, the Radio Corporation of America and the American Telegraph and Telephone Co. have at present systems in practical use for telephotography by both radio and the ordinary telephone lines. The Telefunken Company, in Berlin, in collaboration with Dr. Karolus, in Leipzig, has also just lately succeeded in obtaining results which, especially with regard to reduction of the time of transmission required, are very promising for the future development of this invention.

A present-day product of the telephone transmission system, sent from New York to Chicago in seven minutes. Note the excellent detail.

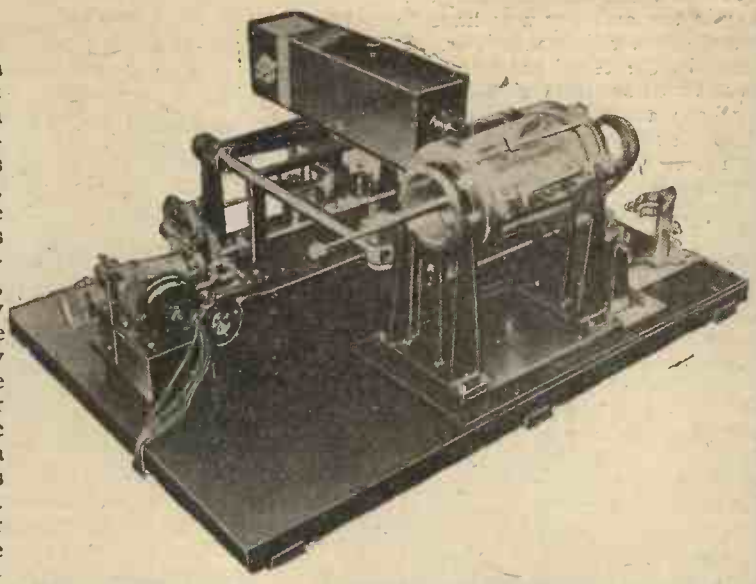
The first picture sent by telephone from San Francisco to New York. Compare its coarse grain with that obtained nowadays.

A Certain Time Necessary

All picture transmission systems have one thing in common—viz., that the whole picture can never be transmitted at the same time, but a certain time is always required for the procedure, even if it is possible to decrease the time of the transmission in such a manner that the pictures on the reception side will give the impression of "moving pictures." The picture transmission system of the Radio Corporation is typical of most such systems, and an account of the same will give readers an idea of the principles involved in the sending of pictures by all such methods.

Use of a Photo-Electric Cell

When sending a picture, it is first photographed on an ordinary photographic film. This latter is developed, and the negative placed on the glass cylinder of the transmission apparatus, where it is kept by means of clips. The picture is now ready to be sent off. Inside the glass cylinder there is an electric lamp, from which a fine ray of light is thrown on to the film. As the glass cylinder is made to rotate, the ray of light penetrates alternately dark and light parts of the film, thus varying the strength of the transmitted light. This ray of light, after passing through the film, is concentrated by a lens on to a so-called photo-electric cell, which transforms the light variations into electrical impulses. The photo-electric cell is popularly called the "eye" of the transmitter, and possesses the property that its resistance varies according to the intensity of the light falling upon it. The photo-electric cell works practically without any "time-lag" whatsoever, and the slightest change in the strength of the light reaching the cell results immediately in a corresponding change in the electric current passing through the cell.



The apparatus used by the Radio Corporation for the transmission of pictures by wireless.

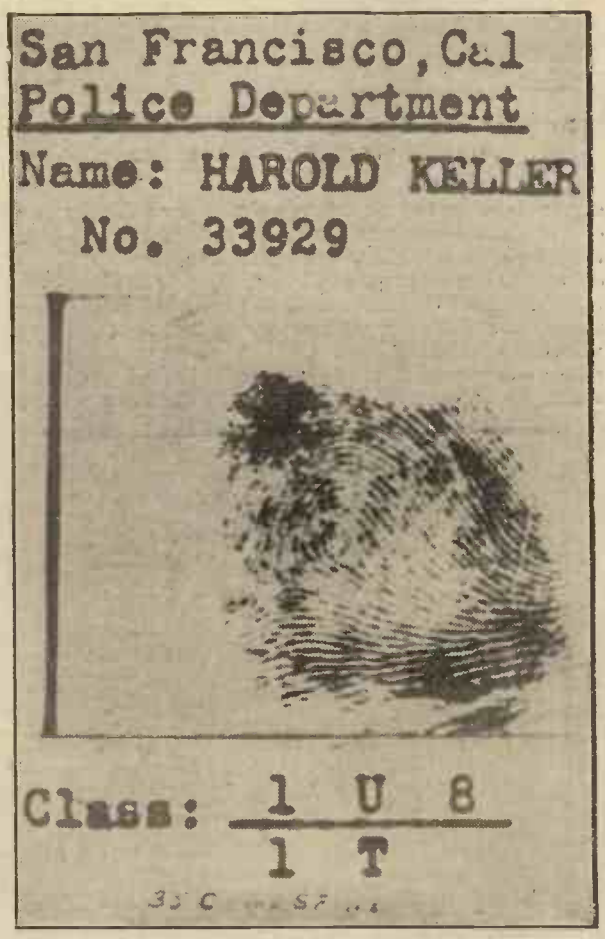
The photograph of a "wanted" man can be sent by wire in a few minutes.

Disadvantages of Selenium

In previous experiments with telephotography, the element selenium was generally used instead of the photo-electric cell. Selenium also possesses the property that its electric resistance is increased by powerful radiation of light, but owing to the inertia of the selenium cell and the length of time which is required for the picture transmission with this kind of cell, the use of the photo-electric cell has been generally adopted. The photo-electric cell causes a countless number of current impulses to be produced, corresponding to the light and the dark parts of the picture which is to be transmitted.

Carrying Out the Transmission

In order to cover the whole original film, the glass cylinder rotates forward and backward until the whole surface has been exposed to the ray of light. The film rotates through an angle which is equal to the length of the picture, and the "electric eye" is pushed along the cylinder one step for each whole revolution. In this way, line after line of light passes through the film until the whole picture has been covered. The electric current impulses through the



The police also send finger-prints and other details in the same manner.

photo-electric cell pass to a number of low-frequency amplifiers, after which they in the ordinary way have to modulate the carrier-wave from a radio transmitter. If the picture is to be sent by the telephone lines, the photo-electric current variations are transmitted direct, of course, after having been amplified to a sufficient degree; or, according to the method of the American Telephone & Telegraph Co., they modulate a high-frequency carrier-wave in accordance with the principles applied for high-frequency telephony by telephone lines.

Similarities and Differences

On comparison between the transmission procedure for sound (telephony) and for pictures (telephotography) it would appear that there is a very close parallel between certain details of the apparatus. In the one case a microphone is used for transforming the vibrations of sound in the air into electric current variations; in the other case, the "electric eye" does

Another excellent example of a photograph received via the telephone lines.

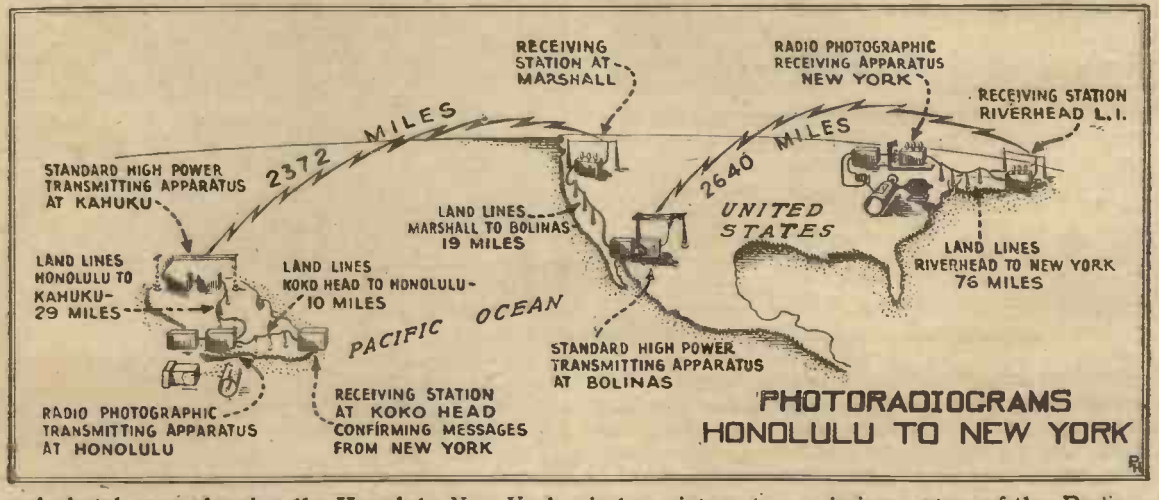
service in order to transmit in a similar way the changes of light into electric current impulses. However, here the points of similarity between the acoustic and the optic transmission cease. During a certain short time interval the microphone can faithfully reproduce in electric currents very complex and complicated vibrations of sound and changes of tone, while the photo-electric cell during the same period of time only reacts to different degrees of light. Thus, a picture

Examining a negative received by wire at the New York Laboratories of the American Telephone and Telegraph Co.

can never be sent off in full at once, but must be divided into small sections which together in line after line give the whole picture. The smaller these tiny sections or points are, the more naturally the variations of the current, or, rather, the resistance, in the photo-electric cell correspond to the dark and the light fields of the picture. Hence the necessity of the rotating cylinder which enables the ray of light successively to pass over all the fields of the picture. This device is to be found, with some modification, in all systems of picture transmission. An analogy which may help to make the difference clear is that by telephony the sound waves are reproduced in one dimension, corresponding to the conception "length," while in order to enable a picture to be electrically transmitted it must be reproduced in two dimensions, corresponding to the conception "surface."

The Receiving Apparatus

On the reception side, the photo-electric current impulses are separated from the carrier-wave by means of a detector, in the way employed for radio telephony, and after sufficient amplification they affect in some way or other a beam of light rays from a powerful lamp. These rays of light are made to vary in strength in time with the electric current impulses received, and



A sketch-map showing the Honolulu-New York wireless picture transmission system of the Radio Corporation of America.

are concentrated by a system of lenses towards a photographic apparatus. If the reception cylinder begins to rotate simultaneously and at the same speed and in the same way as the transmission cylinder, a copy of the transmission negative is obtained on the reception film. The sharpness of the picture is evidently dependent on the way in which the light rays

Picture of a newspaper cutting sent by radio.

at the transmission and the reception stations are made to pass over the film. For radio reception of pictures the Radio Corporation of America has also had a receiving apparatus constructed in which white paper is substituted for the reception film, and a pencil made to mark the paper in time with the photo-electric current impulses. A picture of such a photo-radiogram appears in this article.

How Receiver and Transmitter are Synchronised

The condition of the picture transmissions taking place satisfactorily is that there is absolute synchronism between the rotating cylinders on the transmission and the reception side, or the picture will be indistinct or even absolutely spoilt. With the apparatus of the Radio Corporation this synchronism is maintained by means of specially constructed motors, which are made to describe a constant number of revolutions per minute by control from electric-driven tuning forks. The forms of apparatus used by the American Telegraph & Telephone Co. for picture transmission by the telephone lines obtain their synchronism from an extra current driving both the transmission and the reception cylinders at 600 r.p.m. Besides synchronism being necessary for obtaining a clear and distinct picture, it is quite as important that no changes in the transmission medium must occur during the sending of the picture. The "fading" sometimes experienced with broadcasting reception at long distances would completely or partly spoil a wireless picture reception. Transmission of the picture by telephone lines, therefore, is easier than transmission by radio, because the conditions on a telephone line can be kept constant by comparatively simple means.

American Developments

Owing to the kindness of Captain Ranger, at the Radio Corporation's "Photo-radio" laboratory, and Mr. R. S. Fenimore, of the American Telephone & Telegraph Co., in New York, the writer, at his last visit to New York, was given an opportunity to study the two picture transmission systems at present in use in America. Of these, the system of the Telephone Company is in daily use from 4 to 11 p.m. for picture transmission on the line New York—Chicago—San Francisco. Photographs and drawings are here transmitted in both directions at a price of $35 per picture. The time of transmission is, on the average, seven minutes for each picture, independent of the distance. In this way, the newspapers in New York, Chicago, and San Francisco are in a position to publish the same pictures simultaneously, and, to judge from everything, the system is working to its

A photograph sent by wireless from Honolulu to New York. The black dots are due to atmospherics.

full capacity on the account of the big newspaper syndicates. An interesting experiment was made at the time of the writer's visit to the laboratory of the Telephone Company, by the company in collaboration with the American Military Administration. From an aeroplane, a photograph was taken of the military constructions at Fort Leavenworth, in Kansas. This photograph was developed according to a new method while the aeroplane was up in the air, and let down by means of a parachute to the nearest transmission station. About 29 minutes after the photograph was taken a print was in the hands of the Military Administration in New York.

Members of the Savoy Havana Band

Dance Bands We Have Heard

By

"CARRIER-WAVE"

WHATEVER their faults of omission or commission, the broadcast programmes may justly claim to have developed the listeners' two extremes—the head and the feet.

No ordinary manager would have dared, shall we say, in 1922 to give to what he knew to be a more or less "low-brow" audience excerpts from the Three B's—Bach, Brahms and Beethoven—or Schumann, Schubert and Chopin. He would have laughed at the mere mention of such a scheme. Neither would the concert hall manager have thought it possible to introduce into every household, willy-nilly, the "brutalities" of sound known as "jazz."

But the B.B.C. has gone in where mere professionals fear to tread, and insisted on a course of both "high-brow" music and dance tunes. One thing, however, is certain, and that is that the love of dancing has increased to an almost incredible degree as a result. As regards dancing to wireless music, it is a far step since the first wireless dance, which took place early in 1923 under the auspices of the Highgate Radio Society, being held at the Gate House, where formerly the conventional dance band had been provided for many years.

This venture proved so entirely successful that from that time onward it has proved quite possible to hold dances to wireless music, whether on the conventional lines in a hall, or the more informal and happy method of turning up the carpet, switching on the loud-speaker, and letting the Savoy Bands do the rest.

Early Days

In the early days of 2LO, several bands were used, one of the earliest being the Savannahs Dance Band. Later, we had Mr. Stanley Holt, known for many years as a leader and provider of dance orchestras.

Mr. Herman Darewski, who, as a composer, is intimately connected with the theatre and dance music.

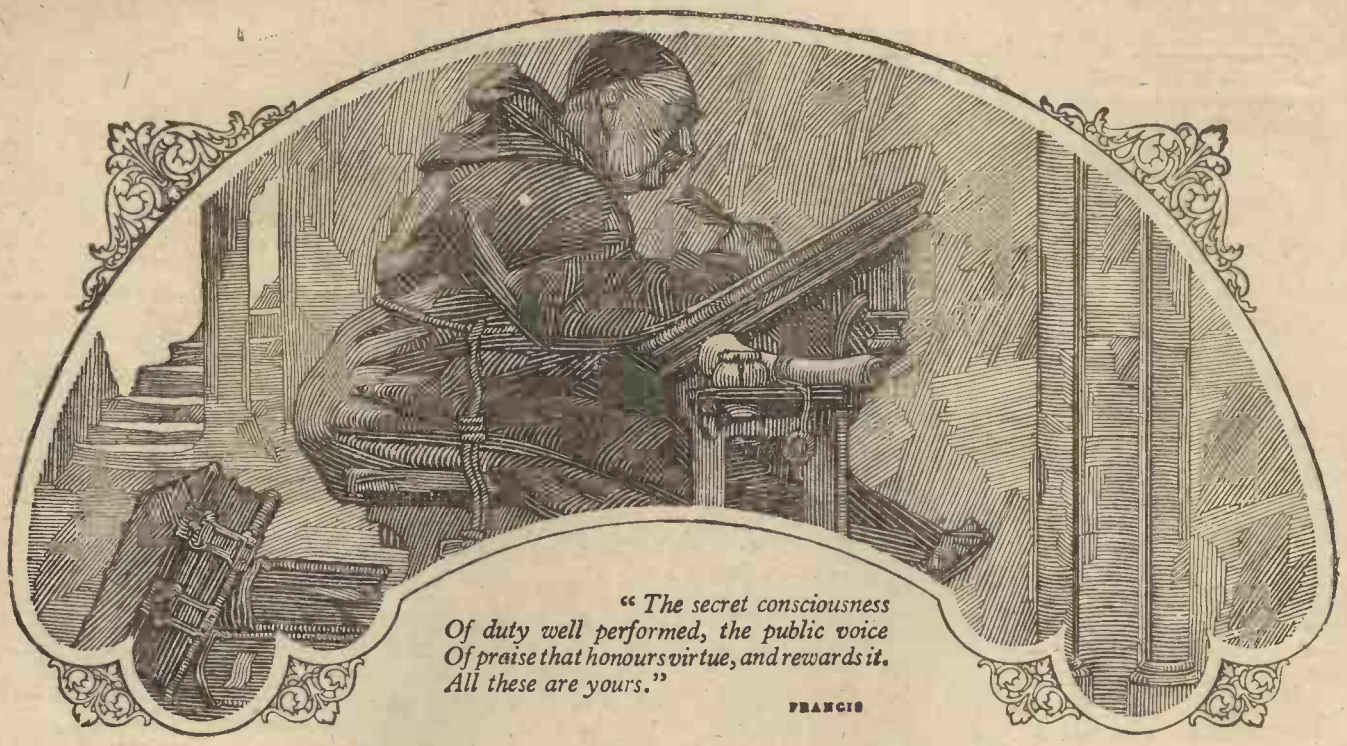
To Mr. Holt may be given the honour—or the blame, according to whether you are an admirer or not—of bringing over syncopated music, otherwise known as "jazz." Returning from a tour in America in 1910, where he found it just gaining ground, Mr. Holt introduced "ragtime," or "jazz," to London managers, who scoffed at the idea and refused to give it a trial.

Undaunted, Mr. Holt used it on his own orchestras, with tremendous success, and some of his syncopated performances were broadcast in the early days of "radio." Although during the past year chief honours have fallen to the Savoy Orpheans and the restaurant orchestras, Mr. Holt comes back to us again this year as conductor of the new Radio Radiance Dance Orchestra, first heard in December.

The Savoy Orpheans

The work and *personnel* of the Savoy Orpheans and Havana Bands, together with their latest Tango Bands, have become so widely known that it is hardly necessary to go over their history again. They were the first to have a big

The dance orchestra at the Carlton Hotel, London, is under the direction of Mr. Bert Firman.



"The secret consciousness
Of duty well performed, the public voice
Of praise that honours virtue, and rewards it.
All these are yours."

FRANCIS

Of Duty well performed . . .

THE monk in his cell—the worker at the bench. Between these two a great gulf, yet by one common bond they are united. The bond of Duty. No monk ever possessed more enthusiasm for his tasks in life than those loyal workers—men and women alike—engaged in the business of making Cossor Valves. Without their co-operation—so cheerfully and willingly given—the nation-wide reputation for long service and dependability enjoyed by Cossor Valves must inevitably suffer.

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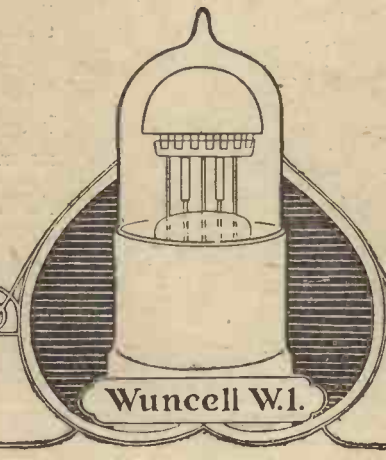

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organization, and to direct jazz into more artistic lines than the mere copying of the original uncouth negro sounds which in the beginning caused as much dismay as laughter. The Savoy Band's numerous instruments, weird effects, and artists of real merit, together with their performances at the Queen's Hall and their provincial tours in the "open light" of publicity, have endeared them to the largest public

One of the pioneers—Mr. Stanley Holt, who introduced "Jazz" into this country.

in the world. Many of their members are well known as individual soloists, and, as examples, may be quoted Mr. Cyril Newton, the conductor of the Havanas, who is a brilliant violinist, singer and composer, Mr. Debroy Somers, who conducts the Orpheans, and Mr. Billy Mayerl, the pianist. The

The Savannahs Band was among the first to provide radio dance music.

latter is a Trinity College man and a composer of more popular dances and fox-trots than can be conveniently named. His latest is "No Wonder," and amply justifies its title as a reason for success.

English Orchestras

When we approach our own instrumental combinations, we find that they have added something to jazz music which the imported bands miss. The principal one may be justly regarded as that of Mr. Herman Darewski, the famous composer. Each member is a trained soloist, not only on one, but sometimes on two or three different instruments, and this accounts for the fact that an instantaneous change can be made, transforming it from a jazz band into a real orchestra.

A Versatile Combination

It is quite possible, therefore, for Mr. Darewski to play the classic "It ain't gonna rain no mo'," and follow it with the full score of any of the standard overtures, and reverse again for the next item. Few musical broadcasts have proved more successful than his recent transmissions from the Spa, Bridlington, and those at the Majestic Theatre, Leeds.

To Mr. Darewski was due the first broadcast to America, one of his Revues then running at Bridlington being chosen. A pioneer of real artistry in dance music, and the creator of a combination of fine players, apart from his own personal achievements in the theatrical and musical world, Mr. Darewski stands unequalled.

Other British Bands

Another noted British dance band is that of Mr. Jack Hylton. A true British conductor, for he hails from Lancashire, Mr. Hylton has also a very wide experience of theatrical matters. Early seeing the vast

Well-known to patrons of 5SC—the Gleneagles Dance Band, which has broadcast from Glasgow many times. Note the microphone beside the leader of the orchestra.

Mr. Vincent Lopez, whose band is known to listeners.

possibilities of the jazz band, he sought to combine it with more harmonious effects, and after gathering round him a little band of six ex-Service men he made a start. These are still with him, but he has increased the number to thirteen, the odd man being a brilliant saxophonist, who also plays oboe and clarinet. Mr. Hylton has been heard at many Stations, and his band was a feature of the recent Radio Revels. He has had many tempting offers to go to America, as well as other countries.

Earlier in the year another famous dance band to broadcast was that of Vincent Lopez, who proved the power of a vivid personality that lent colour to his performances.

Restaurant Orchestras

By their ability to play both jazz and popular music the restaurant bands have stood the broadcast concerts in good stead.

The Piccadilly Orchestra

Naturally the first that leaps to mind is that of Mr. De Groot at the Piccadilly Hotel, but it is unique in that from the very outset Mr. De Groot made it clear that he would not play jazz music. By substituting popular arrangements of the great classics and operas, Mr. De Groot has made his fortnightly transmissions extremely acceptable.

Miss Vera Clarke, who conducts the orchestra at the Trocadero.

A violinist of note, he has also appeared at many of the variety theatres, with two of his confrères, M. Samehtini, a fine 'cellist, and Mr. Zibilaro, the pianist.

There are many other orchestras worthy of mention, including Mr. Bert Firman's orchestra at the Carlton Hotel, Mr. Sidney Firman's at the Cavour, as well as Emilio Columbo's Band and Alfredos's

From the Grand Hotel, Eastbourne, we have heard orchestral music led by Mr. Albert Sandler.

Band, Camille Coutourier's at the Frascati, and Alex Fryer's Band at the Rialto Theatre.

A Lady Leader

It has been left to Miss Vera Clarke to be the only lady conductor, and her afternoon concerts at the Trocadero have become for many listeners a very bright spot of the week. Miss Clarke has united two arts in her professional career, being at one time a dancer, and possibly this accounts for the wonderful precision and attack which mark all the music carried out under her baton.

In the Provinces

From the various provincial stations we have heard excellent

"There's nowt like Lancashire!" At any rate, Mr. Jack Hylton, who hails from there, has gathered together a dance band of which any county might be proud.

dance music. Early in broadcasting annals came the famous Gleneagles Band from Glasgow, and so well known are their performances that they have been recorded. Another famous dance band is that

The wonderful playing of Mr. De Groot and his Orchestra is a regular feature of the London transmission.

of the Royal Bath Hotel at Bournemouth, which has been relayed through 6BM regularly for many months. Originally conducted by Mr. David S. Liff, it is now under the baton of Mr. Alex. Wainwright, and its high reputation has been steadily maintained. There is also the Royal Bath Hotel String Orchestra, directed by Gilbert Stacey, a well-known composer, pianist and singer.

At Birmingham the Decameron Bands under Mr. Shenkman, and the Buffalo Band under Mr. Dan Carroll, playing at the Palais de Danse, are best known, and they have been relayed to London.

Although not a provincial Station, Eastbourne has made its name known to Londoners recently by the performances of the orchestra at the Grand Hotel, led by a young violin soloist, Albert Sandler.

KDKA Calling !

All these bands and orchestras have done yeoman service in relieving the wireless programmes, but one would like to mention the band which has probably met with more acclamation than any other, even if one could only hear a note occasionally, and that is the Westinghouse Brass Band at KDKA.

The Anglo-American Six

SIR,—I cannot help writing to inform you of the wonderful performance of the "Anglo-American Six" receiver which I recently built to the specifications of Percy W. Harris, M.I.R.E., in the January and February, 1925, issues of THE WIRELESS CONSTRUCTOR. I had never attempted to build a set before, but I set out to aim high if I had to fall low, with the result that is beyond my highest expectations. My only previous wireless experience was to handle a six valver of a well-known make for eight months.

The B.B.C. main stations come in often without aerial at favourable times. I am using ·06 D.E.3 Marconi valves as high frequency and Det., with D.E.4's as the two L.F. valves, all working from 4-volt accumulator, with no grid battery; four H.T. batteries, as recommended by you, 60 volts on H.F., 60 on Det., 90 each on L.F., and I find it quite a saving plan in the long run. I have not taken the trouble to stay up for America. All I want is to receive the B.B.C. stations well at all times and at any normal conditions, and I have succeeded in doing this through your wonderful Anglo-American Six. When one can do that properly the rest of the world's principal broadcasting stations are only waiting to be tuned in.

Thanking you for your priceless periodicals.

Yours faithfully,

TOM DAVIES.

Lampeter,
Cardiganshire.

SIR,—I am writing to let you know that I am very pleased with the "Anglo-American Six" described by Percy W. Harris, M.I.R.E., in the January and February, 1925, issues of THE WIRELESS CONSTRUCTOR. I constructed it some time ago, and so far I have received 2LO, 5IT, 2ZY, 6BM, 5NO, 5WA, 5SC, 2BE, 2BD, Rome, Madrid, six German stations, Radio-Paris, Ecole Superieure, Eiffel Tower, 5XX, at good loud-speaker strength; and on April 15 WJAZ at good loud-speaker strength. I am 15 years of age, and have also constructed the S.T.100, All-Concert, All-wave Transatlantic, 3 and 5, 4 Family, and two one-valve receivers. I first started with a crystal set 4½ years ago.

Wishing you the best of luck with your papers.

Yours faithfully,

R. G. J. NASH.

Oxford.

The Savoy Hotel Dance Bands are now world-famous. Above are members of the Orpheans with some of their wonderful instruments.

A "TWO-WAY" CRYSTAL SET

By Stanley G. Rattee, M.I.R.E.

A useful receiver for 5XX and the local station giving alternative circuits for the latter

THE set illustrated and to be described is so designed that reception upon the broadcast wavelength band may be obtained either by means of a specially-wound coil with provision for auto-coupling and crystal tapping, or else by means of a conventional plug-in coil with a parallel tuning condenser in the ordinary manner.

Extra Telephones

For the reception of 5XX or other long-wave stations the plug-in coil arrangement is used throughout.

In order that two or more pairs of telephones may be used with the set, provision is made for one pair of phones to be connected in circuit by means of a plug and

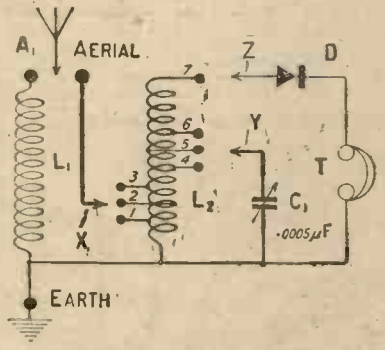


Fig. 1.—The complete circuit diagram.

jack, while other phones, should they be required, may be connected across the telephone terminals.

The Circuit Arrangement

The theoretical arrangement of the circuit of the receiver is shown in Fig. 1, where L_1 represents a plug-in coil, L_2 the hand-wound coil (to be described), and X, Y, Z are three clips for making connections to tapping points.

Standard Arrangement

It will be seen that if we connect the aerial and the clips Y and Z to the point "A_1" and the earth to the point "Earth," we utilise coil L_1 (Fig. 2). In the

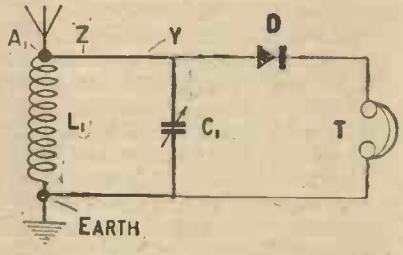


Fig. 2.—The first circuit is suitable for both 5XX and the local station.

set under description this coil L_1 is of the plug-in type, and by connecting the clips Y and Z to the aerial end of the coil, we have the familiar crystal-set circuit of a plug-in coil with parallel tuning. For the broadcast band the coil may be either a No. 35 or 50, according to individual aerial requirements, or for 5XX it should be either a No. 150 or 200.

The Alternative Circuit

If now we connect the aerial to the point "Aerial," and the earth connection to "Earth," as before, but leaving "A_1" free, we may utilise the coil L_2. This latter is an air-spaced coil provided with tappings, and, apart from those connections which are fixed, the circuit is completed by means of the three clips X, Y, Z.

Having connected the aerial to the point just now indicated, the clip X should be connected to one of the tappings marked 1, 2, 3, whereupon it will be seen that the aerial circuit is auto-coupled. If now we connect the clip Y to 7, the condenser C_1 will be across the coil L_2, and by connecting the third clip Z to a suitable tapping on this same coil, the circuit is completed. (See Fig. 3.)

Components and Materials

The construction of a receiver of this type does not call for any special skill, neither does it demand much in the way of expenditure. The complete list of materials, components and so on is given below, and you may therefore see what extra purchases may be necessary in your own particular case.

The names of the manufacturers of the goods listed are given for your guidance, though it may be understood that any good makes would give results of equal efficiency so long as the values and so on are adhered to.

One containing-box to take panel size and baseboard 6⅞ in. deep (Camco).

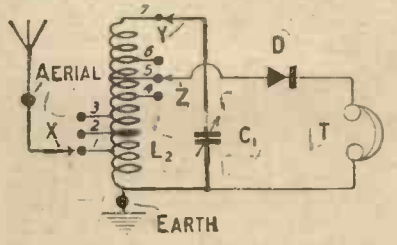


Fig. 3.—This arrangement utilises the special "low-loss" tapped coil L_2.

One ebonite panel 14 in. × 7 in. × $\frac{3}{16}$ in. (American Hard Rubber Co., Ltd.).

One "Polar" crystal detector (Radio Communication Co., Ltd.).

One "low-loss" coil former, 7 in. × 3½ in., with brackets (Peto-Scott Co., Ltd.).

One telephone jack and plug, short type (General Radio Co.).

One coil mount for baseboard use (Burne-Jones & Co., Ltd.).

One "Cyldon" Variable square-law condenser of ·0005 μF. capacity, grounded rotor type (S. S. Bird).

Three spring clips (Peto-Scott Co., Ltd.)

Five terminals.

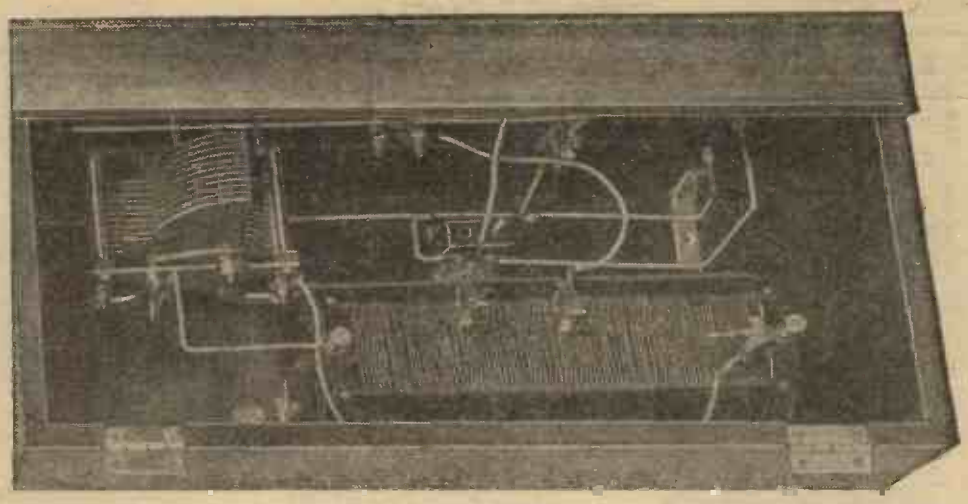
Packet Radio Press panel transfers.

Quantity No. 16 "Glazite" connecting wire.

Quantity rubber-covered flexible wire.

Approximately ¼lb. No. 20 S.W.G. enamelled copper wire.

Two right-angle brackets.



A view of the wiring arrangements, taken from the top with the hinged lid removed.

The Coil

The coil L_2 in the circuit diagram is wound upon the "low-loss" former, and consists of eighty-two turns of No. 20 S.W.G. enamelled wire, each turn being wound in its own groove, the two ends of the coil being connected to the terminals provided on the former.

From one end of the coil count ten complete turns, and on the tenth turn solder a short length of tinned copper wire; this may quite easily be done once the enamel has been scratched off at that point where the connection is to be made. Tappings similar to this should be made at the 20th, 30th, 40th, 50th and 60th turns, and their purpose is to provide suitable points for connecting the aerial and crystal clips.

The Panel

Beyond the winding of the coil, the construction of the receiver is extremely easy, and the first thing to do after the coil has been wound is to drill the panel in accordance with the dimensions given in Fig. 4.

If a variable condenser of the make given in the list of components is used, a special template will be found with it, and as there are four holes to be drilled for the component, care should be exercised in seeing that the holes are accurately made, otherwise the fitting may be somewhat difficult.

Another point to bear in mind is to make sure that the brackets are of a suitable type—that is to say, of such a size and shape that they do not foul any of the components to be mounted upon either the panel or the baseboard.

Fitting into the Cabinet

When all the holes have been drilled in the panel, the latter should be secured to the baseboard and the whole slid into the cabinet to see that a good fit results. This point is mentioned because it is sometimes found that though the panel and baseboard are of the right size, when the two are fitted together they will not easily slide into the cabinet until a certain amount of filing has been done!—a difficulty which is easily overcome once the fault is found and before the components are mounted and wired up.

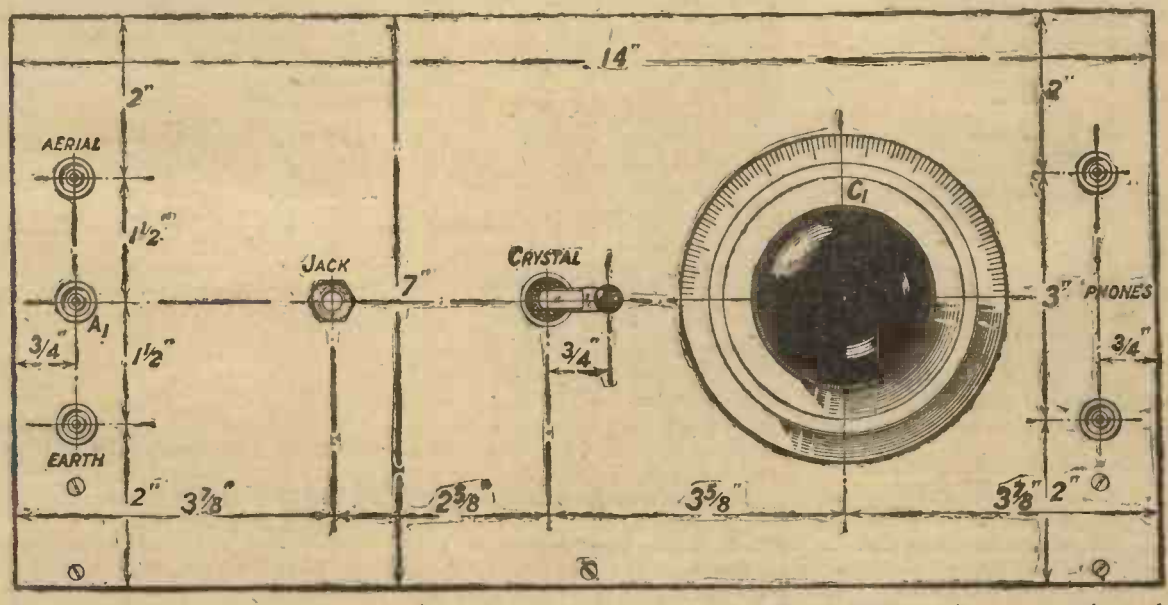
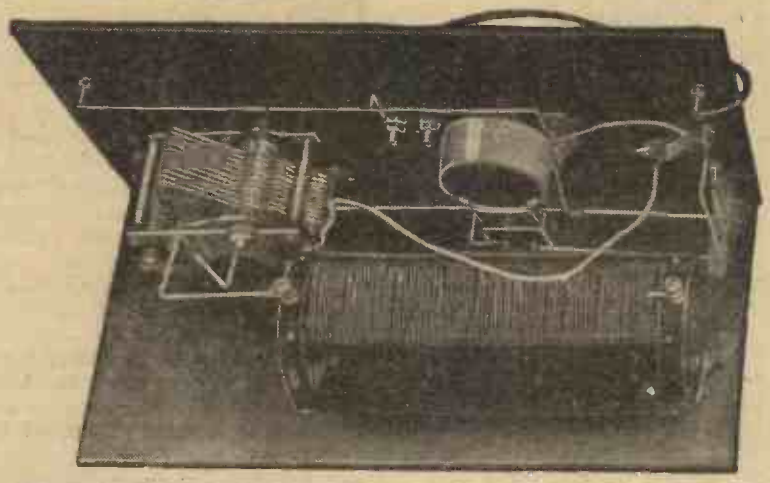


Fig. 4.—The panel must be drilled as shown in this diagram. Normally the phones are plugged into the jack.

Wiring the Receiver

Before mounting the "low-loss" coil upon the baseboard, it is first advisable to do all the wiring which lies close to the back of the panel. Since the "low-loss" coil occupies most of the baseboard, a certain amount of difficulty may result from the inaccessibility of certain points which have to be reached with the soldering iron, and for this reason every possible connection should be made before this coil is placed in position.



When the plug-in coil is used the clips are connected up as shown, X being left free.

One side of the detector (the crystal) is fitted with a flexible wire, to the end of which is fitted a spring clip. Similar wires, with clips, are fitted to the fixed vanes of the variable condenser and to the terminal marked "Aerial." The remaining connections are easily followed from the practical wiring diagram and photographs.

Operating the Set

After the receiver has been completed, connect the aerial to A_1, and the earth to the terminal so marked; with the telephones either plugged into the jack or connected across their appropriate terminals. Connect the clips Y and Z to the stem of the terminal A_1, and insert a No. 35 or 50 coil (according to individual aerials) in the coil socket. By adjusting the crystal detector and slowly turning the dial of the variable condenser you will soon tune in the local station (assuming that it is working). By substituting for the small coil a No. 150 or 200, and retuning, you will be able to pick up 5XX so long as you are within "crystal range" of that station.

Auto-Coupling

With the connections just given both the local and long-wave stations would be received on the direct coupled arrangement shown in Fig. 2, and now by changing the position of the aerial and altering the clips we shall use the auto-coupled circuit of Fig. 3 for the reception of the local station *only*.

The earth connection should remain as it is, and the aerial should be changed from A_1 to Aerial. The clip Y should be connected to the end of the "low-loss" coil, marked 7 in the diagram, and the positions of the clips X and Z found experimentally for the best results.

Adjusting the Clips

First place the clip X on, say, the third tapping, and the clip Z on, say, the sixth tapping. Proceed to set the crystal and slowly turn the variable condenser until signals are heard, whereupon you can adjust the crystal clip to the best tapping point. Now, try "lowering" the clip X down to the first tapping, checking the adjustment of the condenser each time the clip is moved.

Sharp Tuning

It is probable that you will find that as you move the clip X "downwards," the tuning on the variable condenser becomes sharper, and having found the best position as regards signal strength and freedom from interference (if any) turn your attention to the clip Z. It should be remembered that, as with the clip X, each time the tapping is varied the variable condenser will require to be readjusted slightly; also try resetting the crystal detector contact.

Though these instructions may at first appear a little complicated, in actual practice the operation of the receiver is extremely simple.

Results Obtained

When connected to a poor aerial in south-east London, the London Station is received at good

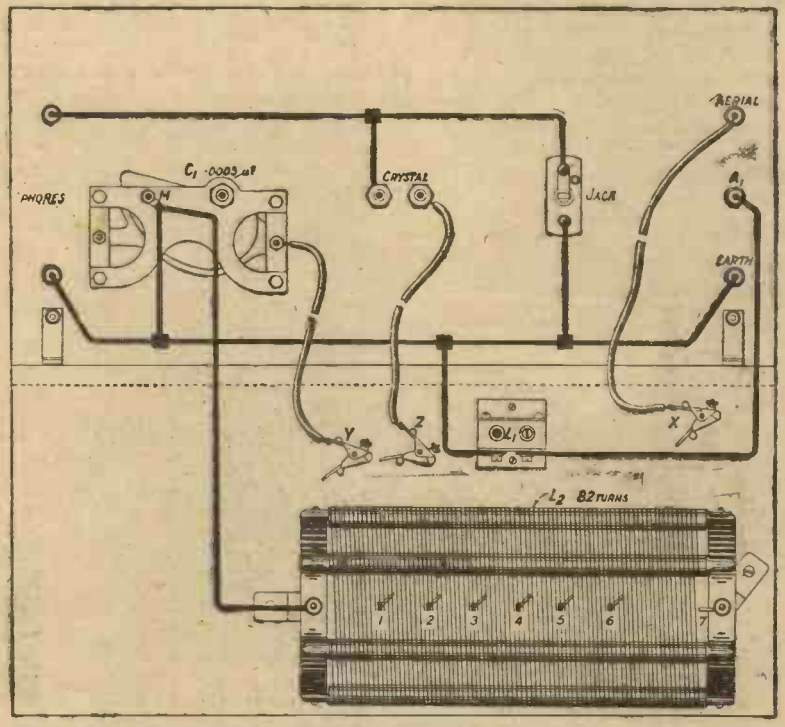
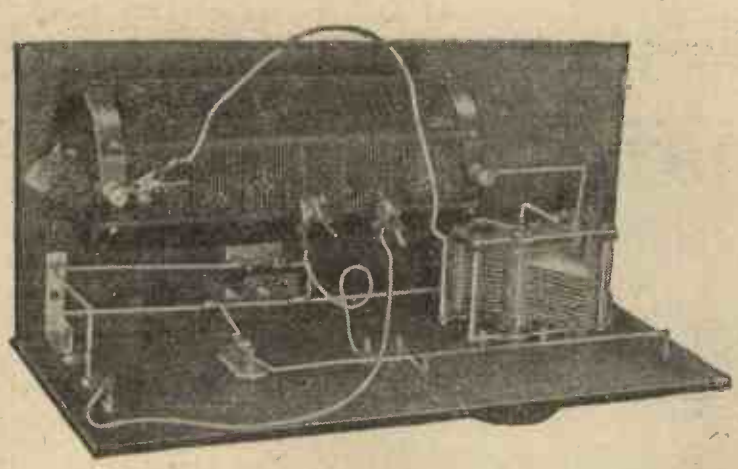


Fig. 5.—The practical wiring diagram. The clips and tappings are lettered and numbered to correspond with Figs. 1, 2 and 3.



The coil clips are here arranged as for the Fig. 3 circuit, the low-loss coil being employed.

strength upon either the direct or auto-coupled arrangements, though louder upon the latter. The long-wave station is also received at good strength when using the direct coupled circuit in conjunction with a No. 150 coil. Though the positions of the clips may be expected to vary with individual conditions, as an indication to readers of what they may expect, the two following instances may be of interest. On my own aerial, which, as previously stated, is a poor one, the loudest results from 2LO are obtained with the clip X connected to the first tapping, and the clip Z connected to the fourth tapping. Connected to a really good aerial about a quarter of a mile away from my own, the best results were obtained during the same transmission with the clip X connected to the second tapping, and the clip Z connected to the sixth tapping.

Elstree Tests

The receiver was tested at our Elstree Laboratories where both its construction and its performance were favourably reported on.' The Fig. 3 circuit employing the low-loss tapped coil L_2 was found to give an excellent degree of selectivity, and improved signal strength on the local transmission—London in this case.

The All-Enclosed Local or Daventry Receiver

SIR,—I have constructed the "Simple All-Enclosed Local or Daventry Crystal Receiver" by F. English, given in the September issue of THE WIRELESS CONSTRUCTOR. I get Daventry (exceptionally good) and Nottingham (very good) on three pairs of headphones. I am also thinking of constructing the "Quick-Change Crystal Set" described by C. P. Allinson in the December number. I think THE WIRELESS CONSTRUCTOR is a very good book for amateurs.

Wishing it every success.

Yours faithfully,

W. A. CORDIN.

The finished instrument is more handsome than the average crystal set.

The Easily Controlled Two - Valve Receiver

SIR,—I am (or shall I say proudly "I was"?) a real raw 'un in radio-craft; I reckoned that a cow could handle a musket better than I a soldering-iron, and yet I have made up a CONSTRUCTOR set with which I am delighted.

I refer to the "Easily Controlled Two-Valve Receiver" designed by Mr. John W. Barber, particulars of which appeared in the May, 1925, issue of THE WIRELESS CONSTRUCTOR.

The only departure I made from

A view up one of the 820 ft. masts at the Rugby Wireless Station.

the original specification was the substitution of variable condensers of other makes.

At the outset, the receiver is badly handicapped, as I have an indoor aerial—96 ft. of wire in six strands across the room, and an earth wire 45 ft. long.

Despite this, I have picked up the Madrid late concerts whenever I wished, and in the early mornings have sometimes heard the Spanish station of San Sebastian, which came through at such strength that music could be heard 6 in. from the phones.

The reception of 2LO is beautifully clear, with not the slightest sign of distortion—a drum *is* a drum and a flute a flute.

Yours faithfully,

JOHN FOWLER FROMINGS.

Islington, N.1.

ELIMINATING INTERFERENCE

SIR,—I am writing to let you know what results I have obtained from the Sharp-Tuning Single Valve Set described by Stanley G. Rattee, M.I.R.E., in THE WIRELESS CONSTRUCTOR of last March. I completed this set some time ago, and I think it is splendid, especially the sharp tuning, which eliminates a lot of interference around here. I can get the following stations quite loud on two pairs of phones :—

Stoke-on-Trent, Liverpool, Nottingham (very loud), Leeds, Bradford, Manchester, Bournemouth, Newcastle, London, Birmingham, Sheffield, and three foreign, one of which is quite good phone strength.

Wishing you every possible success,

Yours faithfully,
R. D. PAXMAN.

Mansfield, Notts.

THE 3-VALVE NEUTRODYNE RECEIVER

SIR,—You will no doubt be interested to hear from those of your readers who have built up sets designed by the Radio Press experts.

I may tell you that I built up the Three-Valve Neutrodyne Receiver by Percy W. Harris, as described in No. 1 of THE WIRELESS CONSTRUCTOR, November, 1924.

I made my lay-out exactly as was shown, and put in all component parts as specified.

In neutralising the set, I find that the Gambrell neutrodyne condenser is almost full in, the plates, I should think, would be about 1/32 in. apart. I have tried various makes of valves, but the setting is much about the same. I also notice that it requires slight adjustment if a larger coil is put in secondary socket, or if a considerable increase in H.T. is made.

I have had this interesting receiver working now for some months, and the results obtained have been very good. I use Gambrell coils and get good results with an A for reaction, A in aerial and B in secondary socket. Without aerial or earth connected, I can hear the nearest station (Dundee), which is 17 miles from here, quite well on earphones.

The set is very selective when working on the "tune" side, and I can tune in Edinburgh and cut out Dundee completely. I get good volume and quality from the latter station on a full-size loud-speaker with the reaction coil well away from the aerial coil. All the B.B.C. main stations and quite a lot of foreign ones come in at good phone strength. I am using a D.E.R.

A photograph of Mr. Milne's fine neutrodyne set.

Marconi valve as H.F., a Wuncell Cossor as detector, and a D.E.6 Marconi for amplifier, working off a 2-volt accumulator. For H.T. I get best results with 50 volts on 1st valve, 40 on 2nd, and about 80 to 90 on last valve, with 4 volts grid-bias. My aerial is about 95 ft. long including lead-in.

Unfortunately, I have to use a rather long earth lead—about 7 yards—to water pipe, but have improved matters by using a good heavy wire.

I enclose a photograph of my set, and should like you to give me your comments on it.

As a regular reader of *Modern Wireless* and THE WIRELESS CONSTRUCTOR, I have to congratulate you on your latest publication *Wireless*, which justifies the claim you make for it; also for your enterprise in research work, which will place the Radio Press in a position to give to its ever-increasing readers the best possible advice in all matters relating to wireless.

Yours faithfully,
WM. MILNE.

Arbroath, N.B.

THE LOW-LOSS CRYSTAL SET

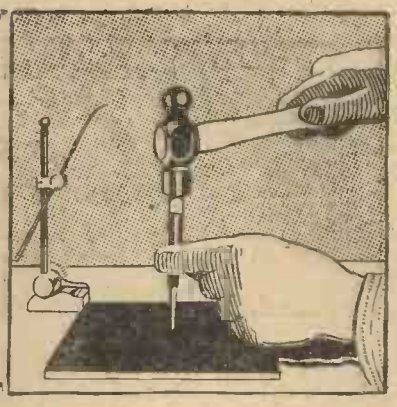
SIR,—I am writing re the "Low Loss Crystal Set," by Percy W. Harris, M.I.R.E., which appeared in the February, 1925, issue of THE WIRELESS CONSTRUCTOR. I made the set according to the instructions, and the results are excellent. Being near to our relay station, the phones are audible on the table, and music from Manchester comes in very well. This is on an outside aerial of three wires, 30 ft. long between masts 25 ft. high. I also tested it 7 miles from Liverpool and about 30 miles from Manchester on a single wire aerial 40 ft. high and 80 ft. long, and both stations were perfectly audible on three pairs of phones. From other sets which I have made and tested similarly, and some others which I have heard, I think yours is by far the best. Wishing you every success.

Yours faithfully,
E. M. SMITH.

Liverpool.

Practical Workshop Hints

Notes on Drills and Drilling — Mounting Clips—One-Hole Fixing Troubles—A Useful Spanner—Dies—Marking Out



Using Large Drills

WHEN constructing any kind of wireless receiving set one has usually to make a certain number of ⅜ in. holes in the ebonite panel in order to mount variable condensers and rheostats. The beginner at constructional work will probably find that the ⅜ in. drill is by no means as easy to use satisfactorily as those of small size needed for the making of clearance or tapped holes for screws.

An ordinary punch mark is sufficient to prevent a small drill from slipping when it is started and to ensure that it goes through the panel at the proper place. When using a ⅜ in. drill, however, or even a ¼ in., it is advisable not to depend upon the simple punch mark as a guide. A tip which will be found very useful is as follows: Having marked out your panel, punch-mark all drilling centres. Then proceed to make all the 4B.A. clearance holes that will be needed with a No. 26 Morse drill. With the same drill make a little hollow at each of the punch marks which indicate the centre of a ⅜ in. hole. You will then have no difficulty at all in starting the big drill, for its point will go comfortably into the hollow, and it will have no tendency to slip.

Use of a Lubricant

Small drills may be used without any lubricant, though their life is considerably shortened by so doing; but with large drills it is very much more important that a little turpentine or oil should be used as a lubricant, for, besides preserving the cutting edge of the drill, this materially lightens one's labour. Many constructors will have found that big drills, which require a good deal of pressure in order to make them cut properly, have a tendency to tear ebonite or to split away small pieces at the point of exit. This is especially liable to occur when the drill has seen a certain amount of use and is becoming blunt, for then one must press pretty hard in order to drive it through.

The risk of tearing is lessened if care is always taken to see that the panel is laid upon a level piece of wood when drilling is in progress. Make sure that when the drill comes out its point will have a flat wood surface to bear against, and will not fall into a hollow made during the drilling of a previous hole. When the drill is very blunt the best method of making sure that the hole is clean cut on both sides of the panel is this: Instead of merely making the little hollow in the first place with the No. 26 drill, run this drill right through the panel. Now take the ⅜ in. drill about two-thirds through the ebonite, turning the panel over

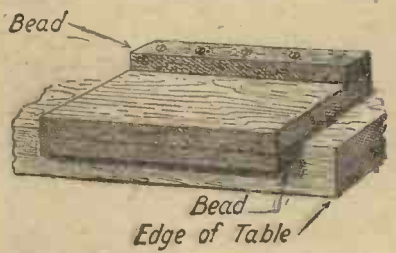


Fig. 1.—A simply made board for use when drilling.

when this has been done, and finishing the hole from the other side.

A Drilling Board

It is not always easy to fix a small piece of ebonite so that it cannot move whilst drilling is in progress. If it is simply placed on an old piece of wood it is very liable to move round with the drill when the point of the drill is coming through, and one cannot hold it, since both one's hands are occupied, the left in holding the handle of the hand drill and the right in turning the crank. When the ebonite turns in this way the side next to the wood is apt to become badly scratched. Fig. 1 shows a drilling board which will be found most useful both in the workshop and when jobs have to be done upon the table of a living room. This is a piece of white wood 1 in. thick, whose size will vary according to the constructor's liking and requirements. Personally, I find that a board measuring 8 in. by 12 is very handy. To the board, beads 1 in. wide and ½ in. high are fixed with screws on opposite sides, as seen in Fig. 1.

Using the Board

When drilling is in progress the board is placed with one bead against the edge of the bench or table, as shown in the drawing. The work is now placed with its edge against the bead on the upper side. It will be found when using the hand or breast drill that the left leg comes naturally against the edge of the board which projects over the table, and holds it in position, whilst the work is prevented by the bead on the upper side from turning. A board of this kind costs very little to make up, and it lasts for a long time, since when one surface has become pitted with drill marks it is simply turned over, when the bead which previously rested against the edge of the table becomes the work stop and *vice-versa*.

Drilling Sheet Metal

Anyone who does much constructional work will have found that from time to time there crop up little jobs which, though they look quite simple at first sight, turn out to be distinctly awkward. One of these is the drilling of thin sheet metal. Despite all ordinary precautions the drill will tear its way out, or, failing this, will leave a raised ridge on the side on which it makes

its exit. The first thing to do in making small holes is to see that the work is firmly held, so that it cannot turn, and that there is a proper bearing surface below it for the point of the drill. In these respects the drill board described in the previous paragraph will be found a very great help. As you use the drill do not apply more pressure than is necessary, and go very carefully when the point has come through on the far side, being on the look out for the slightest jerk which indicates that the drill has begun to tear the metal. When you feel this, stop and turn the crank *backwards* instead of forwards for a second or two. This will smooth down the small jag that has been made, and the drill may now be turned cautiously in its proper cutting direction. Whenever the tell-tale jerk is felt give a few turns in the reverse direction as before. By working in this way one can usually make a hole that is at any rate round, though possibly there will be a slightly raised edge on the far side. The best way of getting rid of this is to turn the work over when the hole has been made, fitting a countersink into the drill chuck, and making a very slight cut with it. This method is usually successful in removing any burring that may be present.

Mounting Clips

There is unfortunately no standard length for grid leaks and anode resistances; if, therefore, one mounts a pair of clips to suit components of one make it is quite likely that should another type be used subsequently they will be found either too close together or too far apart to hold it properly. A simple way out of the difficulty

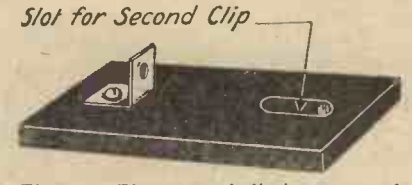


Fig. 2.—The second clip is mounted in a slot.

is shown in Fig. 2. When mounting clips for resistances make a clearance hole for the screw fixing one of them, but pass the screw of the other through a slot instead of a simple drilled hole. The slot is easily made by drilling two or three 4B.A. clearance holes in line, and then cutting the webs between them with a small round file. When clips are mounted in this way it is quite easy to adjust them so that a resistance of any length within reasonable limits can be used in them. Most patterns of resistance clips are held in place by a single screw, which is apt in course of time to become slightly loosened. When this happens the clips show a tendency to turn a little to one side or the other, and so to slacken the pressure upon the resistance placed

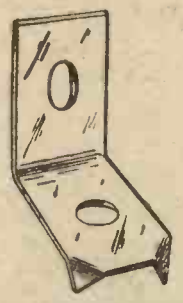


Fig. 3.—Bending down the corners prevents the clip from turning.

in them. Turning can be prevented by making use of the simple tip shewn in Fig. 3. The two corners of the horizontal part of each clip are bent down with a pair of flat-nosed pliers. When the fixing screw is tightened down the points so formed are pressed into the ebonite, in which they make little hollows for themselves. The clips are thus securely held, and will not turn even if the fixing screw becomes a little slack.

For the One-Hole Fixing

Resistance clips are not the only fittings which are liable to work loose. Most of us have had difficulty at one time or another with variable condensers, rheostats, variometers and other components provided with a "one-hole" fixing. This type of fixing is exceedingly convenient, in that nothing more than a single $\frac{3}{8}$-in. hole need be made in the panel for each component. No templates are, therefore, needed, and the marking out of panels is immensely simplified. Still, the fixing by itself is not entirely satisfactory, since under the pressure of a single large nut the ebonite is apt in time to lose its elasticity. When slackening does occur the fixing nut can be got at only by removing the knob and dial, which must afterwards be reset.

Overcoming the Difficulty

Here is a very simple way of ensuring that one-hole fixing components will not work loose even after a great deal of use. Mount

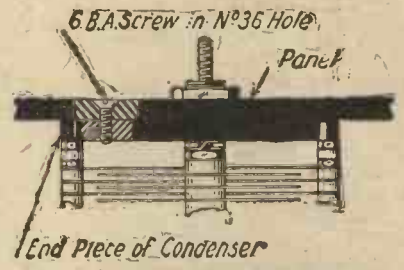
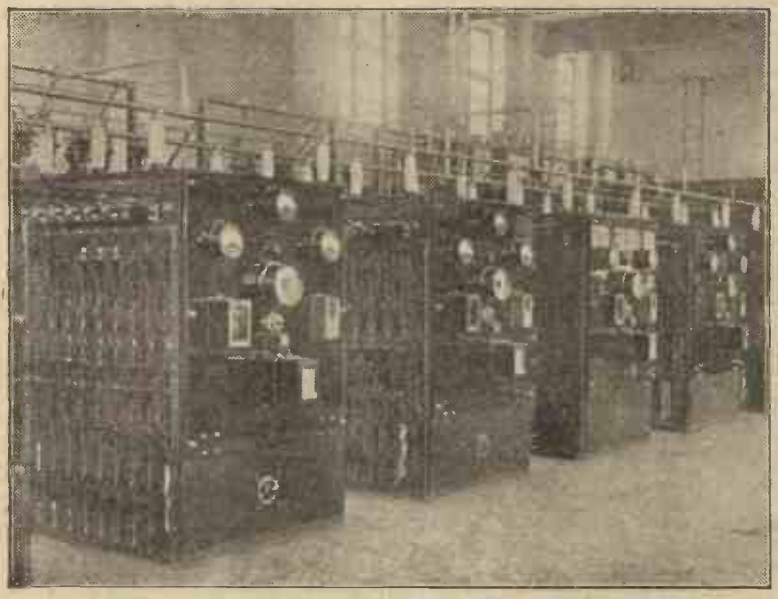


Fig. 4.—The screw prevents movement of the condenser.

the component in the ordinary way, turning the large nut tightly down. Then make a punch mark in a place which will be covered by



The power panels at the great Post Office Wireless Station at Hillmorton, near Rugby.

the dial (if there is one), and with a No. 36 Morse drill make a hole through both the panel and the end-piece or former of the component. Countersink the hole, so that when a screw is inserted it will lie flush with the panel, and so will not foul the dial or pointer. Now cut off a 6B.A. screw to the required length, and screw it straight in. It will be found that it goes in quite easily without any preliminary tapping of the hole, and that it obtains a firm grip of the ebonite (see Fig. 4). If you make a regular practice of using this auxiliary screw you will find that you will have no further trouble with one-hole fixings.

Tightening Down after Soldering

When the wiring of a complete set or of a small piece of apparatus has been finished, one nearly always finds that the nuts securing terminals, valve legs, and so on to which soldered connections have been made have become slightly loosened by the heat of the iron. It is sometimes not an easy matter to get at them in order to tighten them down if the wiring is at all complicated. A box spanner cannot, of course, be used, and there is frequently not room for a flat one or for a pair of nut pliers. I have found the little gadget shown in Fig. 5 extremely useful for the tightening-down process after soldering has been done. It can be made up very quickly and it saves a great deal of time, besides ensuring that terminals and so on really are tightly fixed in the panel. To make it, cut out a strip of sheet brass about ½ in. wide and some 6 in. in length. In one end of the strip file a slot that is a fairly tight fit for a 4B.A. nut. Then bend this end at an angle as shown in the drawing. A tool of this kind will go even into the most awkward

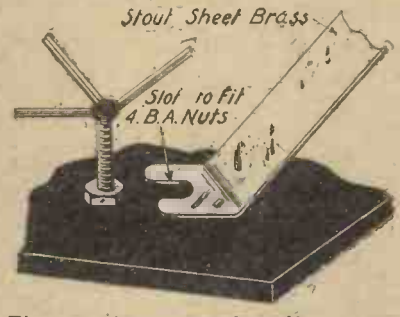


Fig. 5.—A spanner for 4 B.A. nuts can be made from sheet brass.

corner and will enable you to give the nuts just that final half-turn that they need. It is better, of course, to make it of mild steel, but it will be found that if brass is used the tool allows reasonable force to be applied to nuts and stands quite a lot of use.

For Marking Out

When one tackles the marking out of large panels and baseboards, such as those required for four or five-valve receiving sets, one finds that the ordinary workshop set-square is not really big enough for the work. One's task is very greatly simplified if a draughtsman's "T" square with a 24 in. arm is purchased. These are not expensive and they are exceedingly useful for a variety of jobs. A square which I am using just now is made of metal and has an arm 24 in. long, which allows one to undertake without difficulty any marking-out job that is likely to be met with in wireless constructional work. The metal "T" square has the advantages that it does not warp even if it is left in a damp workshop and that it is not as easily damaged by rough usage as a wooden one.

At the B.B.C. "Radio Revels" hats with "aerials" attached proved popular.

A Useful Addition

In wireless constructional work the threads most frequently used are 2B.A. and 4B.A., and I know of few more useful additions to the tool case than a pair of dies of these sizes. They are quite inexpensive and they certainly save a great deal of trouble. Since screwed rod in all the larger B.A. sizes is readily purchasable, one will not need to use the dies for actually cutting threads, and it is therefore not really necessary to purchase a die-holder—they can be fixed in the jaws of the vice when they are in use.

Dies are extremely useful for rectifying burred or damaged threads in screws and for enabling the end of a screw or of a piece of studding that has been shortened to be trimmed off so that a nut will start easily upon it. At the present time there is a good deal of defective B.A. material on the market and one not infrequently comes across batches of screws or a length of studding for which standard nuts are such a tight fit that they will either not go on at all or can be turned down only by the use of a certain amount of force. If one has a die of the right size, matters are very quickly set right by passing the screws or studding through it.

Centre-Punching

Some constructors who are not very experienced in the use of tools find it a little difficult at times to do their centre-punching accurately and are apt to make the punch marks not exactly at the intersection of the cross lines which mark the proper position for the centre of the hole that is to be drilled. The job is made a good deal easier if the cross lines are deeply scribed and a small punch with a sharp point is used. One can then feel one's way with the punch to the right spot, since its point drops into the scores made with the scriber. A still better method when very accurate marking is to be done is this. When you have made the cross lines, make a prick with the point of the scriber at each intersection that marks a drilling centre. It is quite easy to place the fine point of the scriber in exactly the right position and, when it is pressed in, it makes a little hollow easily felt whilst the point of the punch is being moved about over the ebonite.

Your Batteries

By A. JOHNSON-RANDALL

Advice on the types of batteries necessary for those about to acquire a valve set

I PROPOSE in this short article to give a few hints upon batteries in general, and in particular the types of battery which should be used with different types of valves.

It may be remarked that information of this character is of too elementary a nature, but the more experienced readers should bear in mind that at this time of the year there are many listeners who are just about to construct their first valve set, and it is for these that the hints are primarily intended.

The Purpose of the Batteries

In a valve receiver two batteries are essential; one is called the low-tension battery, and the other the high-tension battery.

The low-tension battery (or L.T., as it is more commonly termed) is for the purpose of lighting the valve filaments, and its voltage depends upon the type of valve chosen.

The high-tension (or H.T.) battery supplies the anode current, its voltage depending upon the type of circuit and valve used.

Grid-Bias

In sets employing low-frequency amplification a third battery becomes necessary, this being termed the grid-bias battery, and its function is to apply a negative potential to the grids of the low-frequency valves, an essential feature if good reproduction is desired.

Choosing Your L.T. Batteries

Returning to the low-tension battery, probably one of the greatest difficulties encountered by the beginner is the choice of the right type of battery for the valves he intends to use, or which are suggested for the particular receiver he has in mind.

Wrapped up in this question of batteries there is also the problem of filament rheostats. What resistance must the rheostat have to control the particular type of valve used with a L.T. battery of the type recommended?

It will, therefore, be helpful to state the resistance necessary to reduce the L.T. battery voltage to the rated filament voltage of the valves, assuming that a separate rheostat is used for each valve.

Classification of Valves

Valves may be divided into four types in common use, as follows:—

(i.) Those suitable for use with 6-volt accumulators, such as the R5V, and power valves of the B_4 type.

(ii.) The ordinary R type bright-emitter and power valves of the D.E.4 class, which are suitable for use with a 4-volt accumulator.

(iii.) The ·06 type, which require a 4-volt accumulator or two to three dry cells in series with a suitable filament resistance.

(iv.) The 2-volt class, of which the D.E.R. type is an example.

There are, of course, a number of special types, but I have only considered those in common use among broadcast listeners in general. The 4-volt "R" type valves are very suitable for use with 6-volt accumulators, and may be used together with the 6-volt type provided a suitable filament resistance is employed.

The 6-volt class may be tabulated together with the suggested sizes of accumulators for sets employing from one to four valves:—

SIX-VOLT TYPE.

Set.	Valves.	L.T. Battery.	Minimum Resistance to Reduce Filament Voltage to 5.	Rheostat Suggested.
1-valve	One bright-emitter general-purpose type.	6-volt 20 amp.-hour actual.	1·3 ohms	Standard 7-ohm
2-valve	Two bright-emitters general-purpose type.	Preferably 6-v. 30-amp.-hour actual.	1·3-ohms	Standard 7-ohm
3-valve	Two bright-emitters and a 6-volt power valve of quarter ampere type.	6-volt 30-amp.-hour actual.	1·3 ohms for each bright-emitter and 4 ohms for the power-valve.	Standard 7-ohm
4-valve	Two bright-emitters and two 6-volt power valves.	6-volt 40-amp.-hour actual.	1·3 ohms for each bright-emitter and 4 ohms for the power-valves.	Standard 7-ohm

Slow-discharge accumulators with thick plates are now made for use with ·06 amp. valves.

These are for circuits of conventional type employing, in the case of the three- and four-valve sets, low-frequency stages with transformer coupling. A bright-emitter valve of the general-purpose type may be used to replace the power valve in the case of the three-valve set, if it is not desired to work a loud-speaker. In the 4-valve set a general-purpose valve could be used in the first low-frequency stage.

4-Volt Valves

The above table applies equally in the case of 4-volt valves, with the exception that to reduce the filament voltage of bright-emitters to 3·8 a resistance of ·3 ohm will be necessary with a 4-volt accumulator and 3 ohms with a 6-volt accumulator. The ordinary standard pattern 7-ohm rheostat will, therefore, be adequate in each case, although somewhat coarse when used with a 4-volt accumulator.

·06 Dull Emitters

The 3-volt class of valve will require a 4-volt accumulator, or, if used with dry cells, a suitable battery tapped at 3 and 4·5 volts. The accumulator can be one specially designed for use with these valves, such as is advertised from time to time in this journal.

The resistance necessary to reduce the filament voltage to 2·8 is :—

For a 4-volt accumulator, 20 ohms.

For a 4·5-volt dry-cell battery, 29 ohms approximately.

A 30-ohm rheostat will, therefore, be suitable in each case.

The last type of valve, the 2-volt D.E.R. class, requires a 2-volt accumulator and is not suitable for working from dry cells owing to the comparatively heavy current consumption. It is a good plan to use the sizes of accumulators suggested in the 6-volt table, remembering that only one cell is necessary—hence for the same capacity the bulk will be only one-third of the equivalent 6-volt battery.

To reduce the filament voltage to 1·8 when used with a 2-volt accumulator, a resistance of ·6 ohm is necessary. A 3 ohm type rheostat will give adequate control.

High Tension Values

Dealing now with H.T. batteries, no hard-and-fast rules can be given regarding the voltages to use. If low-frequency amplification is not employed, then a 60- or 72-volt battery of the popular type will be quite suitable. In cases where low-frequency amplification is employed, a battery of 100-120 volts should be chosen. For sets employing three or more valves, it is much more economical to purchase a battery made up of large-size cells in preference to those with cells of the flash-lamp type. This applies particularly to those cases where a small power-valve is used.

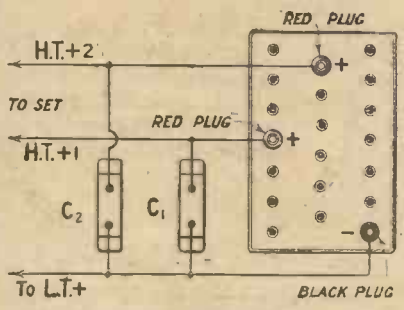
The battery should be tapped at regular intervals from, say, 22½ volts upwards, the best voltage to employ being found by trial.

The Colour Convention

One of the tappings will be marked with a minus sign (—), and it is in this socket that the black plug should be inserted. The positive plugs, which are red, are inserted in any of the remaining sockets according to the voltages required. This rule of red for positive and black for negative applies in the case of accumulators, one of the terminals being marked red and the other black (or blue sometimes). In addition, the plus sign indicates positive and the minus sign negative. The positive terminal of the accumulator must therefore be connected to the L.T. plus terminal on the set, and so on.

Smoothing Condensers

A 2μF Mansbridge-type condenser should be connected across each portion of the high-tension battery in use, *i.e.*, between each positive tapping and the negative



H.T. battery connections. The reservoir condensers C_1 and C_2 may each have a capacity of 2μF.

which is common to all the tappings. The use of these condensers tends to reduce any noises which may be produced in the telephones or loud-speaker by slight variations in the voltage of the H.T. battery. In addition they assist in preventing trouble from L.F. oscillation and distortion caused by an increase in the internal resistance of the battery and, finally, they act as H.F. by-pass condensers.

Grid Batteries

If the receiver employs one or two stages of L.F. amplification,

A grid-bias battery compared in size with a high tension battery.

The Vanicon Square Law Condenser from 17/6.

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—*under the Seas*

STANDARD Dubilier Condensers, of which one or two representative types are shown here, are used in the submarines of practically every navy on the seas. If our ordinary products are good enough for this exacting purpose, no amateur or experimenter need have any hesitation when purchasing condensers. All he has to do is to specify our products.

The Dubilier Condenser Company (1925) Ltd., manufacture Fixed Mica Condensers, Variable Air Condensers, Anode Resistances, Grid Leaks, The Ducon Aerial Adaptor, The Minicap Switch, the Dubrescon Valve Protector and the Mansbridge Variometer. They are also the sole concessionaires for the products of the Mansbridge Condenser Co. Ltd.

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Type 610 Mica Condenser from 3/-.

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E.P.S. 147

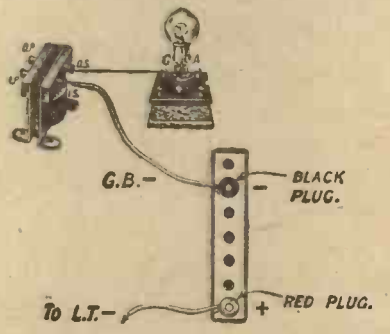
i.e., the magnification of the received signals after rectification, if good reproduction is desired, grid-bias will be necessary.

Size of G.B. Battery

A grid battery is simply a small tapped battery of 6 or 9 volts made up of the type of cells used for flash-lamp batteries. In practice, if small power-valves are used for the low-frequency stages, the 9-volt size is the most convenient. The positive socket of the grid battery should be connected to the negative terminal or busbar of the L.T. battery, not necessarily the accumulator itself, but to the lead from the terminal on the panel to the valve filaments.

Transformer Connections

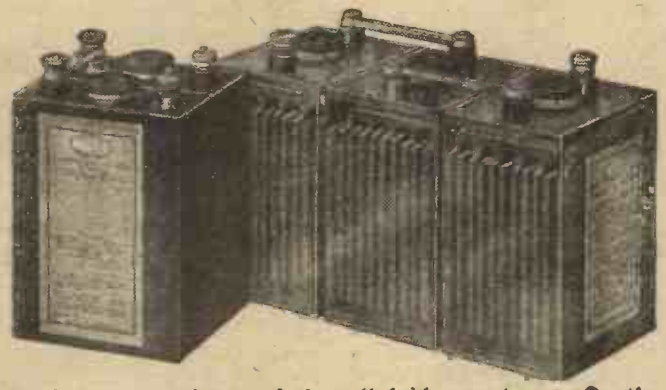
The black plug which is inserted into the remaining sockets on the grid battery has a flexible lead attached, the other end of which is connected to the end of the transformer secondary winding remote from the grid of the valve. In other words, one of the secondary terminals on the L.F. transformer is joined to the grid socket of the valve holder, and the other secondary terminal taken to the black plug *via* the flexible lead. This plug is inserted into the desired socket on the grid battery. The correct grid-bias to use for a given H.T. voltage is specified by the valve manufacturers and stated by them either on the valve box or in the literature describing the particular valve chosen.



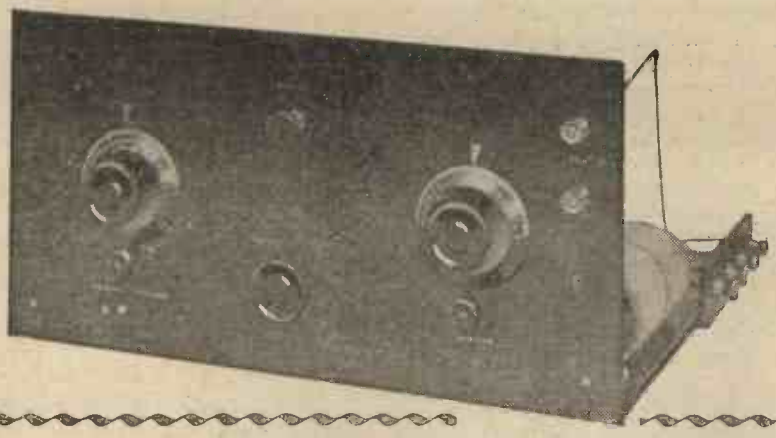
This diagram shows how negative bias is applied to the grid of the valve via the secondary of the transformer.

This information is immediately available on request from any maker of repute.

The value of grid-bias with 120 volts H.T. will be between 6 and 9 volts in the case of the majority of small power-valves used by broadcast listeners.



Typical accumulators of the celluloid case type. On the left is a 4-volt battery, the other being a 6-volt unit.



A Simple Short-Wave Receiver

By JOHN W. BARBER

An easily made one-valve set for use on the higher frequencies

AMATEUR experimental transmission is at the present time largely carried out on wavelengths of 100 metres or below, a considerable number of stations operating on 45 metres (6667 kc.), and those who would follow the movements of such stations must construct a special receiver for the purpose.

Short-Wave Reception Not Difficult

Now the very mention of 45 metres is sufficient to frighten a large number of people, who appear to think that a receiver for such low wavelengths must inevitably be very difficult to construct, let alone the operation of it. Fortunately, however, this is not the case; in fact, the very opposite obtains, as in most cases a single valve is sufficient, and provided that reasonable care is taken in laying out the parts (*see* Mr. Kendall's article "Laying out a Short-Wave Set," *Wireless Weekly*, Vol. VII, No. 5), and in spacing the wiring, no trouble whatever should be experienced in making the set work.

Necessary Refinements

Several points need attention, and these will be dealt with before the actual construction is described. First, the variable condensers used *must* be geared, or have some means of fine adjustment provided. The ordinary vernier dial, giving a reduction of even 10 to 1, I do not find satisfactory, reductions of 50 or 60 to 1 being required. It is also essential that there shall be no backlash on the fine adjustment knob, while some means should be provided whereby a definite scale-reading is possible at all positions of the vernier adjustment, by which I mean that a vernier, the movements of which are not registered on the main indicating scale, should be avoided.

Secondly, a variable grid-leak should be provided, in order that a fine control of reaction may be obtained. On slowly turning the reaction condenser, the receiver should slide smoothly into and out of the oscillating condition, as it is most disconcerting when operating on the edge of oscillation to have the set suddenly "flop" over, thus necessitating a resetting of the controls.

Thirdly, see that the tuning coil is well away from the valve, choke coil, panel, woodwork, and so on. As far as possible, keep components out of the "field" of the coil—this can be done by placing the coil as far from other parts as possible.

Employment of Reinartz Reaction

The circuit employed is shown in Fig. 1, and it will be seen that "Reinartz" reaction is employed, control being obtained by means of the condenser C_2, which is connected between the anode of the valve and the bottom end of the coil L_3. The aerial coupling is of the simplest, consisting of a single turn coupled at about 4 in. distant from the grid coil. Further notes on this subject will be given in due course.

Adding Note-Magnifiers

Note-magnifying valves may be added as required, by joining the primary of the transformer across the telephone terminals of the receiver. If choke or resistance coupling be used, the component will be joined across the telephone terminals, a lead being taken from the telephone terminal connected to the R.F. choke, L_4, to the coupling condenser which goes to the grid of the note-magnifier.

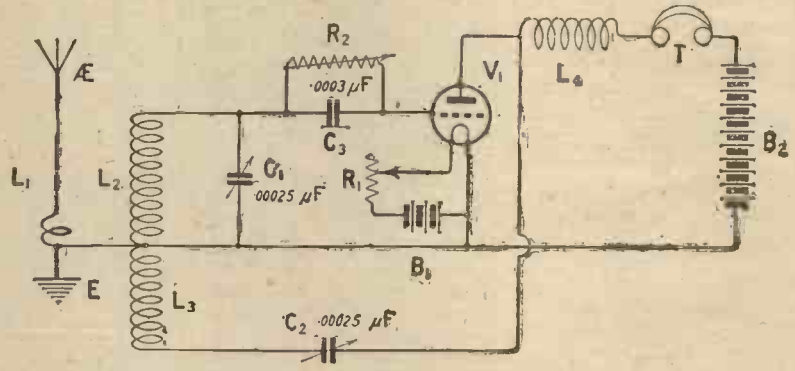


Fig. 1—The circuit of the short-wave receiver. Reaction is controlled by the variable condenser C_2.

Components Required

The constructional work is very simple, and will be easily carried out by the aid of the diagrams and photographs given. For the benefit of those who intend to build such a set, a list of the components used is appended. Other parts of good quality may be used, but due regard must be paid to the preceding notes upon components.

One ebonite panel, 16 in. × 8 in. I have used Radion black, $\frac{3}{16}$ in.

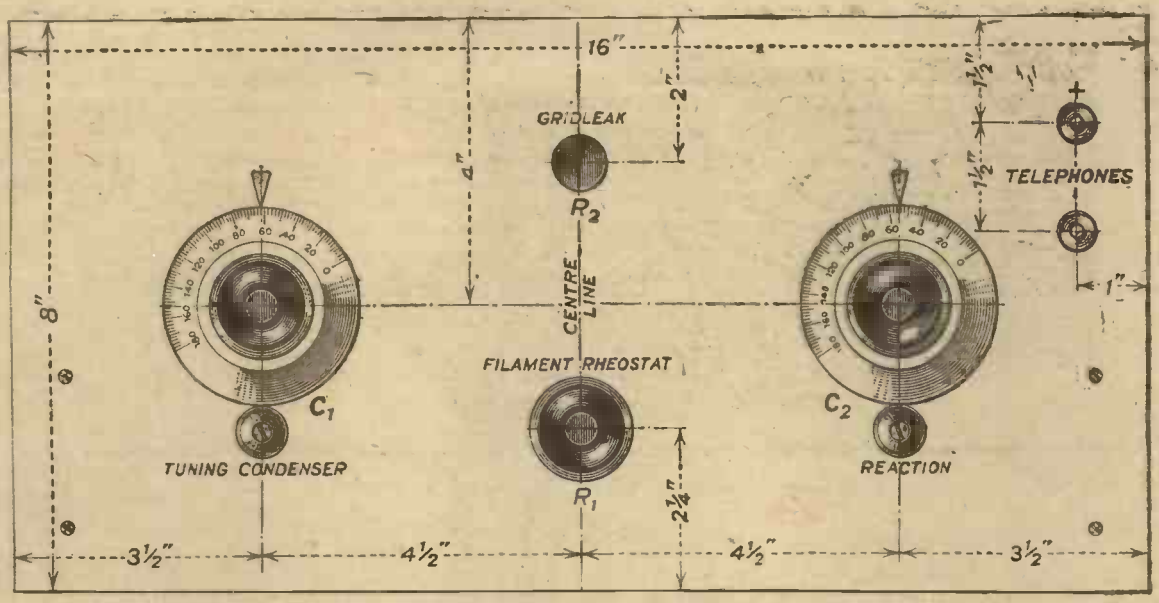


Fig. 2—The drilling diagram for the panel.

thick (American Hard Rubber Co., Ltd.).

One baseboard, 16 in. × 12 in. (Camco).

One pair of brackets (Magnum small type, Burne-Jones & Co., Ltd.).

Two variable condensers, square law geared type, ·00025 μF (Jackson Bros.).

One "Antipong" valve holder (Bowyer-Lowe Co., Ltd.). Some form of low capacity socket is essential here.

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

One variable grid leak ("Success," Beard & Fitch, Ltd.).

One grid condenser, ·0003 μF, or less (Watmel Wireless Co., Ltd).

One spring clip.

One terminal strip with four terminals.

One terminal strip with two terminals, 2½ in. apart.

Piece of cardboard or ebonite tube, 2¼ in. diameter by 4½ in. long.

Quantity of No. 20 double cottou-covered wire, some pieces of flex, and wire for connections.

One lb. No. 12 bare copper wire for coils.

Two "Decko" Dial Indicators.

Two nickelled terminals for telephones.

Radio Press Panel Transfers.

One piece of ebonite, 4 in. long by ⅜ in. × ⅛ in.

Material for coil mounting (*see* text).

Constructional Work

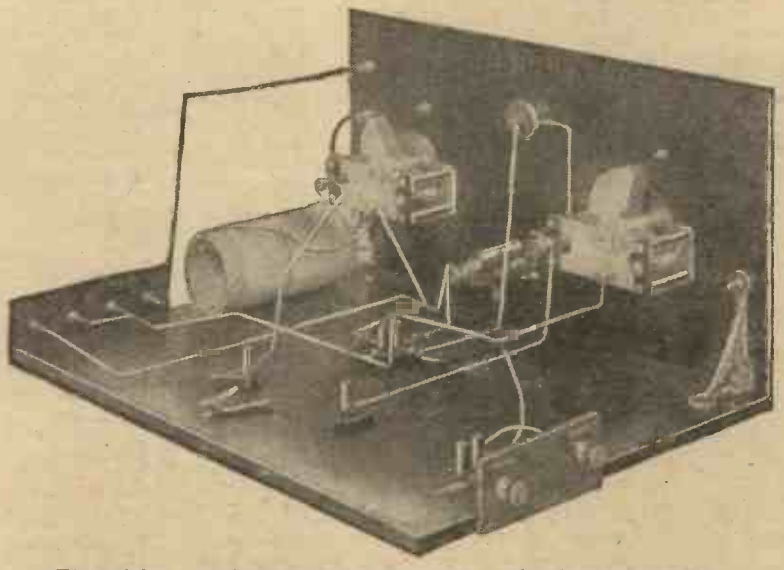
The first step in the construction of this receiver is to drill the panel and to secure it to the baseboard by means of the small brackets provided. Using the condensers specified, the distance between the centres of the two holes necessary is 1¾ in., the main securing bush requiring a ⅜ in. hole, while a hole ¼ in. in diameter will do for the fine adjustment shaft.

The Panel Size

I may be criticised for using so large a panel, but, to reply in advance, I would point out that I have tried dispensing with the panel, the condensers being mounted on small pieces of ebonite of just sufficient size to preserve rigidity, with separate small pieces for the grid leak and filament resistance, but as no improvement was noticeable over the present arrangements, the full panel was adopted, and, in my opinion, certainly scores, if only on the account of neatness in appearance. Should the constructor desire it, however, he can, by all means, substitute small pieces of ebonite as supports in place of the panel.

Mounting the Components

Having drilled the necessary holes, the panel components may be mounted, after which the panel may be secured to the baseboard. The coil mounts consist of a valve socket screwed into a piece of ebonite, but as the tapping of the hole may be a little difficult, especially where the constructor does not possess the necessary taps, an easier method of making the mounts was sought for. Eventually an ordinary board-mounting valve-holder was taken, and sawn into four pieces by means of a hacksaw



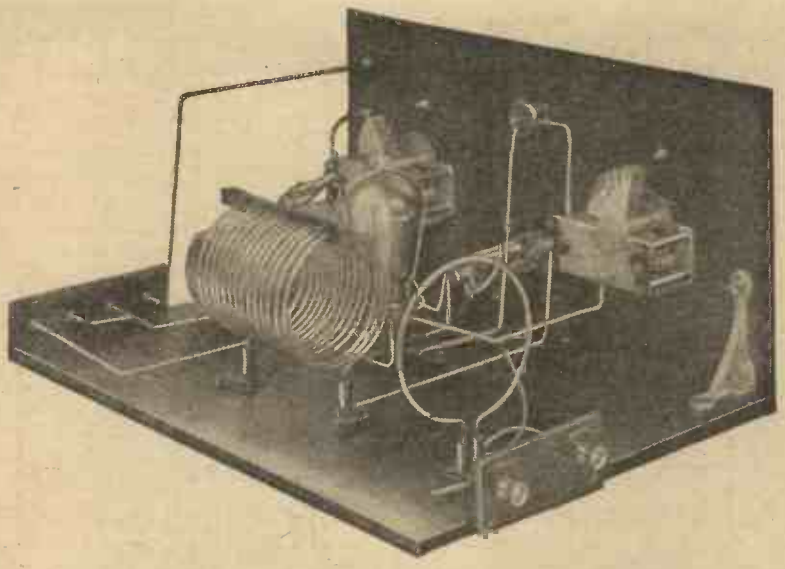
The wiring can be seen quite clearly in this photograph, the choke coil L_4 being on the left.

(you can use an ordinary tenon saw if you haven't a hacksaw), each piece containing one valve socket. It is necessary that the valve socket should not screw right through the ebonite, and as the tapping of a "blind" hole may present some difficulty, the constructor is advised to follow the method given.

The valve-holder and terminal strips may next be secured to the baseboard. Those who so desire may easily make the terminal strips, by taking one piece of ebonite 3¾ in. by 1½ in., and another 5 in. by 1½ in., ¼ in. being a suitable thickness, and drilling four holes 1¼ in. apart in the longer strip, and two holes 2½ in. apart in the shorter strip, for the terminals to pass through.

Winding the Choke

The construction of the H.F. choke L_4 is very simple indeed, all that is necessary being a piece of cardboard or ebonite tube 2¼ ins. in diameter and 3½ ins. long, and some No. 20 d.c.c. wire. Seventy turns are wound on, after which the tube is secured to the baseboard by passing a screw through a hole previously drilled near the edge of the tube.



A photograph showing coils and valve inserted. The aerial coil L_1 consists of a single turn only.

Internal Connections

The wiring may now be undertaken, and care should be exercised to see that the leads are well spaced. The lug of the grid condenser is soldered directly to the grid lug on the valve-holder, and a lead is taken from the junction to the grid-leak. A flexible lead has been used to connect from the lower end of the tuning condenser to the coil, in order that the tapping on the coil may be adjusted to a point such that reaction is just sufficient over the whole range of the tuning condenser. Flexible leads are also used from the aerial and earth terminals to the socket for the aerial coupling coil, in order that the degree of coupling may be varied if necessary. The remainder of the wiring is simple and calls for no further comment.

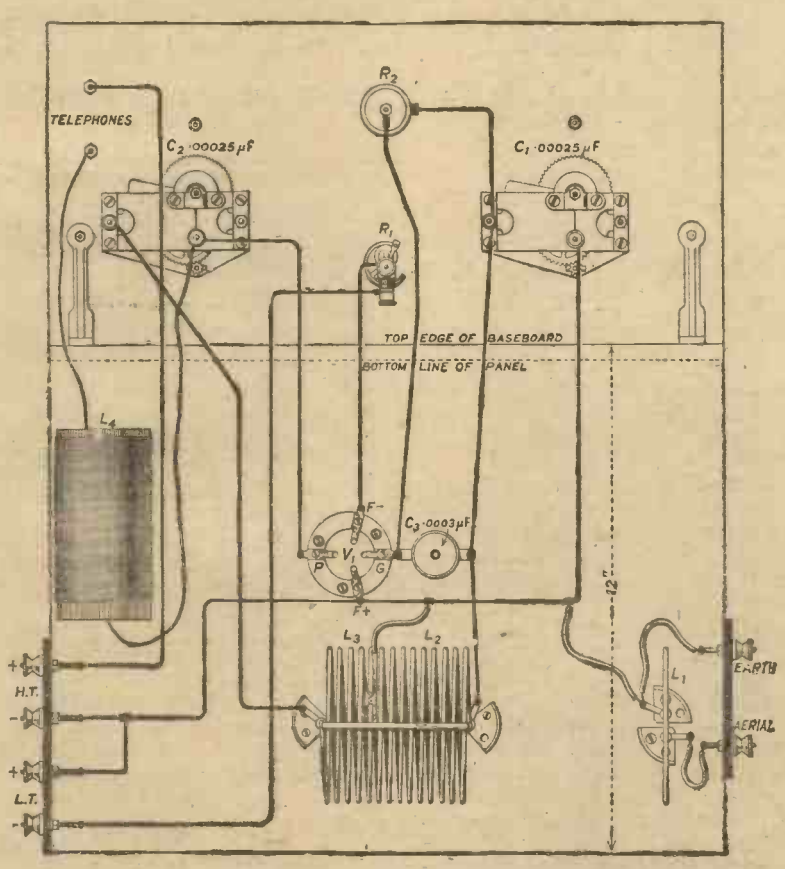


Fig. 3.—The practical wiring diagram, showing the relative positions of the coils.

The Coils

The next point in the construction which calls for attention is the winding of the coils. This will be found quite easy if the following directions are carefully carried out. First, obtain a piece of tubing (ebonite or cardboard, or even a jam jar will do) about 3 in. in diameter. It is best to enlist the assistance of another pair of hands, in which case one person can hold the coil of wire while the second bends it to shape round the tube. When winding the coil, take care that the first turns do not slip off or untwist themselves as subsequent turns are put on, as if this happens the finished coil will present an irregular appearance, different turns having different diameters. Wind on closely 14½ turns, and then release the wire, which will spring out slightly to about 3½ in. diameter, absorbing the extra half turn in doing so. The coil is then cut off the hank, and is laid aside while the ebonite supporting strip is drilled, as shown in Fig. 5. Holes are drilled ¼ in. apart, ⅞ in.

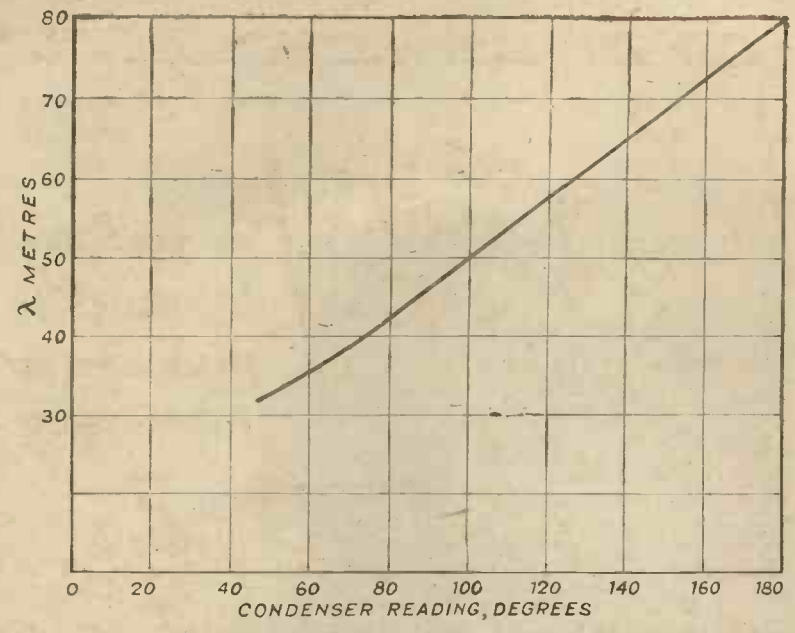


Fig. 4.—Calibration curve of the receiver, plotted from wavelengths of stations heard with this set.

being the correct size drill to use, but if such a drill is not to hand, one ⅛ in. in diameter may be used; the only difference being that in the latter case the wire will be a loose fit in the holes instead of a tight one as in the former case.

Now take hold of the extreme turns of the coil, and gently pull apart, until on releasing the turns the coil does not spring right back to its initial close-wound condition. The ebonite strip is then threaded on to the coil, turn by turn, and the ends of the coil are then turned

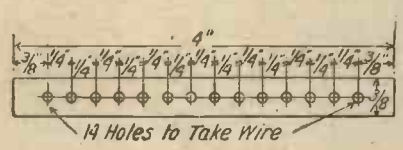


Fig. 5.—How the ebonite coil-supporting strip is drilled.

down at right-angles to enable them to be inserted in the sockets provided.

The Wire to Use

Mention may here be made of the fact that No. 12 gauge copper wire varies somewhat, some specimens being much more tough and springy than others. The wire used was quite workable, being of just the right stiffness to ensure rigidity without undue difficulty of winding. It was obtained from Messrs. Scientific Appliances, of Sicilian Avenue, W.C.1.

The aerial coupling coil consists of one turn only, this being quite sufficient to give maximum signal strength. It is quite possible, however, to dispense with this coil entirely, coupling being effected by laying the aerial lead along the back of the baseboard.

Testing Out

The set is now complete, and may be tried out. It is advisable to test the filament circuit before the H.T. is joined up, in order that any fault may be detected before damage results. It is a good plan to join the accumulator across the H.T. terminals and to see if the valve lights up, in which case something is wrong and the wiring should be carefully examined before proceeding further.

The Valve

With regard to the valve, almost any good receiving valve suitable for a detector may be used, but personally I prefer a valve such as the D.E.5B, or similar type in other makes, owing to the smooth control of reaction that is possible with this class of valve. Having joined up the H.T., L.T., aerial, earth and telephones, the valve may be switched on and the tuning condenser set at zero. The reaction condenser is now slowly rotated from zero, until the set reaches the oscillating condition, when both condensers are slowly turned, by means of the fine adjustment knob, until some signals are picked up. The necessity for slow movement of the condensers must be emphasized, as it is quite possible to miss a signal by turning the condenser too quickly. It must also be remembered that it is necessary for the set to be just oscillating—in other words, if the reaction condenser is increased far beyond the point at which oscillation commences, it is very easy to miss a signal.

Grid Leak Adjustments

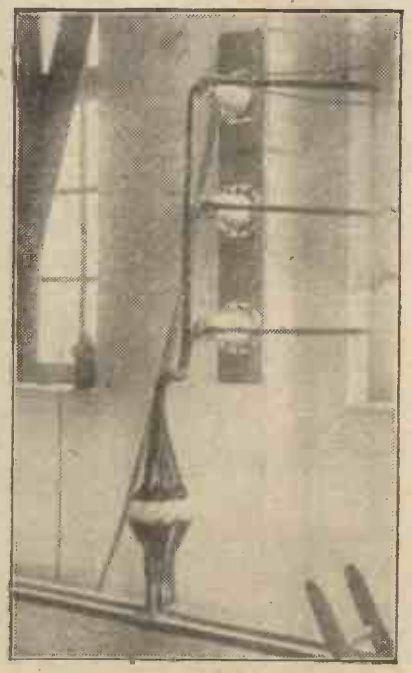
The grid leak should be adjusted so that the set slides smoothly into oscillation, while the tapping clip must be set at such a point that oscillation is obtained over the whole range of the tuning condenser. Once this point has been found (with a D.E.5B valve about 4½ turns are required), no further adjustment is necessary, hence the tapping is not shown variable in the circuit diagram.

Test Report

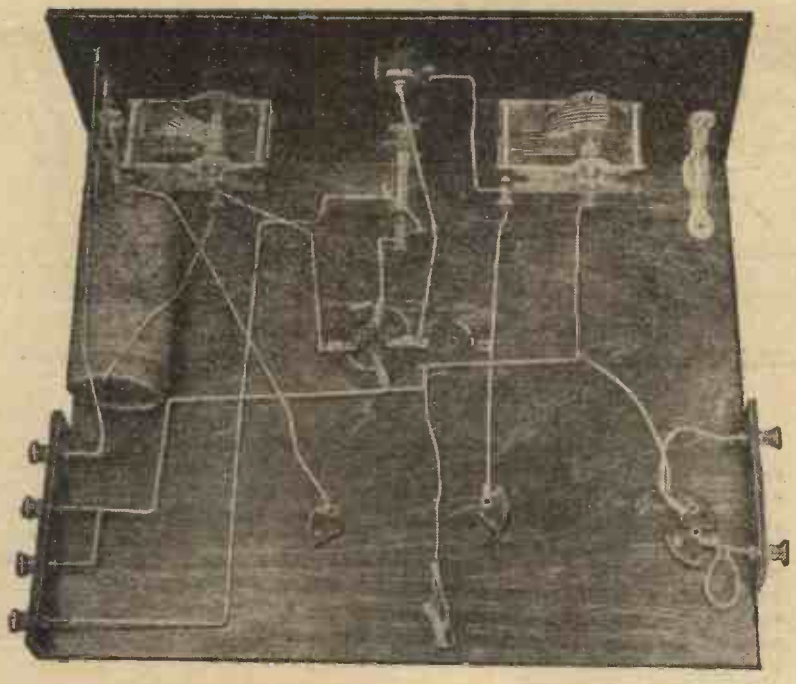
The receiver has been given a thorough testing out, and large numbers of stations have been received.

The tuning range is from roughly 27 metres to 80 metres (11,111 kc. to 3,750 kc.). KDKA's 63 metre transmission comes in at about 135 degrees on the tuning condenser, while the amateur wave of 45 metres comes in around 87 degrees.

Among the stations heard were WIZ, WQO, KDKA, WGY, (American); 1AU, 1RM, 1CO, (Italian); S2CO (Finland), N12BB (Holland), SMUK (Sweden), and



Earth connections at the Post Office Station at Rugby.



A back-of-panel view showing the layout of the baseboard components, which should be rigidly adhered to.

many others. The Post Office experimental station G5DH at Dollis Hill, which sends on 50 metres, may be picked up at practically any time, and serves as a useful indication of the position of the condenser at which that wavelength is received.

Additional coils may be made for different wave bands, one of seven turns reaching down to 20 metres (15,000 kc.).

Calibration Curve

On page 406 you will see a calibration curve of the receiver, from which it is possible to read off condenser settings for various wavelengths, or *vice versa*. In place of wavelengths on the vertical scale, you may have frequency in kilocycles, and this is probably the better way of setting out the chart.

The curve shown was obtained by noting the condenser readings of stations whose transmissions were of dependable accuracy, and marking these off on the squared paper. In doubtful cases a previously calibrated absorption wavemeter was used for checking purposes.

It will be necessary for you to make up another chart of your own receiver, as the one given only holds good for my set, and will be changed by slight alterations in wiring, coil making, and so on. You will find it quite easy to draw the curve if you follow the method given above.

Simplifying Tuning

IT is essential in a receiver which is intended for operation by other members of the family that some simplified method of calibration should be adopted. Instead of rotating the condenser dials to some cabalistic number predetermined from a graph, some easy way of indicating the condenser reading corresponding to the wanted station is desirable.

The Usual Method

When two condenser dials are calibrated in this manner the position of the dials is usually read off against a mark vertically above the condenser spindle. The disadvantage of this is that one's attention is required at two different points, making simultaneous tuning difficult, but if both dials read off at a single point between them, or, better still, by the method indicated in Fig. 1, the operation is very much simplified.

Use of Ivorine Discs

For this method the ebonite condenser dials have attached to their backs with Chatterton's compound or small screws, discs of ivorine, 5 in. in diameter, on which the call signs are to be printed. The variable condensers are mounted on the panel so that the ivorine dials almost touch. The diagram given in Fig. 1 precludes the necessity of further details, except the method of calibration.

Calibration

The condensers are adjusted to the best position for the reception of a station of known call sign, then a line is ruled on both discs passing through the tangential point and at right angles to the common tangent, as shown in the diagram.

This procedure is carried out with as many stations as possible, and all that is necessary in order to repeat a setting is to turn the condensers until the two markings with the call sign of the required station are in the same straight line.

B. G. R. H.

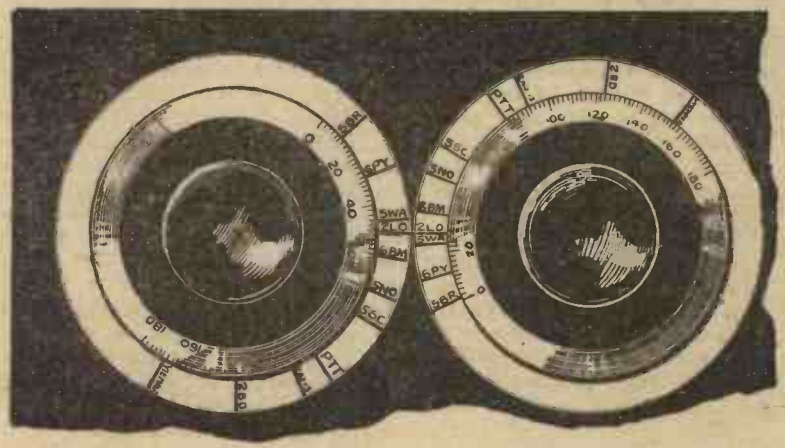
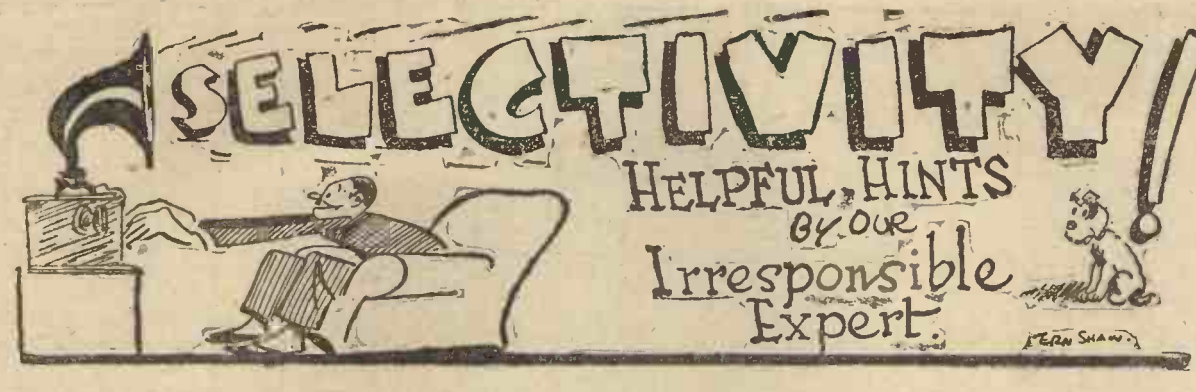
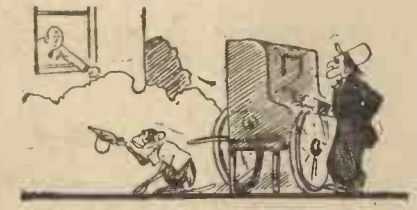


Fig. 1.—How the ivorine discs are marked and used in tuning.



IN the early days of wireless, when we patted ourselves upon the back, as (metaphorically speaking, naturally) we not infrequently did, our reason for doing so was usually that we had accomplished some phenomenal piece of long-distance reception, or, at any rate, that we had been able to bring our friends to believe that we had done so. Wherever wireless men were gathered together, in train or tram or bus or smoking room or den, someone was sure to say quite casually, after a pause in the conversation, "Oh, by the way, did you fellows hear so-and-so the other night?" He would mention some fearfully far-away station, and would then go on to recount how, whilst twiddling his knobs absent-mindedly he had suddenly picked him up, and had subse-



...a barrel organ in full blast...

quently been able to tune him to enormous strength. Those were the days before the loud-speaker became an almost universal fitting, and when we wished to impress our hearers we *always* said "perfectly audible with the phones on the table." Now, if you can hear a transmission faintly by pushing your head as far as it will go into the spout of the loud-speaker you inform anyone who will listen to you that it could be heard in any part of the house, and that even with the window shut the music was quite distinct in the street outside. There is not the slightest need to add that the music was that of a barrel organ which happened to be in full blast at the same time.

The Modern Radioliar

The radioliar of to-day scorns to recount mere feats of long-distance reception. The thing has been done so thoroughly that there is now little credit to be obtained for reporting reception of American broadcasting stations even on a single valve, and only one man has yet had the face to hear KDKA on a crystal.

Distance Despised

Amateurs have spanned the whole world now. It is a nightly occurrence for several of them to converse about nothing in particular with others of their kind in Australia and New Zealand, and in the more distant portions of this globe of ours. Sometimes a novice, a complete and utter beginner, who does not know the ropes, will think to obtain a little *kudos* by mentioning in the company of his betters that he has heard Constantinople or Kandy; but he will soon discover from the patronizing lift of their eyebrows and the heavens-what-next shrug of their shoulders that he has struck the wrong line. The modern radioliar eschews all reference to distance or DX, as the initiated would have called it in the dim forgotten past of a month or two ago, and concentrates entirely upon selectivity.

The Good Old Days

You see, this problem of selectivity is enormously important at the present time. Long before you, dear reader, were born or thought of, in the wireless sense, experts such as myself were listening to wireless telephony. We had Writtle on 400 metres—I think it was 400; in any case I need not give you the kilocycle equivalent, for we did not bother about such refinements then. Then came Croydon and the other air stations on 900, whilst above them was the Eiffel Tower on 2,600. It was comparatively easy, then, to design a set which would enable you to receive Writtle or Croydon or the Eiffel Tower at will. What I mean to say is that it was only in the case of the most amateurish receiving plant that you heard a deep bass voice saying, "Hullo, Handley Page, Beer, George," in the middle of a piano solo by Captain Chuckersley, or "Will you give me your *position*, please?" superimposed upon a weather forecast in French from FL.

Funny Noises

Now all is different. Though I cannot say that I have bothered to count them, they tell me that there are over a hundred European broadcasting stations working upon wavelengths between 300 and 500 metres, or, if you prefer it, with frequencies ranging from 1,000,000 to 600,000. There may be a hundred for all I know; I can well believe, after having tried to catch

.....the patronizing lift.....

some of them, that there are a thousand. On second thoughts I believe that there are about six broadcasting stations and 994 funny noises. All are as funny as each of the rest, but some of them are more so.

New Worlds to Conquer

Since all these stations are pouring programmes into the aether o' nights, it is quite obvious that we wireless folk must make apparatus capable of receiving each and every one of them. I have read heaps of articles written by Those Who Should Know on what wireless teaches us and things of that kind. They all show that though we do not really know it, because the process is a painless

one, wireless is making us more musical and more æsthetic and more appreciative of poetry and all sorts of things like that. Now every night there are scores and scores and scores of messages to our better selves being broadcast from all stations in Europe; would it not be a thousand pities if we failed to make use of the opportunities for self improvement which are ours for the asking? Have you ever spent an evening with a friend who possesses a set claimed to be capable of tuning in simply dozens of stations? I know of nothing more calculated to produce mental uplift. Placing you in a comfortable chair, and providing you, if he knows what is what, with a good cigar—he begins to twiddle knobs and things. From the loud-speaker there issues a curious noise such as might be produced by a German battalion about a mile away immediately after the issue of the soup ration.

An Improving Evening

"Northolt simply blotting out Brussels," says your host. He twiddles again slightly, and in comes a burst of music which sounds as if it is being filtered through screens of cotton wool. It is accompanied by a kind of OOO-ooo OOO-ooo OOO-ooo noise, which he tells you is a heterodyne. You knew that much already. He says that he will now get Rome. What he does get is mainly a Morse message from a cross-channel steamer asking somebody to send on the ski boots that somebody else has forgotten. There is a world of uplift in this. And all the time he keeps on giving you snatches of 2L0, which really

....if he knows what's what....

sound quite jolly. If he does happen to get Radio-Iberica or Radio-Toulouse or Glasgow or Birmingham, or some other station that comes in quite well, he twiddles them out at once, saying "Oh, that's only Radio-Iberica, Radio-Toulouse, or Glasgow or Birmingham. Any fool can get those." At the end of about an hour, when you have finished his cigar or your own gaspers as the case may be, you rise and shake him warmly by the hand, thanking him for a most improving evening. You then go home, just in time to hear the last part of a local station's programme on your own set, and that is that.

The Experts

From what I have said you will see at once that if you want to get the best out of wireless it is essential to construct or to own a selective set which will enable you to tune in all these European broadcasting stations just when you want them. If you ask friends round they are quite sure to demand that you shall take them for a trip over Europe with the help of your receiver. Should you start with 2L0, and after hectic attempts at tuning, pick up the same station again and again you will find them cold and unappreciative. Bring in fifty snatches from fifty stations, and all your friends will feel that you are a genuine expert and that they have spent an evening which has really *meant* something. The expert of to-day has brought selectivity to a fine art. I know a man who claims that the selectivity of his receiving set is such that he can separate the trombone from the rest of the instruments in an orchestral piece.

How it is Done

It is some little time now since we first realised that our receiving sets were far from being all that they might be. We thought that they were doing quite well until somebody exploded a bomb amongst us by writing articles entitled "How about your Condensers?" Thousands of condensers were flung forthwith into thousands of dustbins.

Are ——s Worth While?

The low-loss condenser became the fashionable component, and everyone of us fitted them. Just as we were beginning once more to pat ourselves (metaphorically still) upon the back another expert bombed us once more by inquiring whether low-loss condensers really mattered. Faint but pursuing we told each other that low-loss coils were the thing, and that if you wanted decent reception you must not think of using anything else but copper wire about as thick as your wrist for your inductances and winding it upon specially designed formers which take up an unconscionable amount of room in the receiving set. For a time all was as merry as the proverbial marriage bell; but just as wedding bells are generally followed by a bump to earth, so low-loss coils met their Waterloo. Were they worth while? Forbidding rows of figures interspersed with cabalistic signs seemed to show that the matter was at any rate doubtful. For a spell the conversation of enthusiasts consisted of nothing but x-squareds and pi's and omega's and things of that kind. Every man you met had a worried look—and really I do not wonder. And then somebody showed that the aerial ruined all selectivity, and somebody else that the crystal was at the bottom of

..he can separate the trombone..

all the trouble, and somebody else that the valve was as bad as anything else, if not worse.

The Solution

The only thing, so far as I can see, if you want really first-rate selectivity is to construct a receiving set which will require neither aerial nor earth, and will contain no coils, no condensers, no crystal and no valves.

Meanwhile we shall carry on somehow with our present hopelessly inefficient apparatus, contenting ourselves with receiving half-a-dozen stations or so of an evening and missing the soul-stirring messages of the odd 994. We shall probably go on trying round for the Continental stations and hearing Northolt, and the French sparkers, and the Channel boats, and the Ulster police, and duets, or trios or quartets, or even quintets, between various members of the broadcasting brotherhood. We shall also chase Radio-Toulouse up and down the scale, wondering whom he is going to heterodyne next, and probably finding out before we are very much older. And all of us, young and old, highbrow and low-brow, expert and beginner alike, will tell each other little tales of how we can receive this station or that without the slightest interference from any other.

The Low-Loss Conscience

For conversational purposes spark signals, mush, atmospherics, heterodyne whistles, and music from other stations are not counted as interference. After prolonged consideration I have come to the conclusion that the secret of real selectivity is to be found in the low-loss conscience.

Making Your Own Aerial Insulators

Several home-made insulators are described below—some for permanent use and others for employment in emergencies

THE subject of the effective insulation of aerials is not a new one—it has been dealt with many times in this and other Radio Press journals. Yet the design of the insulators employed for this purpose deserves careful consideration, and before describing the methods of making the insulators themselves I propose to discuss, quite briefly, the theoretical side of the question.

Why Insulators are Used

The purpose of the insulators is to prevent the energy induced in the aerial by the incoming oscillations from being wasted by leaking directly to earth *via* the rope halyards, masts or other aerial supports. Were we dealing with direct currents, it would be sufficient for us to interpose a length of badly conducting material —*i.e.*, material with a high electrical resistance—between the rope and the aerial wire. But the currents induced by the aether radiations alternate at high frequencies (from about 1,500 to 600 kilocycles on the B.B.C. band), and it is a well-known fact that high-frequency currents can pass through a condenser with an ease depending on their frequency and on the capacity of the condenser.

Lessening Capacity Effects

In the ordinary aerial system we have a condenser, the "plates" being represented by the aerial wire at high potential due to the incoming oscillations and the halyard at approximately earth potential, the dielectric between the plates being provided by the insulator used, and in order to reduce H.F. losses to a minimum, the capacity of this "condenser" must be made as small as possible. The capacity of any two-plate condenser can be reduced by the following methods:—

(*a*) Decreasing the size of one or both of its plates.

(*b*) Using a material of lower "specific inductive capacity" or "dielectric constant" between the plates.

(*c*) Increasing the distance between the plates.

(*d*) Placing one or more extra condensers in *series* with it.

Which Methods can we Use?

Methods (*a*) and (*b*) are of little use to us in the present case. In the first place, the "plates" of the "condenser" are the rope and wire, and, therefore, of fixed size. Secondly, all the insulating materials we are likely to employ—ebonite, porcelain, glass, mica, rubber, etc.—have high dielectric constants. However, we can use the other two methods—(*c*) by fixing the rope and wire at opposite ends of an insulator which separates them widely, and (*d*) by adding further "condensers" in the shape of extra insulators between the aerial and halyards.

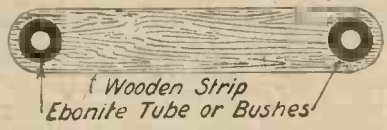


Fig. 1.—Ebonite inserts in a wooden strip form a useful insulator. Three-ply wood may be used.

Common Types

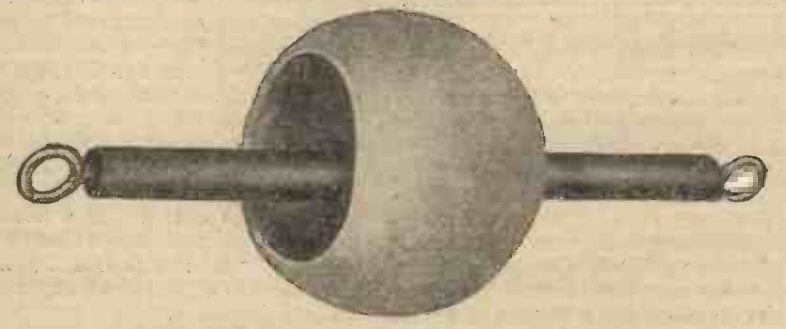
The ordinary "shell," "egg," and "reel" insulators do not fulfil condition (*c*), as the wire and rope are separated by only a thin layer of porcelain. The remedy in this case is to use several insulators in series at either end of the aerial, thus reducing both high-frequency and direct-current losses. There are now on the market various glass and porcelain insulators which do not suffer from this fault, but they are often more expensive than those of ordinary type.

Home-Made Insulators

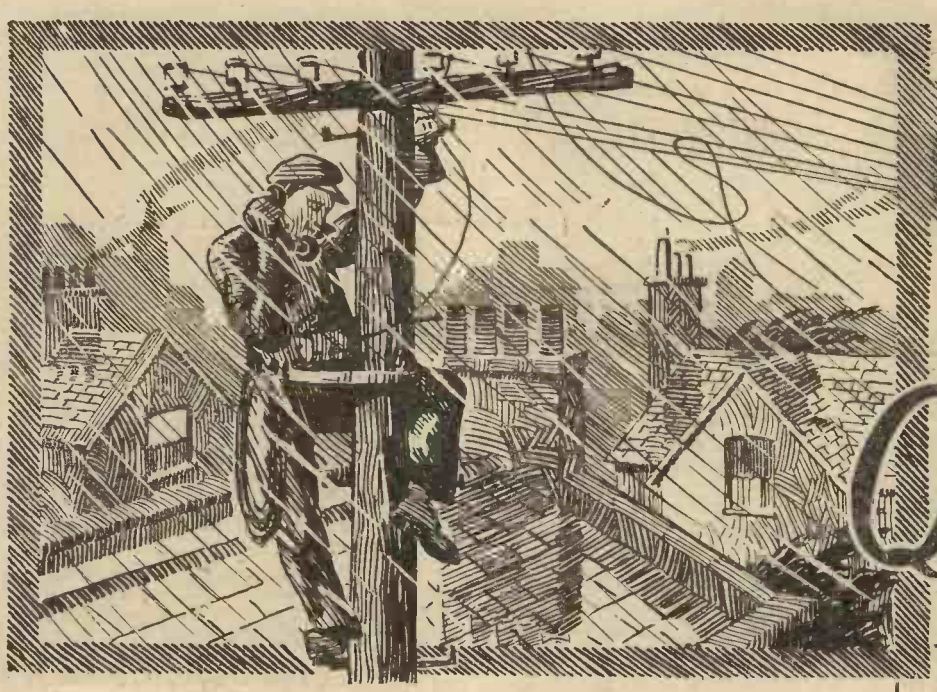
Below I describe several insulators—all of which may be easily and cheaply constructed at home—in which consideration has been given to these points. They also possess adequate mechanical strength, if made carefully, and should prove satisfactory in conjunction with any aerial of ordinary "L" or "T" type.

Use of Ebonite Inserts

The first, shown in Fig. 1, consists of a strip of wood about 4 in. long and ¾ in. wide by, say, ¼ in. thick, in which two holes are bored to take short lengths of ebonite tube or bushes. The pieces of tube should have an external diameter of about ⅜ in., and each be ½ in. long, so that they project slightly on either side of the wood, to allow the rope and aerial wire (to be threaded through the tubing at opposite ends of the insulator) to clear it. If the wood is dried out



A photograph of the "weatherproof" insulator described in this article.



QRL?

In Radio communication the letters "Q.R.L." followed by an interrogation mark mean "Are you receiving badly?" If such is the case the station in reply sends "Q.R.L." "I am receiving badly"

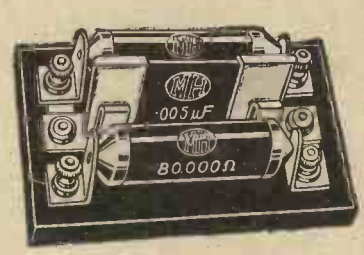
—are you receiving badly?

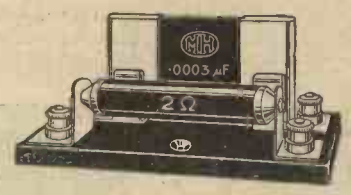
Possibly some component in your receiver, itself working inefficiently, is impairing the good performance of other units in the circuit!

Seek it out—replace it with an (MH) Component. A set incorporating (MH) Components gives a consistent standard of results that is practically perfect, obtained through every unit in the circuit working in complete harmony with the others.

(MH) Fixed Condensers and Grid Leaks will make an appreciable improvement in the range of any circuit.

A (MH) L.F. Transformer, followed by a (MH) Resistance Capacity Coupling will give perfect loud-speaker performance. Your dealer stocks them.





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Are of the permanent capacity engraved thereon. Are instantly interchangeable.

	Each
0·0001µF to 0·0009µF (030) ..	2/6
0·001 µF to 0·01 µF (031) ..	3/–
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(Two clips are supplied with each condenser) Above mounted on ebonite base with terminals as illustrated, any value, 1/– extra

(MH) Resistance Capacity Coupling

Consists of three well-known (MH) units:— a ·005µF Mica Fixed Condenser, a 0·5MΩ Leak, and an 80,000Ω Resistance mounted on ebonite base. Prices:

Complete with base (as illustrated) ..	12/6
Anode Resistance only, with clips ..	4/6
Leak only .. .. " " ..	2/6
Condenser only .. " " ..	3/–
Base only, with fittings "	3/6

(MH) L.F. TRANSFORMER - Price 21/-

(MH) Grid Leaks

All values 2/6 each.

Mounted on ebonite base. 1/– extra.

(MH) Anode Resistances

All values 4/6 each. (Each supplied with two clips). Mounted on ebonite base with terminals, all values, 5/6 each.

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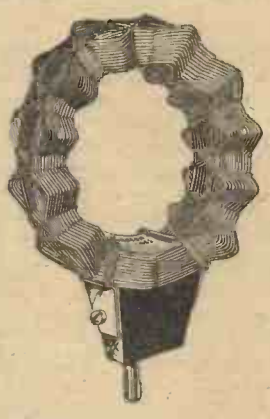

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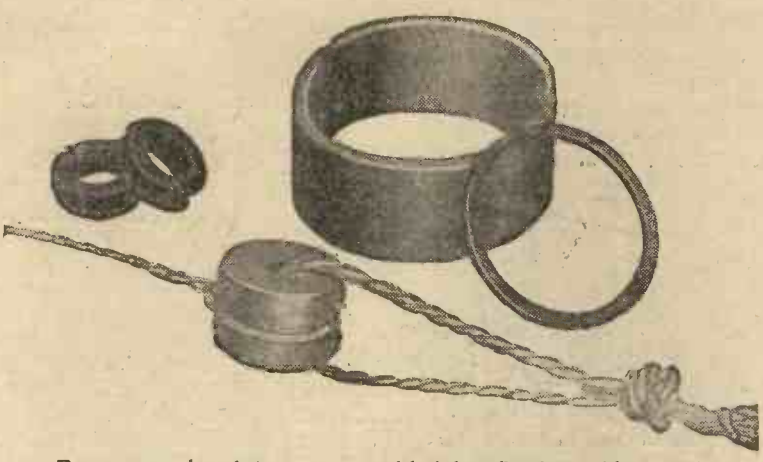
thoroughly before use and well varnished it will itself have a high resistance, while, of course, the ebonite also prevents leaks. Capacity effects are also small, since two "condensers" in series, connected by the high-resistance wood, are formed by the two ebonite inserts.

An Improved Form

A better form of the insulator described above can be made wholly from ebonite, two holes to take the aerial wire and halyard respectively being made, one at either end of the ebonite strip. Losses can be minimised by making the insulator as long and thin as possible, consistent with adequate mechanical strength, while to reduce capacity effects still further small holes may be bored in rows between the hole intended for the aerial wire and that for the rope.

A Low-Capacity High-Resistance Insulator

A neat little insulator which allows ebonite of small cross-sectional area to be used can be made from ebonite rod. I have made several of these, and find them to be very light, efficient and inexpensive. Each is made of a 4 in. length of ⅜ in. diameter ebonite rod. A hole is made with a small drill centrally at each end, and screw-eyes of the kind used for large pictures are screwed into the holes. If the drill has been well chosen the screw-eyes will cut threads in the ebonite and hold very tightly (see photograph). To protect the ebonite and metal from the effects of exposure to weather the insulator may be given a coat of shellac varnish, which, of course, will not adversely affect its insulating properties.



Emergency insulators are provided by ebonite tubing and bushes, a rubber ring and a door-stop.

The "All Weather" Type

In wet weather serious leakage may occur owing to a film of rain water more or less short-circuiting the wire and halyard. Many types of "weather-proof" insulators are now on the market, all working on the principle of protecting a section of the insulator from moisture by means of a hood or cover.

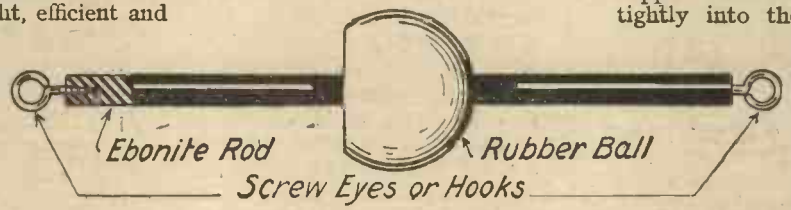


Fig. 2.—A "low-loss" insulator of novel construction. If a stout ball is used there will be no tendency for the rubber to sag.

A Novel Method

The insulator described above may be elaborated into one of "all-weather" type by the following method. Use a greater length of ebonite than given above—say, 5 in.—and drill as before. Then take an ordinary indiarubber ball of about 2 in. diameter, and cut a circular section from one side, as shown, so that about a quarter of the ball has been cut away. Immediately opposite this on the other wall of the ball cut a round hole slightly smaller in diameter than the rod. The ball is then slipped over the rod, which fits tightly into the small hole, but clears the wider opening. The screw-eyes can then be fixed as before. We now have an insulator whose central section is completely protected from rain. If used on an aerial which slopes, it must, of course, be hung so that the wide opening is at a lower level than the tightly fitting end.

Suggestions for Emergencies

Emergency insulators may be made from many household things, and some suggestions are given below, though I do not pretend that all these will pass any stringent electrical tests. A stout rubber band makes a useful "ring" insulator, while a section cut from an ebonite tube answers the same purpose.

Use of Rubber

An insulator of "reel" pattern is furnished by a rubber door-stop, the aerial wire being led through the central hole, while the halyard cord runs round a groove cut in the circumference. An old rubber heel with two holes drilled in it can also be utilised, cord and wire being threaded through the holes at opposite ends.

Three home-made insulators. That on the left is an ebonite strip drilled to take aerial and rope, while ebonite inserts are used in the right-hand one.

A Use for Old Jars

Ordinary porcelain and glass are far too hard to allow of drilling, but a small glass fish-paste jar, which has a raised flange at both top and bottom makes quite a

A small jar makes a very efficient insulator.

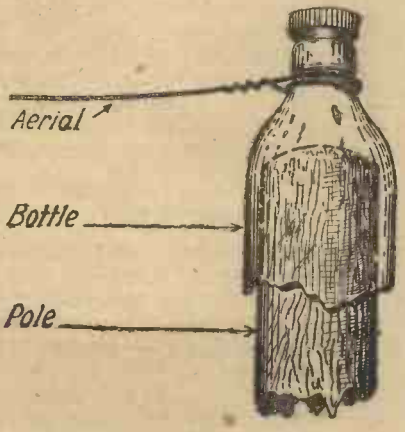
good insulator, as can be seen from the photograph.

The halyard cord is tied round the top of the jar below the glass rim on which the lid normally fits, while the aerial wire is fastened at the bottom, being kept in position by the ornamental flange.

For a Temporary Aerial

When erecting a temporary aerial almost any cylindrical glass or porcelain bottle or jar will make a useful insulator for the top of the pole used as a mast. If a bottle is used, the bottom should be knocked off and the bottle forced over the top of the pole. The aerial wire is then tied to the neck of the bottle and the pole erected. Naturally, this arrangement is only for emergency use, as the aerial cannot be lowered except by pulling down the pole. It may be useful at a picnic or with a portable set, however. A jam jar or similar container can be used instead of the bottle.

The above suggestions do not exhaust the possibilities, but they should prove useful in emergencies.



For temporary erections a bottle can be used.

A Panel Push-Button

A SIMPLE but neat press-button can be made as follows. Two pieces of springy brass strip $\frac{3}{16}$ in. wide, one $1\frac{1}{2}$ in. long and the other $1\frac{1}{8}$ in. long, are cut and bent with the aid of a pair of square-nosed pliers to the shapes shown in Fig. 1. A $\frac{1}{8}$ in. hole is drilled in one end of each so that they can be secured to the panel by means of $\frac{1}{2}$-in. 6 B.A. screws, to which connections to the switch are made. A piece of $\frac{1}{4}$-in. ebonite rod $\frac{5}{8}$ in. long is cut, and a small hole drilled

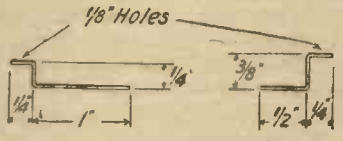


Fig. 1—How the brass is cut to make the contacts.

about $\frac{1}{16}$ in. from one end, through which is pushed a small piece of brass wire, or a small nail from which the head has been removed, to serve as a stop to prevent the button from working through the panel.

Drilling the Panel

Three holes are drilled in the panel to which the button is to be fixed, and the parts mounted as shown in Fig. 2. This press-button may be used for a wavemeter

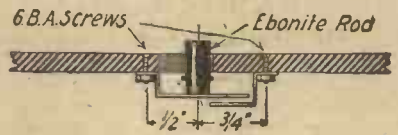
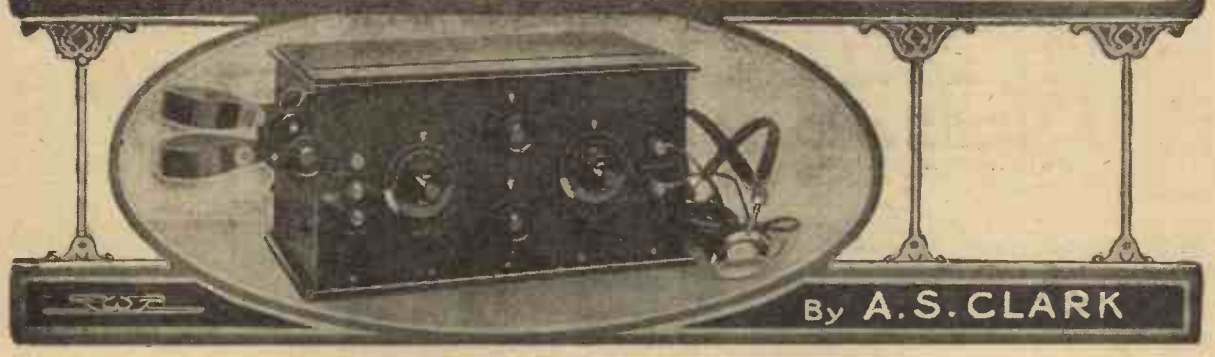


Fig. 2—The switch is assembled as shown, the ebonite rod forming the push-stud.

switch or a voltmeter button, and no doubt the amateur constructor can find many other uses for it.

W. H. F.

THE NEUTRODYNE TWO



By A. S. CLARK

THERE are many listeners who during the winter months feel they would like to reach out with their wireless sets, and receive broadcasting stations other than the local one. But in a great many cases the receiver intended for the local station is unsuitable for distant work, and if a special receiver is made, which is the best thing to do, it must not be expensive. The receiver to be described in this article is not only inexpensive, but is also both simple to make and simple to work.

It has two valves, and is intended for use with telephones, of which two pairs may easily be employed. On any evening it should be possible to receive at least two or three stations, the tuning not being so sharp and critical that the station cannot be left tuned in while the hands are removed from the set.

The Circuit

The circuit employed is a neutrodyned stage of H.F., followed by a detector. Magnetic reaction is arranged in the anode circuit of V_2, and is obtained by coupling the two coils together in the coil-holder, which may be seen on the left of the receiver, so that it is not necessary to touch the neutrodyne condenser to obtain the desired regenerative effect.

Position of Controls

The neutrodyne condenser, C_4, is completely inside the receiver, and is adjusted from the top of the set through the lid with which the cabinet is provided. Dual filament resistances, R_1, R_2, are used, so that either bright or dull emitter types of valves may be employed. The tuning of distant stations is made easy by means of the integral verniers on the two low-loss condensers, C_1 and C_2.

Panel Lay-out

The terminals for connecting the batteries are at the back of the set and thus help to keep the appearance of the set tidy, by avoiding straggling wires at the front of the panel.

The three terminals for connecting aerial and earth are so arranged that the tuning condenser C_1 may either be used in series or parallel with the aerial coil L_1. Very often, especially when a poor aerial and earth system has to be employed, it is a distinct advantage to have the tuning condenser in series with the tuning coil. A standard neutrodyne unit is employed for the tuned anode and neutrodyning coils, separate H.T.+ terminals being provided for the two valves, so that they may be worked on the most suitable value.

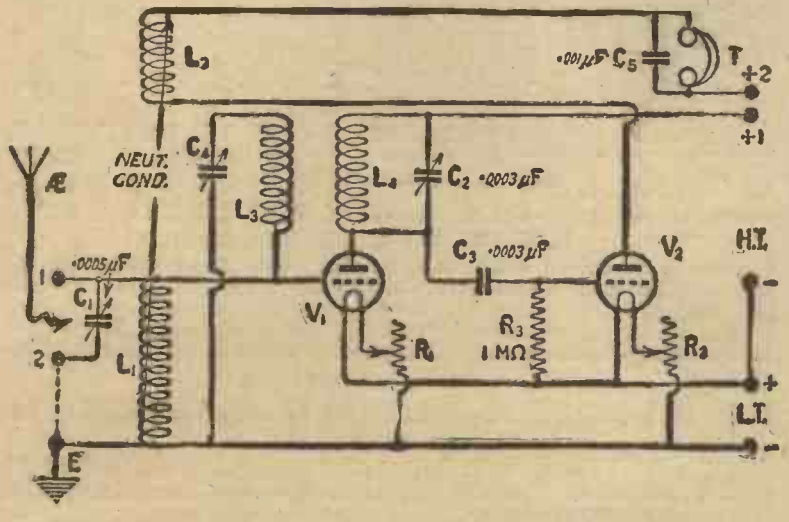


Fig. 1.—The receiver employs a neutrodyned stage of H.F. amplification and a detector.

Components

Do not commence to construct the receiver until all the component parts required have been gathered together. Otherwise you may experience delays, which might tempt you to carry on with a part of the constructional work which should not be started until the previous stage is completed, and the set spoilt. In order to facilitate getting all the necessary parts, a complete list of them is given. The names in brackets are those of the manufacturers of the parts used in the original set, but any other makes of good quality may be employed. These names are only given as a guide to the type of components required, and to help those who desire exactly to duplicate the original receiver.

Panel, 14 in. by 7 in. by $\frac{3}{16}$ in. (Radion Mahoganite. The American

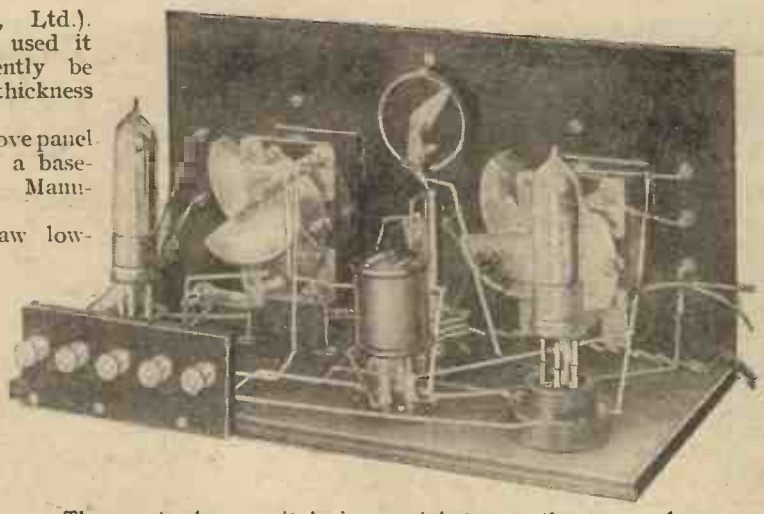
Hard Rubber Co., Ltd.). If another make is used it may quite conveniently be ¼ in. thick, since the thickness is really immaterial.

Cabinet to take above panel and 7 in. deep, with a baseboard, (Carrington Manufacturing Co., Ltd.).

·0005 μF square-law low-loss variable condenser, with vernier plate (Ormond Engineering Co.).

·0003 μF square-law low-loss variable condenser, with vernier plate (Ormond Engineering Co.).

Two dual filament resistances (L. McMichael, Ltd.). If it is intended definitely to use the set with either bright or dull emitter valves only, resistances suited to the type to be employed may be purchased instead of the dual type.



The neutrodyne unit is inserted between the two valves.

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

Two valve holders of the non-microphonic type (Magnum Vibro, Burne-Jones & Co., Ltd.).

One ordinary valve holder for baseboard mounting (Burne-Jones & Co., Ltd.).

·001 μF fixed condenser (Telegraph Condenser Co., Ltd.).

·0003 μF fixed condenser with clips for grid leak (Telegraph Condenser Co., Ltd.).

One or two M Ω grid leak (Edison-Swan Electric Co., Ltd.).

Baseboard mounting type of neutrodyne condenser (Peto-Scott Co., Ltd.).

Five brass terminals.

Terminal strip for five terminals 5″ × 2″ × ¼″ (Burne-Jones & Co., Ltd.).

Packet Radio Press panel transfers.

Flex, screws, square wire, etc.

Four raised type Decko dial indicators (A. F. Bulgin & Co.).

Drilling the Panel

The constructional work is commenced by drilling the panel in accordance with the drilling diagram which is shown in Fig. 2. A full size blueprint of this diagram may be obtained for 1s. 6d. post free, No. C1029A. If this is not employed, but the panel marked out straight from this diagram, it must be remembered that it is drawn looking at the front of the panel, and therefore the dimensions must be all reversed in marking out the panel.

Sizes of Holes Required

Before drilling any of the holes, centre punch all the necessary points, and lay the panel on several thicknesses of soft paper to protect its polished surface from becoming scratched. The two variable condensers and filament resistances are of the one-hole fixing type, a ⅜ in. hole being all that is required for fitting them. 4 B.A. clearance holes are required for the five terminals, and 6B.A. clearance holes, countersunk, for the screws which hold the panel to the baseboard, and 6B.A. for the dial indicators. It will therefore be seen that only three different sized bits are required.

Fixing the Transfers

Having drilled the panel, the necessary panel transfers may be attached as indicated on the panel in the drilling diagram. This is the best point at which to affix

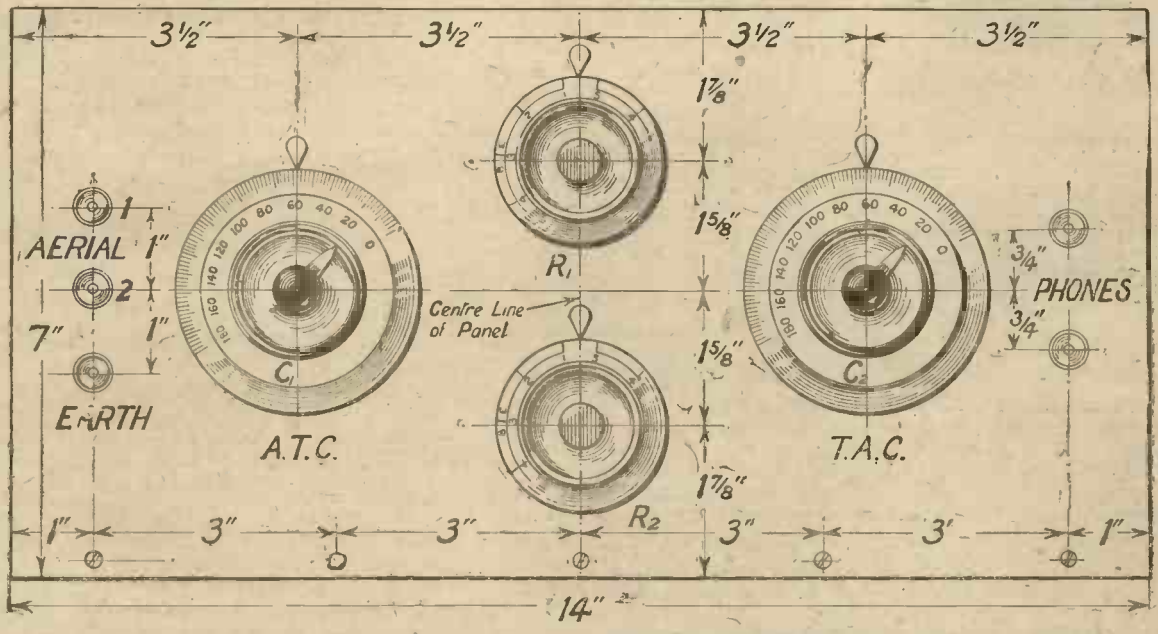


Fig. 2.—A scale drawing of the panel. A full-size drilling blueprint may be obtained from the publishers, C1029A, 1/6, post free.

these, as when all the components are mounted it is not an easy matter to apply the hot pad.

The panel should next be attached to the baseboard, this being done with the panel and baseboard fitted in the cabinet, in order to ensure that they will slide out easily. The terminal strip should also be attached at the same time.

Mounting the Components

Now mount the components, putting on first those which go on the panel. The small parts, such as terminals, should go on first, the variable condensers being left till last. When screwing the components to the baseboard, the general lay-out as shown in the wiring diagram (Fig. 3) should be followed.

Wiring

Before carrying on with the actual wiring, all points to which soldered contact is to be made should be tinned well, since this will greatly simplify the wiring, which must be carried out strictly in accordance with the diagram shown in Fig. 3, the general lay-out of the wires being followed as nearly as possible. Do not forget that room must be left to insert the valves and neutrodyne unit, and the connections to the neutrodyne condenser should be kept as far from the handle of this condenser as possible.

The Coil-holder

The coil-holder is screwed to the side of the cabinet, and connected by means of flexible wires, which are run through holes drilled in the side of the cabinet.

Series and Parallel

When the wiring is completed, the set is ready for testing out. The H.T. and L.T. batteries are connected in the usual way to the terminals at the back of the set, the two H.T. positive terminals being connected together for the preliminary test. The telephones are also connected to their terminals at the right-hand side of the panel.

If the condenser is to be put in the series position, the aerial is placed on A_2, and the earth on the earth terminal. On the other hand, when it is to be used in parallel, which it should be at first, the aerial is placed on the terminal A_1, and the earth on the earth terminal.

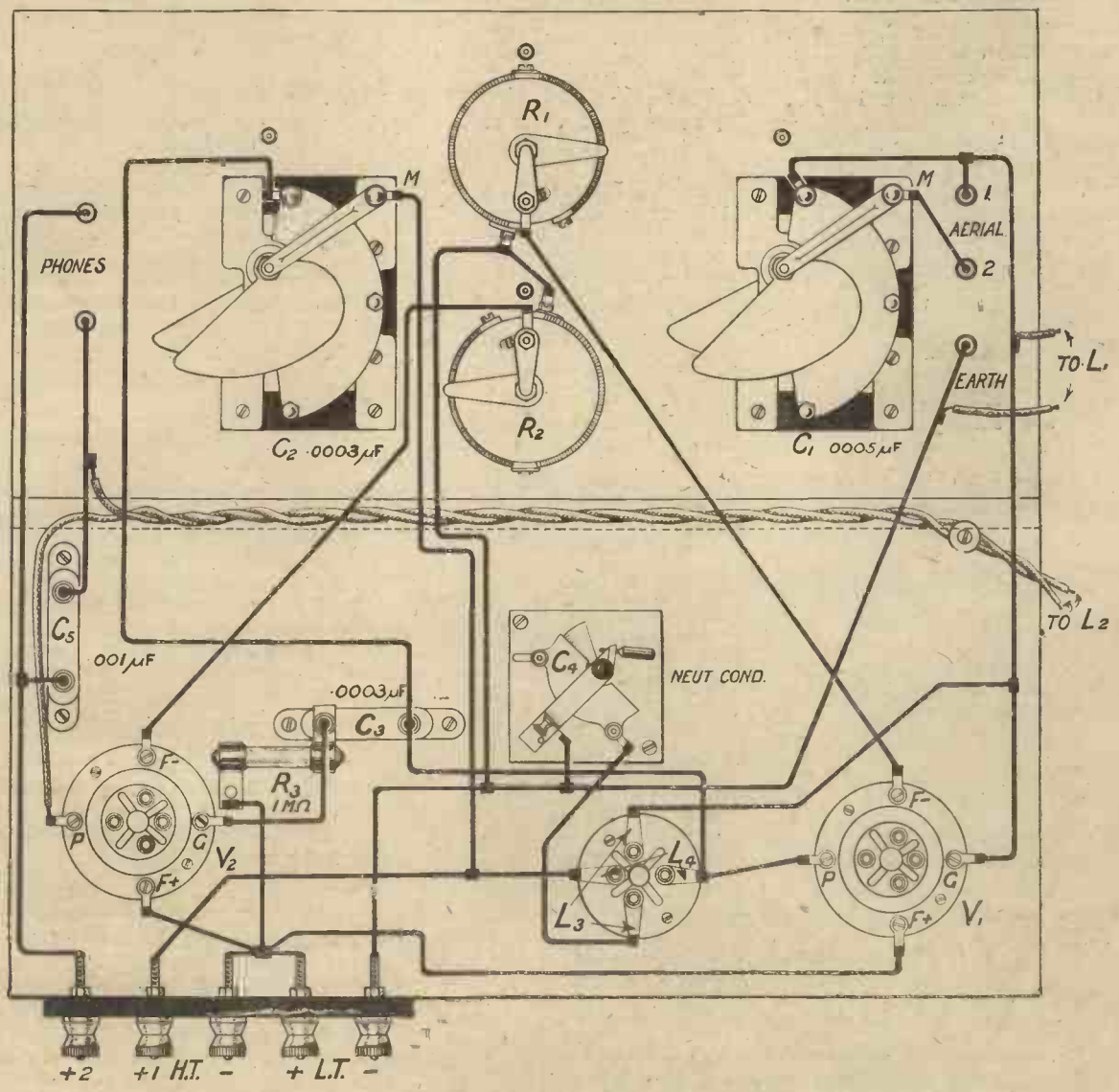


Fig. 3.—The wiring diagram. The full size blueprint No. C1029B may be obtained for 1/6, post free.

this terminal being connected with a piece of wire to terminal A_2.

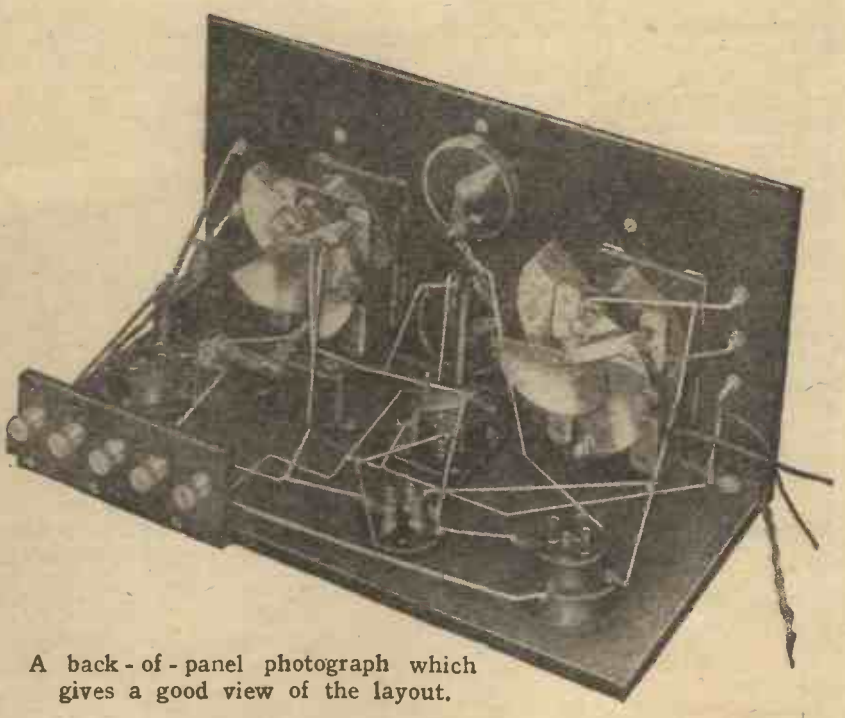
Neutrodyning

Before the aerial and earth are connected it is necessary to neutralise the set. This is done in the following manner. Plug a No. 35 or No. 50 coil in the fixed socket, assuming that the variable condenser is in parallel, and put a shorting plug in the reaction or moving socket. The set will now oscillate when the two variable condensers are so adjusted that the circuit L_1 C_1 and the anode circuit of V_1 are in tune. The object of neutrodyning is to adjust the set so that it will not oscillate at all, whatever wavelength these two circuits are tuned to.

Preventing Oscillation

With the condenser C_1 at, say, 20°, swing the condenser C_2 backwards and forwards. At certain points the set will go in and out of oscillation with a plop. Starting with the neutrodyne condenser all out, gradually increase its capacity until the set does not oscillate at all when the T.A.C. is swung backwards and forwards. Now test in the same way with the A.T.C. at about 40°. It may be necessary to alter the value of the neutrodyne condenser slightly to prevent oscillation.

The set should be adjusted in this manner until it will not oscillate at any setting of the two condensers.



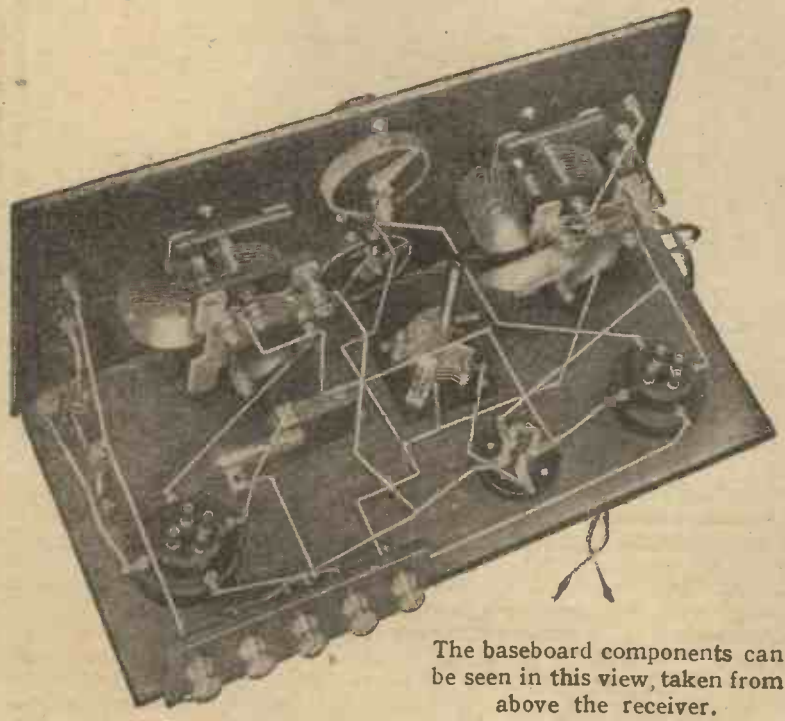
A back-of-panel photograph which gives a good view of the layout.

Reception

Having successfully neutrodyned the set, the aerial and earth may be connected, keeping the condenser in parallel as before.

A No. 50 or No. 75 coil can now be plugged in the reaction socket, and tested to see if it is connected the right way round by bringing it up to the aerial coil and noting if the set oscillates.

Should it be found that no reaction effect is obtained, it will be necessary to reverse the flexible leads to the reaction coil only. On some aerials it is possible that an improvement in reaction control may be obtained with the aerial tuning condenser in the series position, the aerial lead being taken to "Aerial 2."



The baseboard components can be seen in this view, taken from above the receiver.

Tuning

The method of tuning is much the same as that of any single valve circuit as far as the aerial tuning condenser and reaction control are concerned. But there is the additional control of the second condenser to be made. This should be done simultaneously with the A.T.C., when one is increased the other being increased.

After a little practice the control of the set will become quite easy, and the settings of the various controls may be noted for different stations in order that they may easily be tuned in on future occasions. The best value of H.T. voltages for the two valves can be best found by trial, since it will vary greatly with the particular valves in use.

Use of X Coils

If the selectivity is not sufficient to reduce the jamming effect of the local station enough, it may be greatly improved by using Lissen X coils. The X coil is used in the fixed socket, and the aerial connected on to one of the terminals provided. Since the turns are counted from the socket of the coil, it is necessary to see that the

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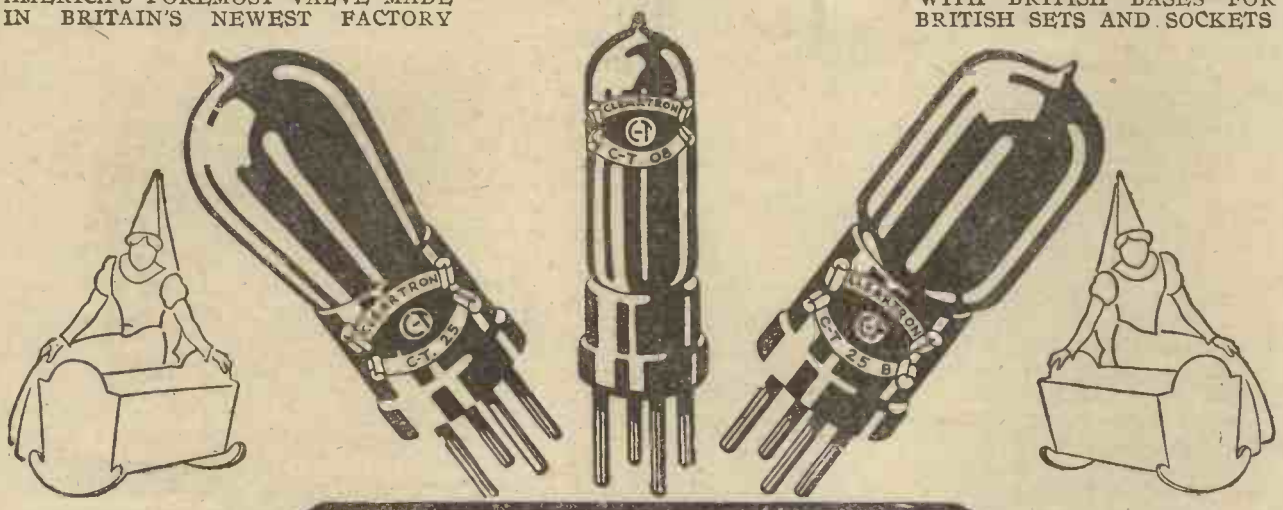

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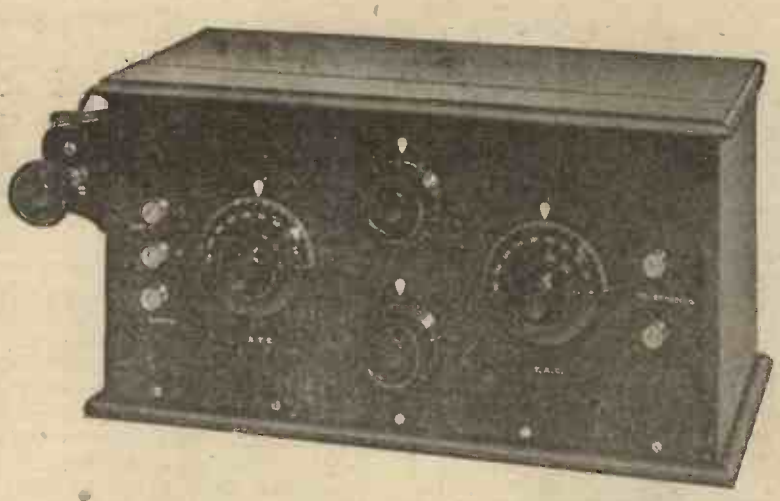
plug of the coil-holder goes to earth.

Results

The results obtained from this set will be found to repay amply the trouble and time taken in making it, and it will be found just the thing for those who want to receive distant stations without multi-valve sets or complicated controls.

Test Report

The receiver was tested about eight miles S.W. of 2LO, that station being received at very good strength. Although no attempt has been made to see how many stations could be identified in one evening, indications show that the number would be quite large, since on every evening that the set was tested it was possible to hear three or four B.B.C. stations, and three or four continental ones.



The finished "Neutrodyne Two" has a very good appearance.

Do You Know — ?

By C. P. ALLINSON

THAT if the primary winding of an L.F. transformer is burnt out the instrument need not be discarded, as the secondary winding can be used as a choke for choke-capacity amplification.

* * *

That dead spots (*i.e.*, frequencies at which the receiver goes out of oscillation) in short-wave reception are generally due to too tight aerial coupling. A very small series condenser or a detuning coil in series with the aerial (50 turns on a 3 in. former will do) will generally cure this trouble.

* * *

That in some cases the trouble may be caused by a circuit which happens to be tuned to a frequency within the range of the receiver though situated two or three feet away.

That the large transmitting inductances used in long wave commercial wireless stations are wound and mounted on wooden formers, as wood does not grow dangerously hot or melt under the effect of the stresses produced by the intense high-frequency fields due to the coils.

* * *

That many square law condensers are very seldom "square law" at their lower readings when used in a receiver. This is due to coil and other capacities in the receiver. When calibrating a receiver by finding two known points and drawing a straight line between the two the lower point should not fall within the first 30 degrees of the condenser.

* * *

That paper is an insulator. It is sometimes required to join two pieces of double flex, and perhaps no insulating tape is handy to insulate the joins in the two strands of wire from each other. Paper will do quite well. Thread should be tied round it to keep it together.

* * *

That when receiving weak CW signals on the short waves the receiver should only just be oscillating. If reaction coupling is too tight it may wipe out the signal it is desired to read.

* * *

That the tuned-anode method of H.F. amplification is very little used in America. It is further generally referred to there as the "British tuned anode" circuit.

* * *

That although most oils and greases are insulators, there is one—viz., vaseline—which appears to be suitable for use in obtaining smooth easy working of such things as switch contacts without detriment to the electrical continuity of the circuit.

With the Amateurs on Short Waves

THOSE who are interested in short-wave reception, and therefore to a certain extent in transmission, though not holding transmission licences, may often complain that their interests are neglected. Short-wave reception is, of course, a somewhat peculiar subject; its interest varies with the time of the year, and those enthusiasts who listen on short waves every night have no regular broadcasting stations on which to depend.

2LZ's Achievement

To such as these the article appearing in the December 30 issue of *Wireless Weekly*, by Mr. F. A. Mayer, will be of great interest. Mr. Mayer is the owner-operator of the well-known amateur station 2LZ, and he describes how he re-broadcast the programmes from Daventry to a receiving experimenter in Tasmania, and how his own telephony is frequently heard at the Antipodes. There is also the weekly feature, "Short-wave Notes and News," a summary of the chief work carried out by amateurs during the previous week, which will also prove useful to those who are interested in this phase of radio reception.

Problems of Transmission

For the more advanced experimenter, considerable value is attached to the series of articles on transmission, written by the staff of the Radio Press Laboratories. These articles deal specially with any problems likely to arise when first attempting transmission, and one dealing exclusively with circuits will be found in the December 16 issue.

Is It Worth While?

In the January number of *Modern Wireless* there is also a short article by L. H. Thomas, entitled "Is Short-wave Reception Worth While?" in which the writer discusses the position of those who would like to construct a short-wave receiver, but have no knowledge of the Morse code.

Reducing Tuning Controls

The simplification of receivers is now receiving more attention, perhaps, than ever before; it is becoming more and more clear that the average listener wants a fool-proof set with the minimum number of controls, without having to sacrifice efficiency. One step towards this end is described by Mr. J. H. Reyner, B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E., in the January issue of *Modern Wireless*, entitled "Reducing Tuning Controls." He describes a single-valve receiver embodying some novel principles, simplicity being one of the chief features.

Hiding Wires

In addition to simplicity, a feature much desired by many owners of receivers is the absence of wires and terminals, etc., on the front of the set. It has for some time been common practice to place the terminals on one or two strips at the rear of the receiver, but all the controls are still, as a rule, visible from the front. This has been remedied in the case of a handsome four-valve receiver designed and described by Mr. G. P. Kendall, B.Sc., also in the January *Modern Wireless*. This set, embodying two stages of high-frequency amplification, and crystal rectification, followed by two stages of choke-coupled L.F. amplification, employs a self-contained frame aerial in the back of the cabinet into which the actual panel is built. Though intended primarily as a local receiver for flat-dwellers, provision is made for its use in conjunction with an outside aerial for reception at greater distances.

The Aerial System

Mr. Kendall also writes in *Wireless* for January 2 on the subject of "Emergency Aerials," and Mr. H. J. Barton-Chapple, Wh.Sch., B.Sc.(Hons.), A.C.G.I., D.I.C., A.M.I.E.E., contributes an article "About Earths," so that those interested in their aerial systems will find themselves well catered for.

Converting a Variable Condenser

MANY readers have in their possession some variable condensers of the old type, and, while wishing to use the more modern "square law" type, do not wish to scrap their old instruments, which may still be perfectly serviceable. The following method of converting a variable condenser from "straight-line capacity" to one possessing one of the advantages of the "straight-line wavelength" type may therefore be of interest.

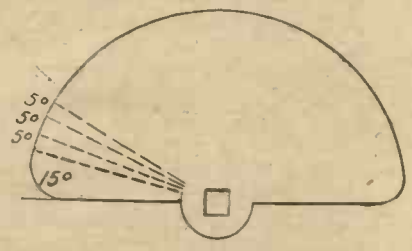


Fig. 1.—The sectors are marked off on successive plates as above.

The bottom end-plate carrying the bush for the spindle on which the moving plates are mounted is first removed. The whole "rotor" is then taken off, the end nut unscrewed, and all the moving plates separated. Then, with a sharp pair of scissors, sectors of gradually increasing size are cut out from the plates (see Figs. 1 and 2). From the first plate a sector subtending an angle of 15° at the centre (Fig. 1) is cut. Then from the second plate a sector subtending 20° is cut, and from the third plate one subtending 25°, etc. Thus, after the first plate, the angle at the centre of the sector removed increases by 5° for each plate until seven plates have been treated, the remainder being cut the same size as the seventh.

How It Works

Now, although this method does not actually give the condenser a straight-line wavelength curve, it has the advantages of lessening the minimum capacity very considerably (the maximum capacity also being reduced, of course), and of facilitating tuning on the first 40° or so of the dial, which is usually the troublesome portion in the case of an unconverted condenser.

On rotating the knob, first only *one* moving plate engages with the fixed plates, then two, three, and so on until all the plates have engaged.

Finishing Off

The only constructional detail worthy of note is that after the plates have been cut, the jagged edges *must* be flattened with a large pair of pliers, an iron or a vice. They will then give no trouble when the condenser is reassembled.

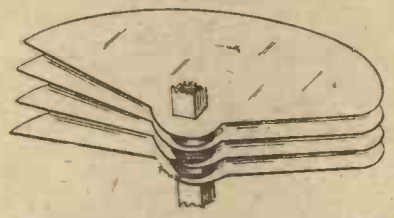


Fig. 2.—A sketch of part of the finished rotor.

L. H. T.

How Far Can "Low-Loss" Go?

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

A discussion of the cause of distortion in too-selective circuits

WITH the increasing number of stations all transmitting within a comparatively limited band of frequencies, the cry nowadays is for more and more selectivity. The question must have arisen in the minds of several readers as to whether there was any limit to the degree of selectivity which could be employed in a receiver. We all know, for example, that by increasing the reaction coupling of the receiver right up to the limit of oscillation we can obtain particularly sharp tuning and can increase our selectivity to a considerable extent.

A Possible Cause of Distortion

What happens when we do this, however? The quality of the speech, or music, is seriously impaired, and in many cases the distortion introduced by this proceeding is so great as to render the transmission well-nigh unintelligible. Is this a particular undesirable property due to the amplification of reaction, or does it arise from some other cause?

The answer is that reaction is the indirect cause, the real reason for the distortion which occurs being that the circuit has been made too selective. There is, therefore, some limiting factor which must be taken into account when the question of low-loss construction is being considered.

Finding the Limit

The problem which confronts the experimenter, therefore, is exactly where this limit occurs, and whether it is likely to impose any serious restriction upon the design of super-selective receivers.

The solution of this problem will be appreciated very much more clearly if the problem is stated perfectly definitely. In fact, it is often found that the very statement of a problem will be of considerable assistance in finding the solution. The point at issue, therefore, is briefly this. It is found from practical experience that the reduction of the resistance in a circuit by the employment of reaction causes a marked increase in the selectivity, but at the same time produces considerable distortion. What, therefore, is the effect of the resistance of the circuit upon the quality of the reproduction?

A Mechanical Analogy

The great difficulty in wireless, as indeed with a good deal of electrical engineering, lies in the fact that it is impossible to see exactly what is going on. A mechanical analogy, therefore, is of considerable value in assisting one to obtain a clear conception of any particular process. I have already given several mechanical experiments with pendulums in order to demonstrate certain well-known properties of wireless circuits, and I propose to invoke the aid of this simple method once again.

Making the Pendulums

For these experiments, therefore, we require first of all a piece of stout thread, stretched between two convenient points in a room. This cord should be fairly tight, but not excessively so. We next require two matchboxes, both of them full of matches. Two short lengths of cotton are then taken and one end of each cotton is tied round a matchbox in the manner indicated in Fig. 1. The arrangement must be such that the box containing the matches may be withdrawn from the outer shell. The other ends of these two lengths of cotton are then attached to the triatic previously erected, the distance between the pendulums so formed being, say, 3 ft. to 4 ft., depending on the length of the triatic. Fig. 2 shows the arrangement.

The First Experiment

Now start one of these pendulums swinging, disregarding the second pendulum for the time being, and notice how violently it is still swinging after, say, 25 swings. Then remove from the shell the inner box and all the matches contained therein, leaving

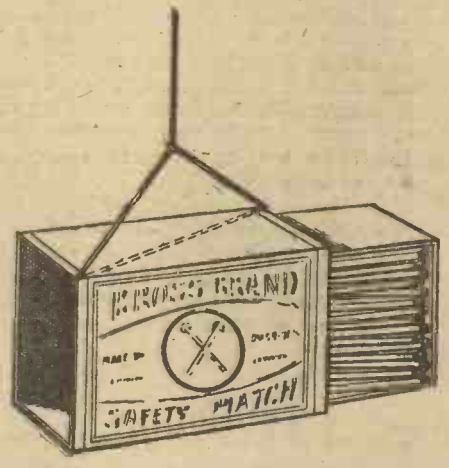


Fig. 1.—The manner in which each matchbox is suspended.

just the outer shell suspended by the cotton, and again start the pendulum swinging. If the relative swing at the end of 25 of the swings is noted again, it will be found that there is a marked difference between the two. The first pendulum would still have been swinging comparatively strongly at the end of 25 swings, whereas the second pendulum will, in all probability, be reduced almost to a standstill after the same interval.

Effect of Friction

This effect is due to the air friction upon the box. In the first case, the weight of the matchbox full of matches was comparatively great, and the effect of the air friction, therefore, as the pendulum travelled backwards and forwards, was comparatively slight. In the second case, the weight of the pendulum was considerably reduced by the removal of the box and matches, so that the air friction exercised considerably

more effect and slowed up the pendulum very considerably.

The effect of this air friction is termed the "damping," and in an electrical circuit we can have a similar effect. In a wireless receiving circuit we have currents flowing backwards and forwards in a similar manner to the oscillation of the pendulum just considered. The movement of these currents is opposed by the resistance of the circuit, just as the motion of the pendulum is restrained by the air friction. If this resistance is large, then the electrical oscillations in the circuit will be very rapidly damped out, corresponding to the case of the second pendulum where the air friction was relatively heavy.

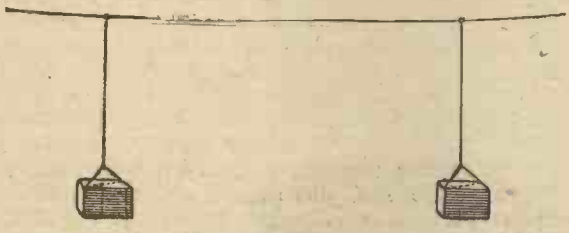


Fig. 2.—The two matchboxes are tied to threads to form pendulums.

A Further Experiment

This, therefore, explains the effect of resistance in a wireless circuit when a current has been started by some means and is allowed to die away. In the case of telephony, we have a somewhat different condition of affairs because we have continually varying voltages induced in the aerial by the wireless waves. We can represent this condition, however, to a large extent by means of the second pendulum.

If we adjust the two pendulums to have the same length and then start one swinging, the second pendulum will shortly commence to swing also and the two pendulums will still be swinging together. This was the phenomenon I employed to demonstrate the process of tuning. In my original experiments, however, both pendulums were exactly similar and we did not take into account the effect of air friction in any way.

Let us try now some simple experiments to find what the effect of damping is. First of all, adjust the two pendulums to the same length as just described, and let both the matchboxes be similar, that is to say, both full of matches in the ordinary way. If one pendulum is started swinging, then the other pendulum will shortly follow suit and the two pendulums will swing in unison. It will probably be noticed, however, that there is a slight difference in the swing of the second pendulum. It will follow slightly behind that of the first pendulum, but apart from this there will not be very much difference between the two when they are properly under way.

Increased Damping Effect

Now remove about two-thirds of the matches from the first pendulum, and replace the box in its shell. The effect of this will be to increase the damping on this pendulum, as we saw from the first experiment, while the damping of the other pendulum will remain the same as before. If, now, we start the first pendulum swinging, two effects will be noticed. In the first place, the second pendulum will not pick up quite as quickly as it did before, and in the second place it will tend to go on swinging comparatively strongly after the oscillations of the first pendulum have died down to a small value.

This means that the second pendulum is not accurately following the variations of the first. The first pendulum was started with a large swing and gradually decreased in amplitude to a small value. The ideal condition would be for the second pendulum to pick up swinging very rapidly and then to die away more or less at the same rate as the first pendulum. This would be the nearest approach we could get to a faithful copy of the movement of the first pendulum.

A Comparison

If we consider this as a mechanical analogy to a wireless system, the first pendulum would represent the transmitter, and the second pendulum would represent the receiver. Consequently, unless the movement of the second pendulum is a fairly accurate copy of the motion of the first, we shall have a condition analogous to distortion.

Attaining Faithful Reproduction

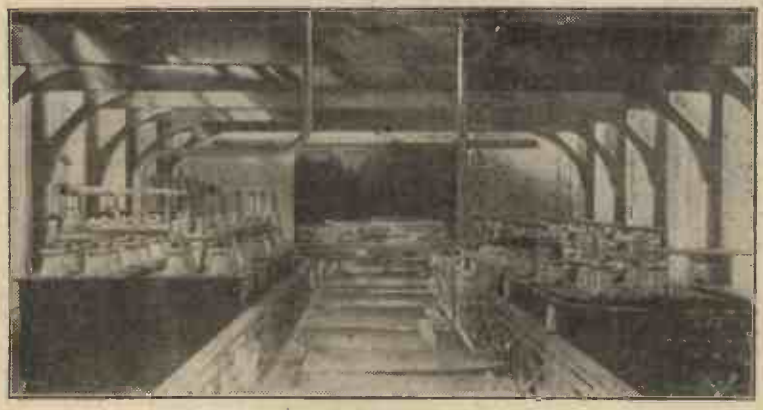
We may try one or two other experiments to demonstrate the effect. Let us remove all the matches and the box from the shell of the first pendulum, leaving simply the shell. This pendulum would be very rapidly damped, very much more so than the second pendulum which, of course, has not so far been altered. If, now, the first pendulum is started swinging, it will be found that the second pendulum hardly moves at all. This is because it takes so long to get moving that the first pendulum has practically come to rest before the second pendulum has gathered any appreciable momentum. Intermediate conditions can, of course, be obtained by filling the box again with an increasing number of matches, and it will be found that as the number of matches in the box is increased, so the motion of the second pendulum becomes more and more a faithful replica of that of the first.

Introducing Damping into the Receiver

We may summarize the results of these experiments so far by saying, therefore, that if the damping of the receiving pendulum is *less* than that of the transmitting pendulum, then the motion of the second pendulum will not follow that of the first. Let us now see the effect of making the damping of the receiving pendulum *greater* than that of the transmitting pendulum. This will be done, of course, by removing some of the matches from the second pendulum, leaving the first full of matches as in the original condition.

Mr. Frank Worthington, F.Z.S., better known to 2LO listeners as "Uncle Frank."

Interesting results will follow when this is done. It will be found that as more and more matches are removed from the second box, so this receiving pendulum gets under way more and more rapidly, and is very soon swinging in unison with the transmitting pendulum. More important still, as the transmitting pendulum gradually dies away, so the swings of the receiving pendulum follow it, and it will be found that the two pendulums die away practically together. This result is analogous to the condition of faithful reproduction in a wireless receiver. The experiments with the pendulum are, of course, incomplete. To devise any real mechanical analogy would require a certain amount of fairly elaborate apparatus. In the case of a wireless system, the voltage induced in the aerial is continually varying, increasing and decreasing in accordance with the speech vibrations. If it were possible to make the swing of the first pendulum increase and decrease in some manner, then we should be able to gauge just how the second pendulum would follow the variations.



Some of the big condensers in the inductance room at the Rugby Station.

Interpreting the Results

We can get a pretty fair estimate, however, from the experiments just described, the results of which indicate that, provided the damping of the receiving system is equal to, or greater than, that of the transmitting system, then reasonably good reproduction may be expected. This means that in a wireless system it is essential to have a certain amount of resistance in the circuit in order that the natural tendency of the currents set up in the circuit may be within the bounds of the variation required of them.

In the case of a receiver having a very low resistance, such as the reaction receiver referred to in the beginning of this article, the damping in the receiving circuit is so low that the currents tend to disregard the variations imposed upon them by the speech and music from the transmitter. Just as the lightly-damped pendulum in the experiments made took practically no notice of the heavily-damped pendulum which was obtained when all the matches were removed, so the currents in a lightly-damped (low resistance) wireless circuit are too sluggish in their action to follow faithfully the variations required, and consequently distortion results.

Conflicting Conditions

The reader will immediately say "Yes, but what about the selectivity? I always understood that in order to obtain a selective receiver it was necessary to reduce the resistance as far as possible." This, of course, is perfectly correct, and we really have two conflicting conditions. For good selectivity we require a low resistance, and for good reproduction we require a high resistance, up to a certain limit. That is to say, provided there is a certain definite resistance in the circuit then we shall obtain good quality.

The problem imposed by these conflicting conditions is not easy to solve. It can be shown both theoretically and practically that it is impossible to obtain good selectivity and to retain good quality with a single circuit. The resistance permissible in order that the selectivity shall be good is very much lower than the minimum which is required for good speech.

A Way Out of the Difficulty

Fortunately, however, there is a way out of the difficulty which lies in the use of several tuned circuits. If we obtain our selectivity by means of two tuned circuits, then it is found possible for each of the circuits, individually, to have a higher resistance, so that we can get a little nearer the conditions required for good quality. Similarly, if we employ three tuned circuits, we can make the resistance of each circuit still higher, and still obtain the necessary selectivity. Thus it will be seen that the greater the number of tuned circuits which can be employed, the better will be the quality of reproduction which can be obtained without sacrifice of selectivity.

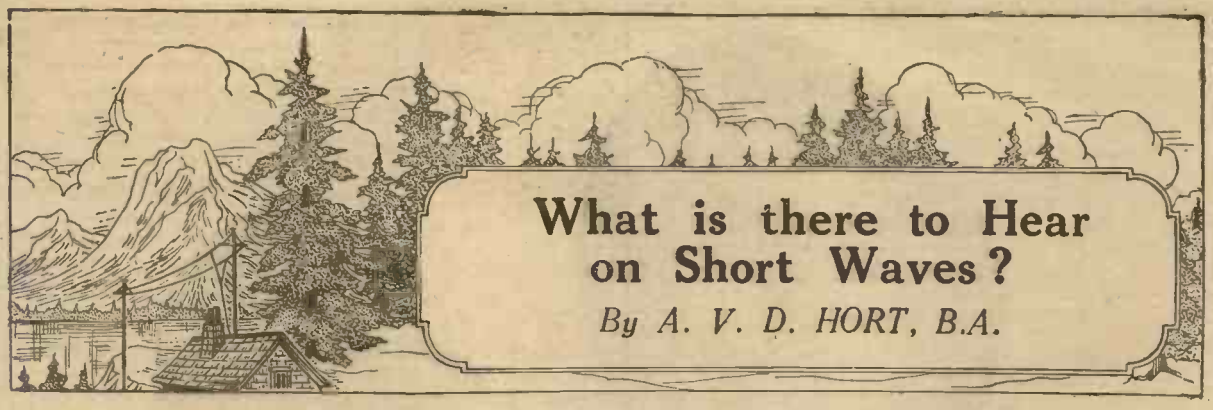
Unfortunately, of course, the use of a large number of tuned circuits is undesirable owing to the difficulties of adjustment. It is found, however, that with four tuned circuits both the required conditions are fulfilled. We can obtain really good selectivity, such as will cut out the local station at a distance of a couple of miles only, and will bring in a similar station 500 miles away at good loud-speaker quality. With a slight sacrifice of quality we can obtain good selectivity with only three tuned circuits. Two tuned circuits are hardly sufficient if really good selectivity is required. The problem, however, depends entirely upon the conditions, the principal factors being the distance from the local station.

Use of Low Loss Coils

Returning now to our original question, "How far can low-loss go?" we require to know now whether the types of coils which we are producing nowadays are anywhere near the permissible limit. As we have seen, it is not permissible to reduce the resistance of a coil below a certain amount, and it might reasonably be supposed that it would be possible to obtain such a good construction as to lie below this limit.

We have not, however, reached this limit yet. The best coils that we can produce with ordinary types of winding are not yet down to the limit which is permissible. We are certainly approaching the limit and, no doubt, before very long we shall devise new methods of construction which will enable us to achieve the desired limit.

Since the majority of circuits, however, require a certain amount of reaction, the actual resistance of the coil is considerably modified. Thus, in, say, a three-valve circuit where we have reaction on one or more of the circuits, it is possible to employ an ordinary type of coil. On the other hand, where we have only one or two circuits, particularly in crystal receivers with no reaction, then we require the very best possible type of coil, and here one of low-loss construction is definitely desirable.



What is there to Hear on Short Waves?

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

All readers interested in the higher frequencies will find this article of use

AN answer to the above question for the seeker after new broadcasting stations might well be given as "Not very much." The short waves, that is to say, the band of wavelengths from about 150 metres downwards, have not yet been fully exploited by broadcasting stations, and in consequence there is not a large number of stations to be heard transmitting music and speech regularly.

KDKA

There are at present some stations which send out regular programmes on short waves, the best known being, of course, KDKA, the Westinghouse station at Pittsburg, Pennsylvania, U.S.A. This station can be heard working any night now, with the exception of Sundays, a "dinner-hour" programme being sent out between 11.15 p.m. and midnight by our time. The strength and clearness of the transmission, which during the period quoted often consists of musical items, varies in a surprising way from night to night. On some nights it may be found a difficult matter to find the station at all, while at other times a single-valve receiver will bring in speech and music at clear telephone strength.

Another U.S.A. Station

KDKA's transmissions are not the only ones to be heard nowadays. The station WGY of the General Electric Company at Schenectady, New York, transmits now both on 109 metres and in the neighbourhood of 40 metres. On several occasions recently the writer has heard the transmissions from WGY on the latter wavelength at quite remarkable strength on one valve, no difficulty being experienced in hearing the announcer's remarks.

Curious Phenomena

The transmissions from both KDKA and WGY, originating as they do at a considerable distance from this country, are subject to fading and also to a curious form of distortion. But these phenomena are by no means always noticeable, and on some nights they may be found conspicuous by their absence.

English Amateurs

A large number of amateur transmitters in this country are now working on the 45-metre wavelength, while not a few are working on lower wavelengths. Transmissions in the morse code predominate, but amateur telephony at these wavelengths is by no means uncommon. The recent successful relaying on 45 metres of the Daventry transmission by an amateur is a case in point.

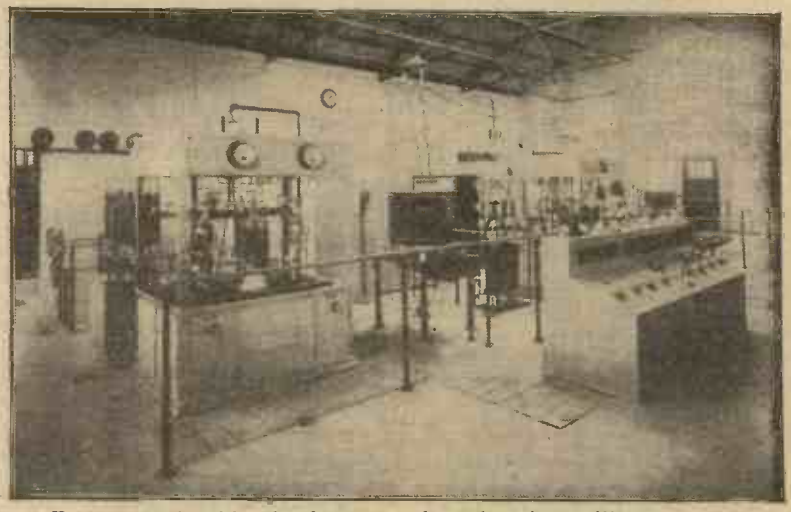
Apart, however, from those who are interested in the broadcast transmissions mentioned above, there is little doubt that the great bulk of those who listen on short waves are concerned mainly with morse code transmissions. Of these there is no lack, and the number of amateur transmitters increases daily.

Long-Range Reception

Owing to the remarkable penetrating power of certain bands of short waves at certain times of the day, stations in the most distant parts of the world may be heard working, surprisingly little apparatus being required either for transmission or reception. An evening on which reception on the 35- to 50-metre band brought in a few signals from the United States of America only, for instance, would be regarded as poor. One would expect to hear also signals from Brazil and the Argentine, and also perhaps from places 2,000 or 3,000 miles to the east of this country.

When to Listen

It appears that signals from various directions come in best at certain times of the day. At present, for instance, the best time to listen for signals from the Antipodes is during the early morning, for the hour or two round about sunrise.



The control table (in foreground) and main oscillator at 5XX, the Daventry Station

On some nights large numbers of American (U.S.A.) stations can be heard between about 10 p.m. and midnight, and on into the early hours of the morning. The writer has often heard Brazilian amateur transmissions at good strength between midnight and 1 a.m.

Knowledge of Morse Necessary

It is, of course, assumed in the reception of these distant transmissions that the listener has a working knowledge of the Morse code. Without such knowledge it is impossible to tell whether a station heard is situated in the U.S.A. or in the next street. While this is an extreme case, it may be noted that signal strength can never be taken as a guide to the location of a transmitter. The vagaries of the short waves are such that while signals from New York may come in at loud telephone strength, signals from a station 50 miles from the receiver may be barely, if at all, audible.

"Intermediate" Letters

To assist those who are interested in the reception of both near and distant amateur transmissions, a list of the "intermediate" letters allotted to various countries is appended here. If the correct procedure is used, a station will always be heard sending the appropriate "intermediate" letter or letters before his own call sign.

A : Australia.
B : Belgium.
BE : Bermuda.
BO : Bolivia.
BZ : Brazil.
C : Canada.
CH : Chile.
CO : Colombia.
CR : Costa Rica.
CS : Czecho-Slovakia.
D : Denmark.
E : Spain.
F : France.
G : Great Britain
GI : Northern Ireland.
GW : Irish Free State.
H : Switzerland.
HU : Hawaii.
I : Italy.
J : Japan.
K : Germany.
L : Luxembourg.
LA : Norway.
M : Mexico.
N : Holland.
O : South Africa.
P : Portugal.
PI : Philippine Islands.
PR : Porto Rico.
Q : Cuba.
R : Argentina.
S : Scandinavia (Iceland, Sweden, Finland).
U : United States
X : Ships and various portable stations.
Y : India.
YS : Jugo-Slavia.
Z : New Zealand.

Metres or Kilocycles?

The use of frequency rather than wavelength was discussed in a recent issue of THE WIRELESS CONSTRUCTOR. *Below will be found a conversion table from metres to kilocycles, together with the formula employed in making the transformation*

IN the early days of wireless, when aether radiations were first investigated, the wavelength of the disturbances produced was very small (of the order of 1 metre or less) and could actually be measured as a length.

As the science developed, however, the wavelengths used became longer and longer, and the term wavelength became merely a method of distinguishing between different stations.

The fundamental property of any tuning circuit, however, is its *frequency*, the wavelength which may be radiated being a secondary effect. A wavemeter (so called) is in reality a frequency-meter, since it is the frequency of the circuit which is varied by the condenser or variometer employed for tuning.

This month we publish a table of wavelengths from 10 to 100 metres, the equivalents in kilocycles being given in each case correct to the nearest whole number.

The figures for 100 to 1,000 metres (in steps of 10 metres) may be obtained by dividing the frequencies in the table by 10. Thus, if 78 metres = 3,846 kc., then 780 metres = 3,846 ÷ 10 = 384·6 kc. Similarly, frequencies corresponding to wavelengths of 1,000 to 10,000 metres, every 100 metres, can be found by dividing the appropriate value by 100; thus, 7,800 metres = 3,846 ÷ 100 = 38·46 kc.

The table below is calculated from the fundamental relation that, for wave motion, frequency = velocity ÷ wavelength. In the case of wireless waves the velocity is approximately 300,000,000 metres per sec. so that remembering 1,000 cycles = 1 kilocycle,

$$\text{Frequency (kc.)} = \frac{300{,}000}{\text{wavelength (metres)}}$$

METRES TO KILOCYCLES, OR KILOCYCLES TO METRES

Metres.	Kilo-cycles.	Metres.	Kilo-cycles.	Metres.	Kilo-cycles.	Metres.	Kilo-cycles.	Metres.	Kilo-cycles.	Metres.	Kilo-cycles.	Metres.	Kilo-cycles
10	30000	23	13044	36	8333	49	6122	62	4839	75	4000	88	3409
11	27273	24	12500	37	8108	**50**	6000	63	4762	76	3947	89	3371
12	25000	25	12000	38	7895	51	5882	64	4688	77	3896	**90**	3333
13	23077	26	11539	39	7692	52	5769	65	4615	78	3846	91	3297
14	21429	27	11111	**40**	7500	53	5660	66	4546	79	3798	92	3261
15	20000	28	10714	41	7317	54	5556	67	4478	**80**	3750	93	3226
16	18750	29	10345	42	7143	55	5455	68	4412	81	3704	94	3192
17	17647	**30**	10000	43	6977	56	5357	69	4348	82	3659	95	3158
18	16667	31	9,677	44	6818	57	5263	**70**	4286	83	3615	96	3125
19	15790	32	9375	45	6667	58	5172	71	4225	84	3571	97	3093
20	15000	33	9091	46	6522	59	5085	72	4167	85	3529	98	3061
21	14286	34	8824	47	6383	**60**	5000	73	4110	86	3488	99	3030
22	13636	35	8571	48	6250	61	4918	74	4054	87	3448	**100**	3000

Remember :—High Frequency means Low Wavelength (Short Waves). Low Frequency means High Wavelength (Long Waves).

A Reference Book for Every Constructor

Further details concerning the Radio Press Year Book for 1926

THE preliminary announcement which appeared in the last issue of THE WIRELESS CONSTRUCTOR concerning the *Radio Press Year Book* for 1926 has aroused so much interest that some further details will no doubt be appreciated.

A special feature which was not disclosed in the previous announcement will be found in an exceedingly complete and accurate list of call signs of experimental transmitting stations.

A special effort has been made to bring this list up to date and to make it thoroughly dependable, and it will prove invaluable to everyone who listens on wavelengths other than the broadcast band.

Valve Data

The valve data section will make a strong appeal to the serious experimenter, providing as it does an almost unrivalled collection of easily accessible information. Just the things the practical man wants to know about a valve are presented in handy tabulated form for scores of different types.

For the more advanced worker, again, actual characteristic curves of a very large number are also given.

General Section

For the non-technical reader the general section will be found to provide a fund of interesting and helpful matter by well-known authorities, which covers a remarkably wide field.

Articles appear from the pens of Major James Robinson, D.Sc., Ph.D., F.Inst.P., Captain H. L. Crowther, M.Sc., and many other distinguished contributors.

Workshop Instructions

The articles and condensed information in the workshop section include such items as instructions on marking out and drilling panels, matting ebonite, general hints on wiring and soldering, tables of sizes of drills and taps, tables of areas per pound of ebonite, and so on. This part of the book has received special attention, and the home constructor will find that the expectations aroused by these hints will be fully borne out by the book itself when he receives his copy.

Formulæ Disliked

The majority of home constructors do not, as a rule, feel that wireless calculations come within their field, but this is probably due in large part to a feeling that the formulæ involved in such operations as the calculation of the number and size of plates required in making a fixed condenser of a certain capacity are difficult to use.

Simplified Mathematics

The section of the *Year Book* which deals with simplified calculations will be found to remove such ideas with singular completeness, and to prove that everyone may carry out such elementary design work for himself with the aid of the simplest arithmetic.

This section has been prepared by an author well known for his capacity to present mathematics in simple form, and covers all the important calculations met with in every-day wireless work.

Long Distance with a "Prince" Receiver

(*Concluded from page* 368)

this set, however, it is possible to receive Radio-Toulouse free from interference, and, although the signal strength may not be quite so great as that obtained with the more usual type of receiver, a marked improvement in quality and background is noticed.

With a wavetrap it is, of course, a simple matter to get other stations whose wavelengths lie between those of Radio-Toulouse and London, with the exception of Cardiff and Manchester, which are rather difficult to get at the moment in the writer's neighbourhood.

Among the other stations received were Bournemouth, Newcastle, Hamburg, Madrid, Glasgow and Belfast (rather weak), FPPT at good strength, several German stations, Birmingham and Aberdeen. Below 2LO many relay stations were found, as well as various Continental transmissions such as Radio Belge, Elberfeld and some new stations. In every case distant stations were received with remarkable purity of tone, and many of them at medium loud-speaker to good loud-speaker strength.

Reception of Daventry

With the large coils inserted, Daventry is received at full loud-speaker strength, while Radio-Paris can be obtained at fair loud-speaker strength clear of interference from 5XX. Hilversum, on 1,000 metres, also comes in at good strength, as well as one or two other transmissions in the neighbourhood of 1,000 to 1,200 metres.

Once one has become a little accustomed to this receiver, it is noticeable for its ease of handling, notwithstanding the sharp tuning, while control of reaction is delightfully smooth and free from backlash.

Valves to Use

The following valves have been used successfully and may serve as a guide to the user: For H.F. and detector, two Cossor Wuncell red tops, or a D.E.8 H.F. followed by a D.E.5B or C.T.25B, or a B.7 or similar small power-valve. A.R.06 and B.5's have also given satisfactory results. B.5 for H.F. and a D.E.3B for detector form another good combination. For the L.F. any small power-valve will do; the writer has used Cossor Wuncell green top, B.7, D.E.5, P.V.8D.E., and the D.E.8 L.F. At the same time, G.P. valves have given good results, if not, perhaps, quite the same volume.

The writer will be glad to hear of the results obtained by constructors of this receiver as a guide to further experimental work.

The All-important variable condenser

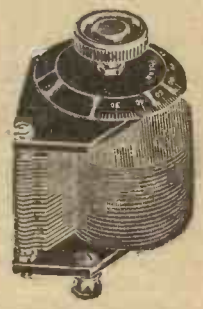
And the prestige behind the Polar

The "Polar" Junior Condenser

5/6

All Capacities

Possesses all the characteristics of the well-known Polar "Straight-line-Frequency" condenser. Gives a straight line of frequencies, with an approximately even movement of dial in relation to change of wave-length. Low minimum self-capacity; one-hole fixing; 350 degrees dial; perfectly screened; remarkably compact; occupying minimum space behind panel.

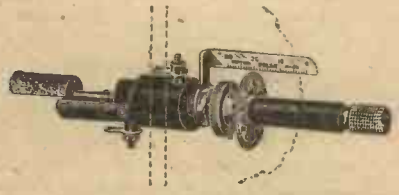


The "Polar" Cam-Vernier Variable Condenser

Compensated square law design of vanes; this means that the Condenser functions in the square-law manner, *not on the bench*, but *on your set*. Its shape of vanes compensates for the inherent self-capacity of your coils and aerial, with the result that the figures on the dial indicate definite wave-lengths. You can recognise the Cam-Vernier Variable Condenser, if by nothing else, by the specially engraved dial which *commences* at "26"—recognising that no aerial tuning system can have a zero-capacity. It embodies the well-known Cam-Vernier device, giving 10 degrees of vernier movement in any position; and *the vernier readings register on the dial.*

Prices:

·0003	. . .	10/6
·0005	. . .	11/6
·001	. . .	12/6



The "Polar" Micrometer Condenser ("N" Type)

The condenser is of the cylindrical type, and the variations in capacity are obtained by varying the relative positions of the two semi-cylinders. It has the extremely small minimum capacity of two micro-micro-farads. Locking-nut for fixing in any desired position. The finish and workmanship are of the usual high Polar standard.

Price . . 5/6

Vertical and Rotary Scales, as shown, 9d. extra

Not all variable condensers can be judged by appearance and price alone. It is unlikely that the condensers produced by any but long-established Radio Engineers *can* be fully efficient.

It is, further, unlikely that nondescript, cheaply-assembled condensers will carry anything like the UNCONDITIONAL written GUARANTEE enclosed with every "Polar" Condenser. It is a guarantee against original defects, as well as against breakdown or the development of faults in ordinary use—for a period of ONE YEAR.

All constructors of Radio Sets have an appreciation of quality in *appearance*, as well as of quality in *performance;* yet not all are equally able to indulge in the *expensive* class of components. For this reason, we have introduced the "Polar" Junior Condenser, at a price of 5/6 for all capacities—putting a product of high quality (backed by a great reputation) within the reach of all.

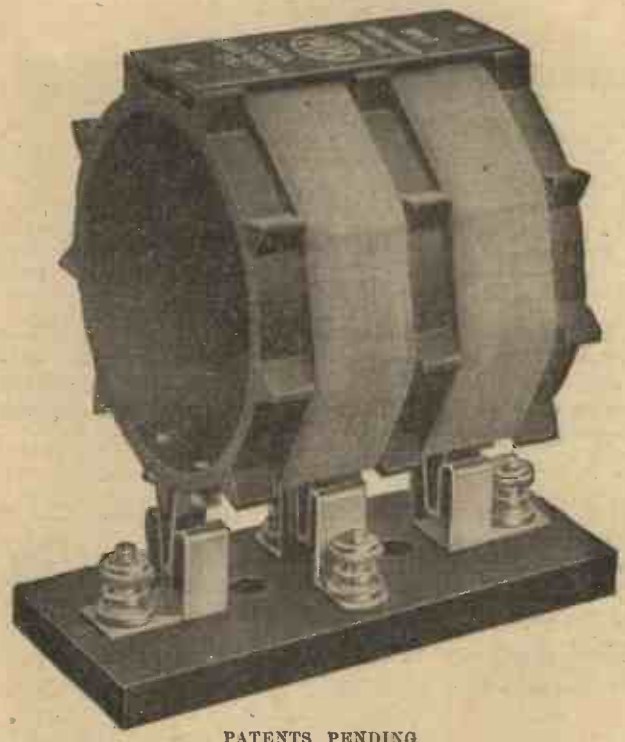
Buy the products of well-known Firms—disregard any maybe biased recommendations of "cheap" components—and depend upon the Manufacturers to "see you through."

Sold by all reputable Radio Dealers. Ask your Dealer, or write to us, for the "Polar" Condenser Booklet

Radio Communication Co., Ltd.

34-35, Norfolk Street, Strand, London, W.C. 2

A New (MH) Product



PATENTS PENDING

Reg. No. 717674

No. 1
200 Microhenries
300-600 M.

THE DIMIC COIL

PRICE

Dimic Coil No. 1
(300-600 M.) 10/-

Base ... 2/6

No. 3
(1100-3000 M.)
will be issued
shortly.

What the (MH) DIMIC COIL is

First and last a highly efficient inductance of a particular form. (Patents pending.)

What the (MH) DIMIC COIL does

Provides:

(a) A perfect aerial tuning inductance of two ranges, or "centre tapped."

(b) A perfect H.F. intervalve coupling. (Auto transformer, Neutrodyne, Tuned Anode or loosely coupled transformer.)

(c) A unit applicable to a multiplicity of uses, some of which are shown diagrammatically on opposite page. Further information as to other applications will appear from time to time.

TO those who, constructing their own sets for the first time, desire range selectivity and stability, the Dimic Coil offers a certain and satisfactory solution.

* * *

To those who wish to improve or add to existing sets this component gives an adaptability and efficiency hitherto unobtainable.

* * *

To the advanced experimenter the design speaks for itself.

* * *

The complete series will finally be available covering all wavelengths from 20 to 7,000 metres and fitting the standard base.

THE NEW MH DIMIC COIL

and some of its many applications

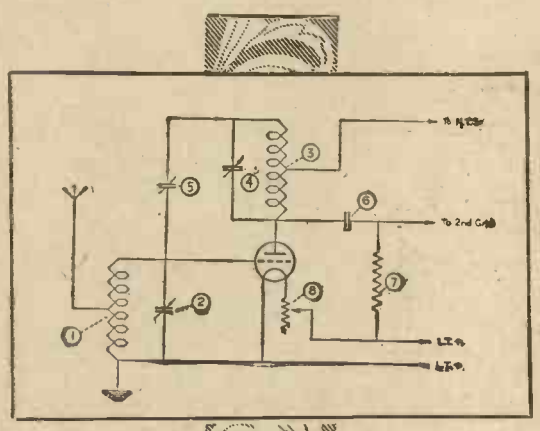


Diagram No. 1

ONE of the most important applications of the Dimic Coil is that of neutrodyning, *i.e.*, it enables the ultra-efficiency of the Dimic windings to be taken full advantage of for the purpose of high frequency amplification with perfect stability. We claim that the particular principle of neutrodyning employed with Dimic coils is the only basically sound method, since the neutralising component is of necessity in its proper phase relationship with the effects to be neutralised. Neutrodyning is effected on the Diagram shown, but the construction of the Coil is such as to permit of variations in the method of application

KEY TO DIAGRAM NO. 1

		Prices
1.	No 1 DIMIC COIL as Centre Tapped Aerial Inductance	10/-
	Base and Clips ..	2/6
2.	Aerial Tuning Condenser '0005 μF ..	10/6
3.	DIMIC COIL No. 1 as Tuned Anode for H.F. amplification ..	10/-
	Base and Clips ..	2/6
4.	Anode Tuning Condenser '0005 μF ..	10/6
5.	Neutrodyne Condenser	2/10
6.	Transfer Condenser (MH Fixed Condenser '00025 μF)	2/6
	Base and Clips ..	1/-
7.	MH Grid Leak 1 megohm	2/6
	Base and Clips ..	1/-
8.	MH Dual Rheostat ..	7/6

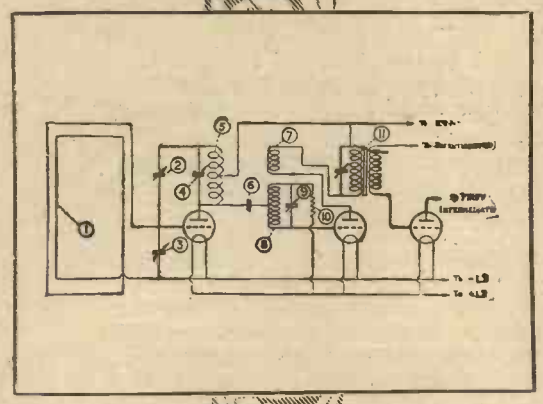


Diagram No. 2

IN Diagram No. 2 we indicate the application of the Dimic Coil to an H.F. stage preceding a supersonic receiver of the autodyne type. The excellent results obtained with MH supersonic outfits are enhanced enormously by this addition. It has a double advantage, giving even greater range to the set, and increasing the selectivity without interfering with the perfect tonal properties associated with MH Supersonic outfits. It is applicable to any supersonic system, however. The Diagram is self-explanatory, and the circuit is strongly recommended, giving as it does a very high degree of efficiency, ease of control and simplicity of layout

KEY TO DIAGRAM NO 2

1.	Loop Aerial		
2.	Neutrodyne Condenser		2/10
3.	Aerial Tuning Condenser '0005 μF ..		10/6
4.	H.F. Tuning Condenser '0005 μF		10/6
5.	DIMIC COIL No. 1 ..		10/-
	Base and Clips ..		2/6
6.	MH Mica Condenser '0003		2/6
	Base and Clips ..		1/-
7.	Reactor (MH Reactor)	Combined Unit	2/-
8.	MH Autodyne unit 300-600 m.		
9.	Autodyne Tuning Condenser '0003 μF ..		8/6
10.	MH Grid Leak M Ω		2/6
	Base and Clips ..		1/-
11.	MH Supersonic Filter		21/-
	Succeeding stages as usual		

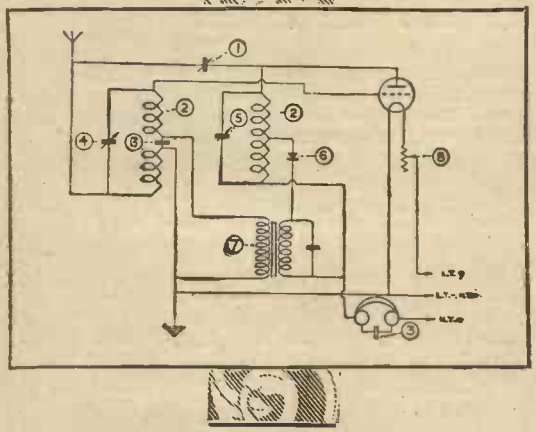


Diagram No. 3

THIS represents a one-valve reflex circuit, which follows the general lines of S.T.100, with the important modification that the reflex transformer is removed from the earth lead. Reaction is effected by means of the Neutrodyne Condenser (No. 1) and two Dimic Coils are used, advantage being taken of the special construction adopted (Patents pending), for obtaining a divided centre point on the aerial coil, this division of the coil being obtainable and automatically effected by the special base clips in any case where desired.

KEY TO DIAGRAM NO 3

1.	Neutrodyne Condenser	2/10
2.	DIMIC COILS No. 1	10/-
	Base and Clips ..	2/6
3.	MH Mica Fixed Condenser '001 μF ..	3/-
	Base and Clips ..	1/-
4.	Aerial Tuning Condenser '0005 μF	10/6
5.	Anode Tuning Condenser '0005 μF ..	10/6
6.	Crystal Detector ..	
7.	MH L.F. Transformer with MH Mica Condenser of '001 μF	21/- and 3/-
8.	MH Dual Rheostat ..	7/6

Relieve the Strain!

IS it fair to expect the remainder of the household to maintain an unnatural silence while one member enjoys the programmes? The use of headphones while imposing this restraint on the family also cramps the listener's movements and tethers him to his set.

Radio Press Envelope No. 7 contains all the necessary instructions to build "A Two-Valve Amplifier de Luxe" so complete and clear that the veriest novice cannot go wrong, provided he follows them exactly.

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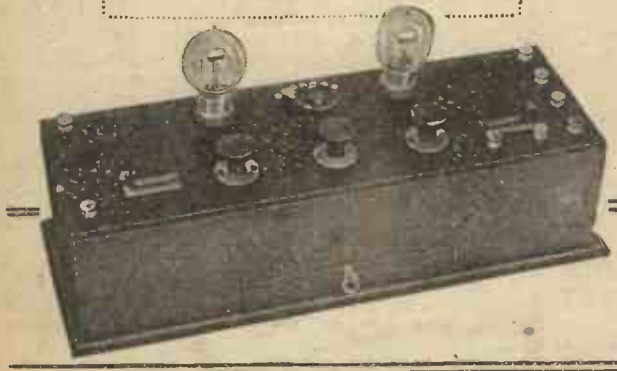

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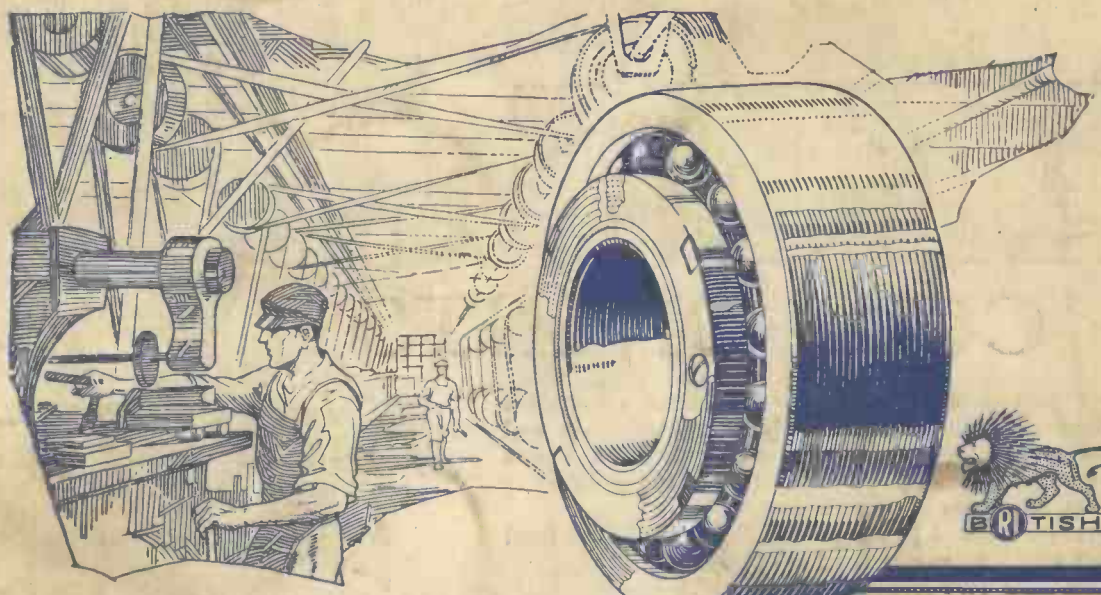

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