The Wireless World

A PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 684. FRIDAY, OCTOBER 7TH, 1932. VOL. XXXI. No. 14.

Editor:
HUGH S. POCOCK.

Proprietors: ILIFFE & SONS LTD.

Editorial Offices:
116-117, FLEET STREET, LONDON, E.C.4.
Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:
DORSET HOUSE, TUDOR STREET,
LONDON, E.C.4.
Telephone: City 2816 (15 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.
Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS.

EDITORIAL COMMENT.

To Our New Readers.

A Word of Welcome.

WITH this issue we hope to be able to extend our welcome to a much widened circle of readers, for this is a "New Readers'" Number which our publishers are taking special steps to bring to the notice of many who may not previously have been acquainted with *The Wireless World*. Summer time has ended and foreign stations can now be received more consistently and at even greater strength, so that the publication, week by week, of the Programmes from Abroad makes *The Wireless World* of special value to listeners. Whereas a year or so ago it was almost an art to receive foreign stations, to-day the majority of those whose programmes we publish week by week can be received, even on simple sets, at such strength and clarity that there is often little to choose between them and the local B.B.C. transmissions.

The special tuning chart supplement issued with this number enables the listener to prepare, in a simple and interesting way, an easy guide to tuning in any station at will.

We hope that all those who are "New Readers" to-day may from now on be regarded as "Regular Readers" interested week by week in all that *The Wireless World* provides for them.

Interference Crusade.

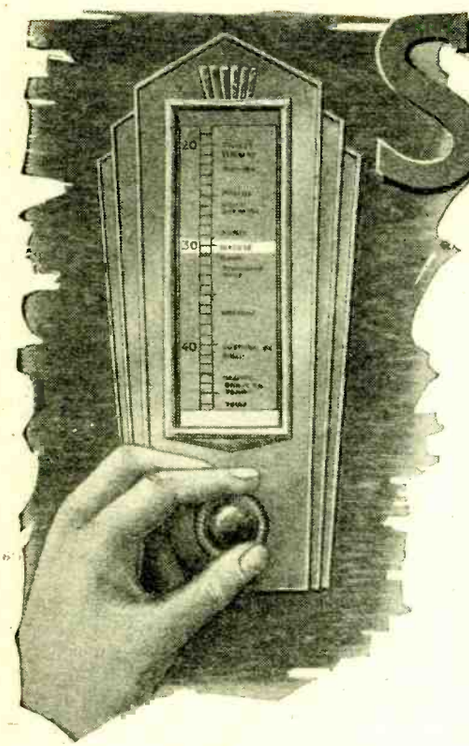
Response to Our Proposals.

IN this country, more perhaps than anywhere else, wireless reception is constantly being affected by interference from electrical apparatus in the neighbourhood of receivers, and these interruptions are particularly noticeable when listening to distant stations, when the volume control of the receiver is turned up so as to put the set in its most sensitive position. Nearly all this interference is capable of elimination, and it can mostly be traced to faulty switches, bad electric wiring, sparking at the commutators of electric motors, and many other avoidable causes of this nature.

The Post Office is ready and willing to co-operate with listeners in an endeavour to remedy this trouble, but the task is too big for the Post Office to be expected to deal with it throughout the country. It is for this reason that we put forward the suggestion in our issue of September 23rd that competent wireless amateurs should perform this work which *The Wireless World* would be willing to support and organise, the main purpose of this organisation being to identify and locate the various forms of interference and make suggestions as to the proper remedy when the source of interference had been run to earth. We suggested that readers interested in taking part in such an organisation should communicate with us. The response received so far is extremely gratifying and has served to decide us on taking action with a view to conducting a crusade for the elimination of unnecessary interference with wireless reception.

We shall have more to say on this question in future issues; in the meantime, we thank all those who have communicated with us and intimated their willingness to co-operate. The next step is for us to decide what is the best way of dealing with the matter, and our proposals will be published as early as possible. Meanwhile, any other readers interested in the scheme should communicate with *The Wireless World*, marking their envelopes "Interference Search."

www.americanradiohistory.com



Selectivity

Methods of Cutting Out Interference.

THE need for selectivity has never been greater than to-day, and unless almost unhoped-for results are achieved at the Madrid Conference on the wavelength situation, it will be even more urgent in the future. This has been widely recognised for some time past, and during the last few years many articles on the subject have appeared in the pages of this journal. The band-pass and tone-correction methods of obtaining high selectivity while retaining first-class quality of reproduction have been thoroughly dealt with, and the contribution of the superheterodyne towards the attainment of an improved performance has been fully discussed.

There are certain fundamental points about this question of selectivity, however, which are not generally appreciated, and they are points which affect chiefly those living within a short distance of modern twin-wave high-power broadcasting stations. Such listeners may be divided into three classes, those to whom local reception is alone of any importance, those with whom foreign reception ranks at least as highly as the local, and those who rely mainly upon the local for entertainment but require occasional programmes from Continental stations. Their requirements in the matter of selectivity are thus very different, and yet the reception of each is influenced by the same facts.

The main features of the selectivity problem are well known, and there is no need to stress the importance of employing efficient coils and as many tuned circuits as possible. The conflicting requirements of selectivity and quality are also generally appreciated, and it is unnecessary to enter into these matters here. It will have often been observed, however, that a modification to a receiver which cannot in the least affect the selectivity, such as the addition of an extra L.F. stage, results in an increase in interference. Similarly, another alteration may materially increase the selectivity, and yet give no greater freedom from jamming.

The truth of these apparently contradictory statements will become clear when it is realised that there is no definite relationship between the true selectivity and the apparent selectivity of a receiver. The true selectivity may be defined as the ratio of the voltage produced on the detector grid at resonance to that produced at some other frequency differing from resonance, for the same input voltage at both frequencies. The apparent selectivity is really the degree of freedom from interference, and it depends not only upon the true selectivity but also upon the field strength ratios of the wanted and unwanted stations, the amount of amplification incorporated in the receiver, and the volume level at which the loud speaker is worked.

THE problems of selectivity are of the greatest interest to all, and although the general principle of adding tuned circuits to reduce interference is well known, there are many other points which are not generally appreciated. The connection between real and apparent selectivity and the dependence of selectivity upon amplification, volume level and reaction are discussed in this article.

True Selectivity.

This will, perhaps, be most readily understood if we take a concrete case. Let us suppose that we are using a simple detector-L.F. set of the type shown in Fig. 1. Suppose, further, that we are using the set at such a distance from the London transmitters that each sets up the same signal voltage in our aerial. Now, if we tune to the London Regional on 843 kc. a certain voltage due to that station will be applied to the detector grid, and another voltage of smaller value due to the London National on 1,147 kc. will also be found at the detector. Both the absolute values of these voltages and their relative values will depend upon the distance from the transmitter and the efficiency of the receiver circuits. Let us assume, however, that we have 1 volt from the Regional transmitter and 0·1 volt from the National.

The true selectivity, therefore, between these two stations will be the ratio of these two voltages, or 10. Now if the receiver be fitted with a small power valve of the type giving a maximum output in the neighbourhood of 100 milliwatts, we may obtain this figure from the Regional transmitter, but the power fed to the loud speaker by the National programme will be 1/100 of this amount. The ratio of voltages on the grid of the output valve, of course, will still be 10-1, but the power output is proportional to the square of the voltage, hence the 100-1 ratio of power.

The maximum power obtained from the National programme, therefore, is only 1 milliwatt, and this is so small that it is probably inaudible. We may say, therefore, that for our purpose the selectivity is sufficient, since when the set is tuned

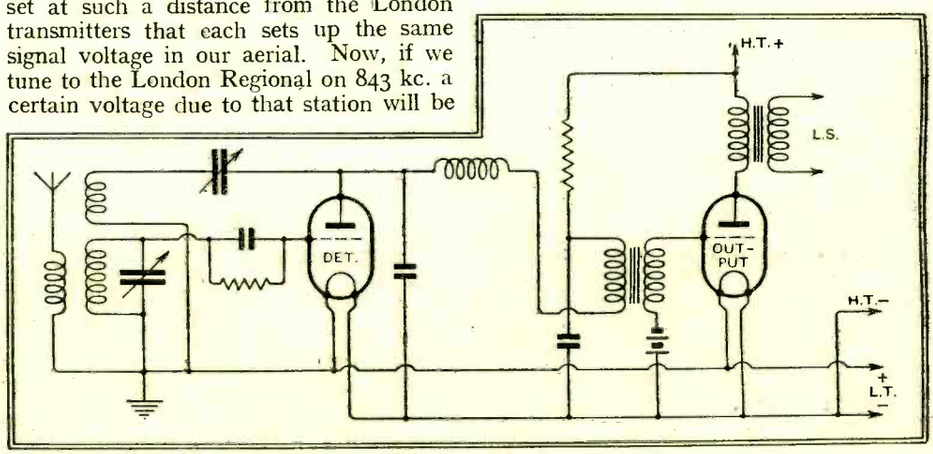


Fig. 1.—A popular type of two-valve local station receiver. The selectivity is low and may prove insufficient to separate completely two local stations.

www.americanradiohistory.com

Selectivity.—to the Regional transmitter, no interference is experienced from the National.

A maximum output of 100 milliwatts is quite small, however, so that the quality of reproduction will not be very good. If in an endeavour to get better quality, therefore, we alter the receiver to include a larger output valve capable of delivering 1,000 milliwatts to the speaker, and we work at this level on the desired station, we shall now obtain an output of 10 milliwatts from the National transmitter. The power ratio of the two programmes will still be the same at 100-1, but the change has raised the general level by ten times.

The true selectivity of the set therefore remains unaltered, but we shall now find interference from the National programme. By raising the general volume level, and without altering the relative intensities of the two signals, we have brought the weaker above the threshold of audibility. The output of 1 milliwatt from the unwanted station in the first case was too small for the ear to appreciate; the output of 10 milliwatts obtained with the increased volume level, however, is certainly within the range of audibility.

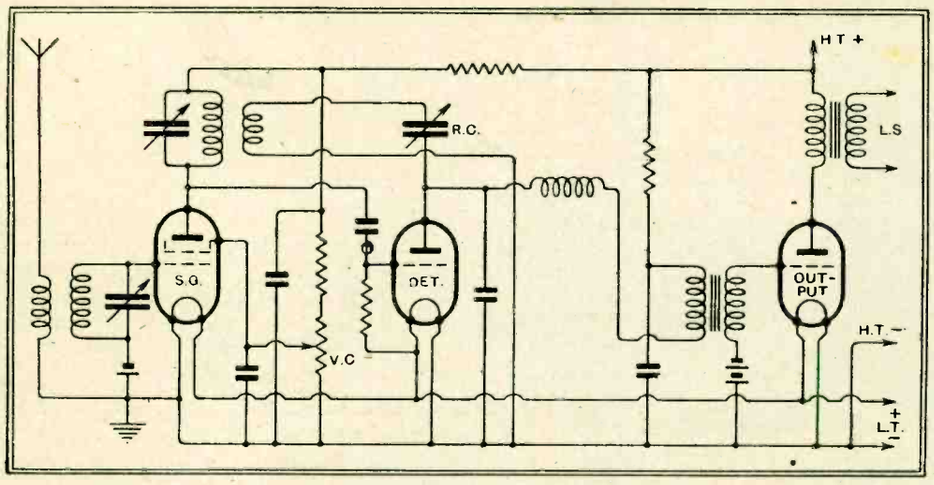


Fig. 2.—The three-valve set is an extremely popular type. As explained in the text, freedom from interference may often be secured by decreasing the volume control (V.C.) setting while increasing reaction (R.C.).

The Question of Reaction.

If we assume that an output of 1 milliwatt is the maximum which can be tolerated from an interfering station, then with the larger output valve it will be necessary to increase the selectivity by a little over three times in order to maintain the same apparent selectivity. It will be seen, therefore, that one cannot with impunity increase the amplification of a receiver, or the general volume level of reproduction, without proportionately increasing the selectivity. If both amplification and selectivity be increased together in the same degree, then the apparent selectivity remains unaltered.

The common practice of adding a screen-grid H.F. stage, as in Fig. 2, in order to obtain increased selectivity is not necessarily effective. The additional tuned circuit certainly increases the selectivity, but usually to a smaller degree than the additional valve augments the sensitivity, so that the net result is often a decrease in apparent selectivity. In practice, of course, there is usually some gain, for the full amplification of the extra valve is not always needed. The setting of the volume control is then reduced, and the apparent selectivity immediately increases.

The question of reaction is another point about which misconceptions so often arise. There is no doubt that it can increase the selectivity very considerably, as can be seen from Fig. 3, which shows the resonance curves of a circuit with different degrees of reaction. The effect of reaction may be considered as being an increase in the strength of the wanted station without any appreciable change in that of the unwanted.

If the unwanted station is already so strong that in the absence of reaction it gives an audible signal, then the application of reaction will do nothing to reduce it. The chief purpose of reaction, therefore, is to give an increase in sensitivity, for although it gives also an increase in true selectivity, it will do nothing of itself to reduce any interference.

By means of an artifice, however, it is possible to obtain increased apparent selectivity through its use. Suppose that we desire to receive a certain station, and that interference is found due to a station on a neighbouring frequency. If we first reduce the volume, say by means of an aerial input volume control, to such a degree that the interference can no longer be heard, we can then apply reaction to increase the sensitivity to the extent necessary to receive the desired station, and we shall find that the interference is still inaudible.

Since the amount of reaction which can be used is limited, this process cannot be carried very far, and it is only useful where the interference is of moderate strength. It is, nevertheless, a very useful property, and it will often be found that the apparent selectivity of any ordinary receiver may be considerably increased by reducing the setting of the volume control to a point at which the desired station is rather weak, and then bringing the strength up to normal again by the application of reaction.

This same process is really at the root of the oft-repeated advice to shorten the aerial when interference is found. A reduction in the size of an aerial does not of itself greatly affect the selectivity, provided that it is properly coupled to the receiver circuits. The chief result is a general weakening of the volume level, the consequence of which is that the interference falls below audibility, and the application of reaction then permits the desired station to be received at normal volume without interference.

Such methods are, of course, inefficient and limit the range of a set owing to the fact that signal strength cannot be increased indefinitely by means of reaction. Furthermore, unless tone correction be used, too much reaction introduces a very serious amount of distortion. It is therefore much better practice to obtain increased selectivity by the addition of an extra tuned circuit, for this involves only a moderate loss of sensitivity, and gives a very great increase in both true and apparent selectivity.

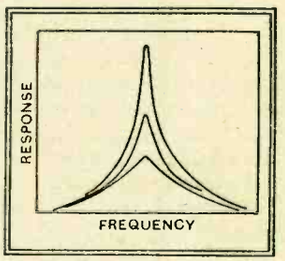


Fig. 3.—The effect of increasing reaction is seen to be an increase in the strength of the desired station, while a neighbouring unwanted station has its strength increased to a lesser extent, or not at all.

With a receiver of the type of Fig. 1, for instance, it is readily possible to add another tuned circuit, without a valve, and this will definitely act as an attentuator for frequencies other than that to which it is tuned. The actual interference level, therefore, is reduced.

"The Chronicle" Wireless Annual.

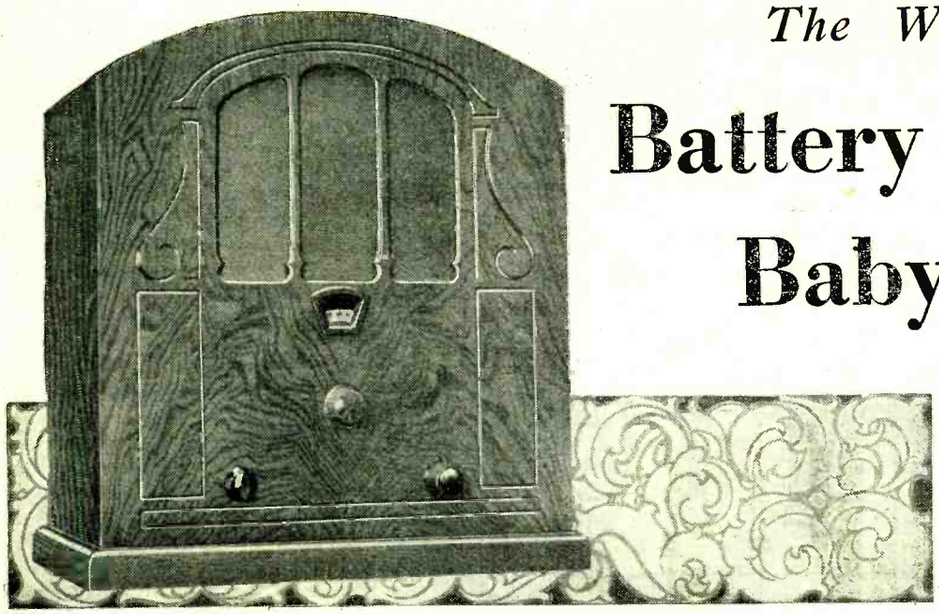
LISTENERS and home constructors will welcome the tenth edition of the very useful Annual issued by the *Manchester Evening Chronicle*, which fully maintains the high standard gained in past years.

For the beginner there is an article "From Mike to Loud Speaker," explaining, in popular language to non-technical listeners, the processes involved in broadcasting speech and music, and the advanced experimenter will find much valuable information in the more technical pages. Among the many interesting articles we would, perhaps, single out "Television Experiments," in which one of the pioneers among northern television enthusiasts describes, from practical experience, the method of constructing a televisor, and the useful hints on tone control and achieving ideal reception.

Many typical receivers, ranging from a simple crystal set to a five-valve superheterodyne, are described, and a sheet of wiring diagrams is included in the book. Listeners reaching out for foreign stations will find a useful short-wave list, as well as a map of the European stations.

The Annual, comprising 224 pages and abundant illustrations and diagrams, is published by Allied Newspapers, Ltd., Withy Grove, Manchester, and sold for the modest price of 1s.

www.americanradiohistory.com



The Wireless World

Battery Baby Superhet.

An Ultra-selective and Economical Four-valve Set.

By

W. T. COCKING.

READERS have not been slow to appreciate that the single-valve pentode frequency changer recently developed by "The Wireless World" is of even greater importance to the battery user than to the fortunate possessor of a lighting supply. Although the first receiver to embody this new development was designed for A.C. mains operation, numerous requests have been received for a battery model, and it is in this latter type that the full economy given by eliminating a valve is obtained.

THERE are few who will not admit that, on account of its power of combining high selectivity with first-class quality of reproduction, the superheterodyne is the ideal type of receiver. The large number of valves which has been necessary in the past, however, has rendered it anything but economical where electric light mains were not available for its operation.

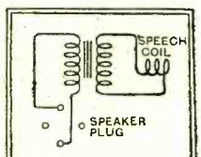
Recent developments have permitted the reduction of the total number of valves to only four, and careful attention to the details of design has made possible the production of a really economical receiver. A degree of sensitivity adequate for most normal requirements, with high selectivity and good quality of reproduction, can be obtained with a total anode current consumption of only some 10/13 mA. from a 100-volts battery.

In its essentials this new receiver is the same as the earlier A.C. model,[1] to the articles on which those interested in the underlying theory are referred, and the complete circuit diagram is shown in Fig. 1. It will be seen that the first valve is preceded by a two-stage inductively coupled band-pass filter, to the primary of which the aerial is coupled through the 0.0001 mfd. adjustable condenser C_6. A switch S_3 is included to permit the connection of a 50-ohms resistance R_7 (actually two 100-ohms resistances connected in parallel) between the aerial and earth terminals in order to prevent the first valve from being overloaded when listening to the local station.

A type Pen. 220A. valve is used for the non-radiating pentode frequency changer,[2] and it is biased negatively by 1.5 volts, the bias battery being shunted by the 0.1-mfd. condenser C_7. The first I.F. transformer is included in its anode circuit, and the tuned oscillator circuit is shunt-fed through the primary trimming condenser C_8. The condenser C_3, which tunes the oscillator, is of the shaped-plate type, so that the use of padding is obvi-

[1] *The Wireless World*, August 19th and September 2nd, 1932.

[2] *The Wireless World*, July 29th and August 5th, 1932.



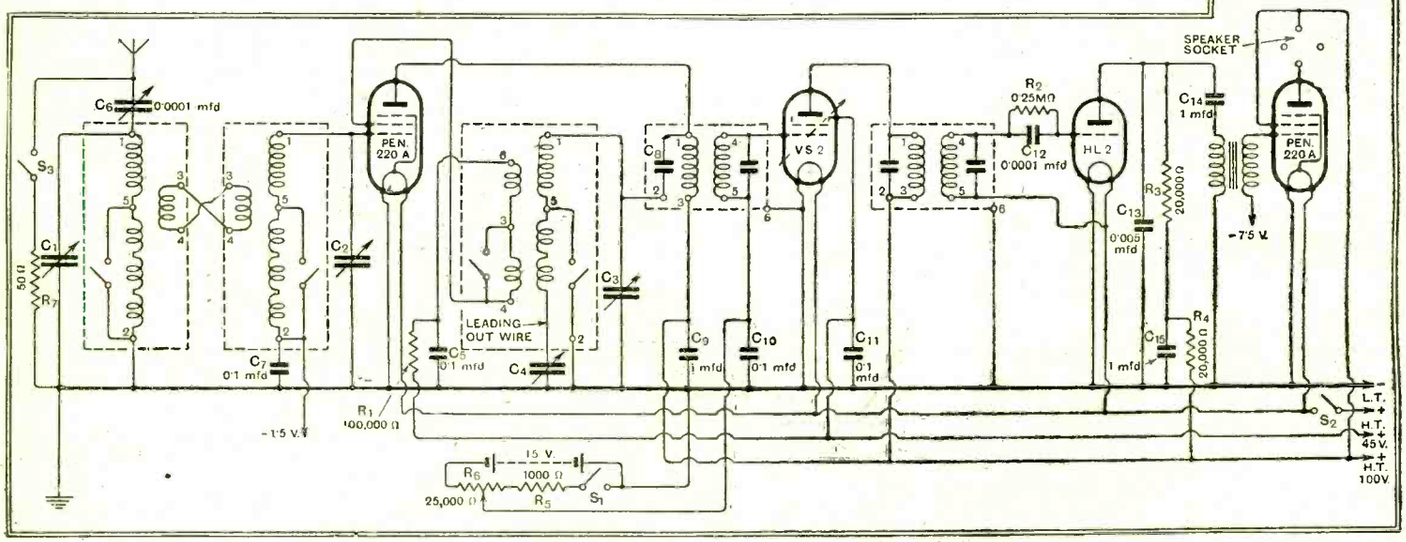


Fig. 1.—Complete circuit diagram. The switches S_1 and S_2 are ganged together and linked to the volume control. For local reception the local-distance switch S_3 is used to reduce the aerial input.

www.americanradiohistory.com

Battery Baby Superhet.—

ated on the medium waveband, while the necessary tracking condenser C_4 for the long waveband is introduced automatically by the waverange switching. The reaction coil is included in the screen circuit, which is fed through the 100,000-ohms resistance R_1 from the 45 volts tapping on the H.T. battery, while a 0.1-mfd. condenser C_5 provides an easy path to the filament for H.F. currents.

The V.S.2 variable-mu I.F. stage is fed from the secondary of the first I.F. transformer, tuned to 110 kc., and is coupled by another similar band-pass filter to the grid detector. The screen grid is fed from the 45 volts line, with a 0.1-mfd. condenser C_{11} shunted to earth, and the full 100 volts of the battery is applied to the anode.

Volume Control.

Volume control is obtained through the adjustment of the bias voltage on this valve, and a 25,000 ohms potentiometer R_6 in series with a 1,000 ohms resistance R_7 is connected across the 15 volts bias battery. The purpose of the resistance R_5 is to provide a fixed minimum bias voltage of about 0.6 volt negative, and so to prevent any flow of grid current. A switch S_1 is included in this circuit, and is ganged to the L.T. switch S_2, so that the bias battery does not discharge through the potentiometer when the set is not in use; both switches are ganged to the volume control, and are operated when this is turned fully in an anti-clockwise direction. The 0.1-mfd. condenser C_{10} gives a low-impedance path to I.F. currents in the I.F. valve grid circuit.

The H.L.2 detector is provided with the usual values for the grid leak R_2 and condenser C_{12} of 0.25 meg. and 0.0001 mfd. respectively, and in the anode circuit a 0.005-mfd. condenser C_{13} gives a low impedance load to currents of the intermediate frequency. The intervalve coupling is by means of a 5:1 ratio resistance-fed transformer, with a value of 20,000 ohms for the resistance R_3 and 1 mfd. for the condenser C_{14}; decoupling is obtained through the 20,000-ohms resistance R_4 and another 1-mfd. condenser C_{15}.

The Pen. 220A. output valve has its screen fed directly from the 100 volts line, and the primary of the transformer fitted to the permanent-magnet type moving-coil loud speaker is connected in its anode circuit. The grid is biased negatively to the extent of 7.5 volts.

Since the chassis can be obtained ready drilled, the construction presents no particular difficulty. The coils are supplied ready mounted on an aluminium bracket and are fitted beneath the baseboard. Wherever an earth connection is made to this bracket, care should be taken to see that the cellulose finish is scraped off in order to avoid any risk of a bad connection. The valve-holder of the frequency changer is inaccessible after the volume control has been mounted, so that it should be completely wired before this latter component is placed in position.

When wiring, care should be taken to see that the filament leads are run to the correct valve-holder legs in case metallised valves are used, for the metallising must always be joined to the negative side of the filament. It should be noted, also, that it is intended that the pentodes have five-pin bases with the centre pin for the screen connection; if pentodes with a side terminal for the screen are obtained, it will be necessary to provide a *short* lead to this from the centre socket of the appropriate holders.

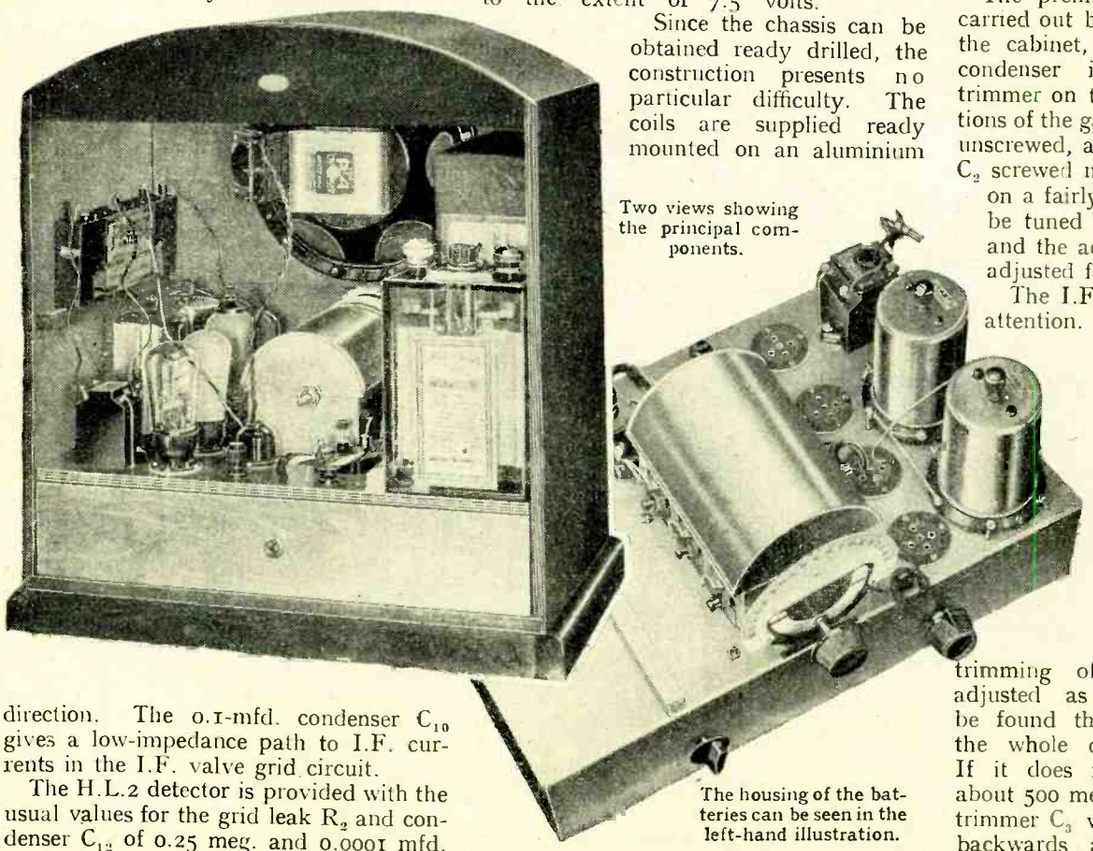
FEATURES.

General.—*Four-valve self-contained superheterodyne for battery operation. Ganged tuning with band-pass pre-selector. Four I.F. tuned circuits with automatic tone correction for sideband cutting.*

Circuit. — *Self-neutralised single-valve pentode frequency changer, with variable-mu I.F. amplifier, grid detector and pentode output to permanent-magnet moving-coil loud speaker.*

Controls.—*(1) Tuning control. (2) Combined volume control and on-off switch. (3) Wavechange switch. (4) Local-distance switch.*

Batteries.—*L.T. 2 volts, 0.7 amp. H.T. 100 volts, 10/13mA. G.B. 15 volts, 0.576mA.*



Two views showing the principal components.

The housing of the batteries can be seen in the left-hand illustration.

Preliminary Adjustments.

The bias battery is held in clips on the side of the cabinet, and short flexible leads are brought out to it from the various points on the chassis. There is comfortable room for the specified H.T. battery and L.T. accumulator to stand on the chassis, but if different types be used care should be taken to see that they will fit into the space available. Small strips of wood fastened to the chassis will serve to hold them in position. As the "local-distance" switch is mounted at the back of the set, it is necessary to cut a large-diameter hole in the cabinet back through which it can be operated.

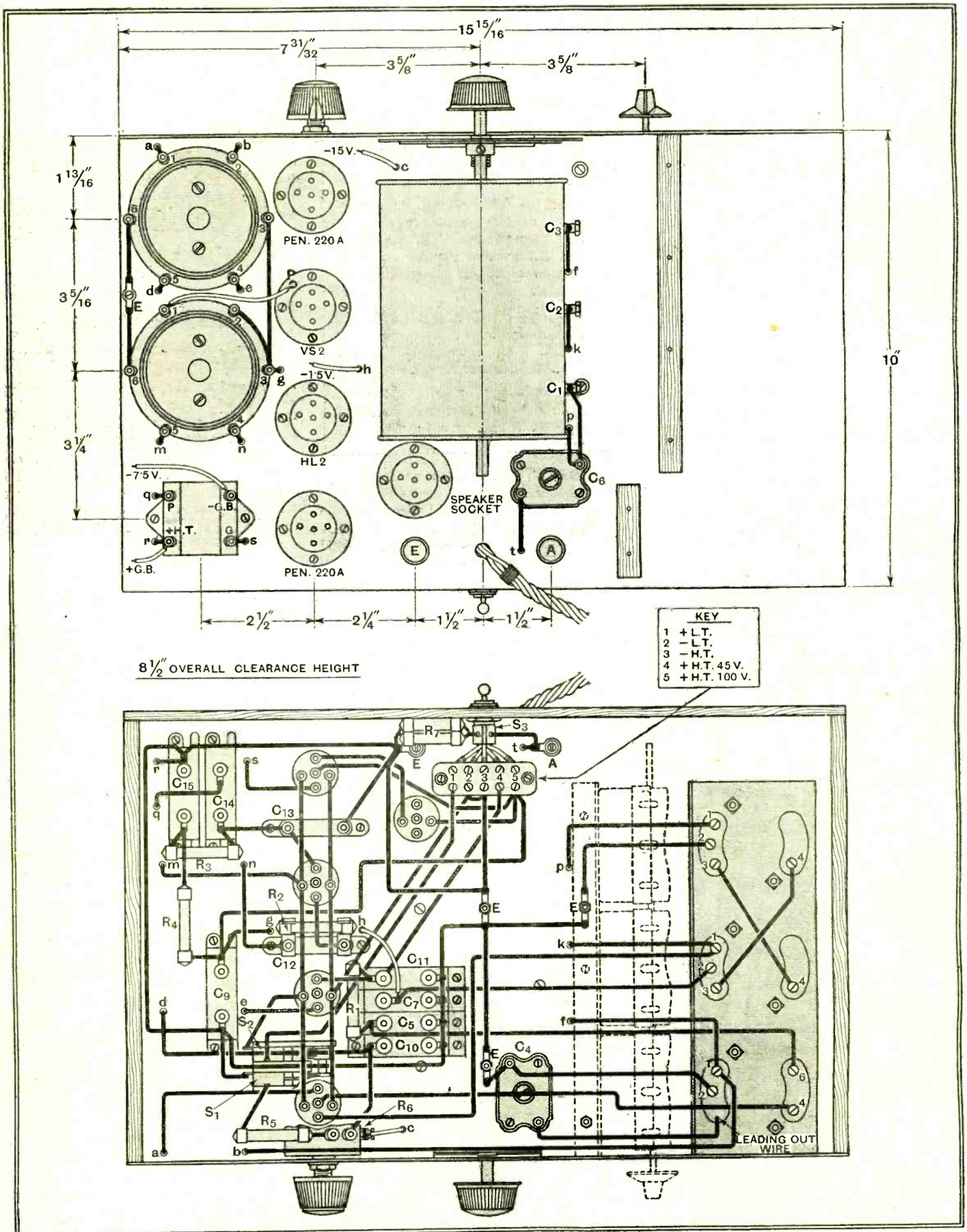
The preliminary adjustments must be carried out before the chassis is placed in the cabinet, for the long-wave tracking condenser is then inaccessible. The trimmer on the first C_1 and third C_3 sections of the gang condenser should be fully unscrewed, and that on the second section C_2 screwed nearly fully home. A station on a fairly low wavelength should then be tuned in, and the trimmer on C_2 and the aerial series condenser C_6 each adjusted for maximum signal strength.

The I.F. circuits should next receive attention. The coupling knobs must be turned in a clockwise direction until signals weaken perceptibly, and then each of the four trimmers adjusted for optimum strength. The next step is to adjust the coupling in each transformer for the greatest signal strength.

An attempt should now be made to tune in a station within the first 20 degrees or so of the dial, and the trimming of the gang condenser re-adjusted as before. It should now be found that the ganging holds over the whole of the medium waveband. If it does not, tune in a station on about 500 metres and adjust the oscillator trimmer C_3 while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings be found. Then tune in the low wavelength station again, and readjust C_2 and C_6.

www.americanradiohistory.com

WIRING AND LAYOUT OF THE NEW SUPERHET.



The receiver is self-contained, and the batteries are held in place by the battens shown on the right of the plan.

www.americanradiohistory.com

Battery Baby Superhet.—

If it be found impossible to maintain correct ganging, the most probable cause is that the I.F. circuits are set to the wrong intermediate frequency, and this may be checked by noting upon which station second-channel interference occurs. In the case of London listeners a whistle will usually be found on the upper edge of the North Regional, and this indicates that all is in order. Should the whistle occur on Brussels, however, the intermediate frequency is too high, and each I.F. trimmer must be screwed up a little more. After any adjustment of this nature, of course, the set must be reganged.

On the long waveband it is merely necessary to tune in a high-wavelength station, such as Huizen or Radio-Paris, and to adjust the tracking condenser C_1 while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings be found.

Tone Correction.

To a large extent the quality of reproduction and the adjacent channel selectivity are controlled by the precise settings of the I.F. transformer couplings. It is not necessary that they be adjusted to give any marked band-pass effect, for the output pentode, in conjunction with the specified loud speaker, gives a marked degree of automatic tone correction for side-band cutting. It will often be sufficient, therefore, merely to adjust the I.F. couplings for optimum signal strength.

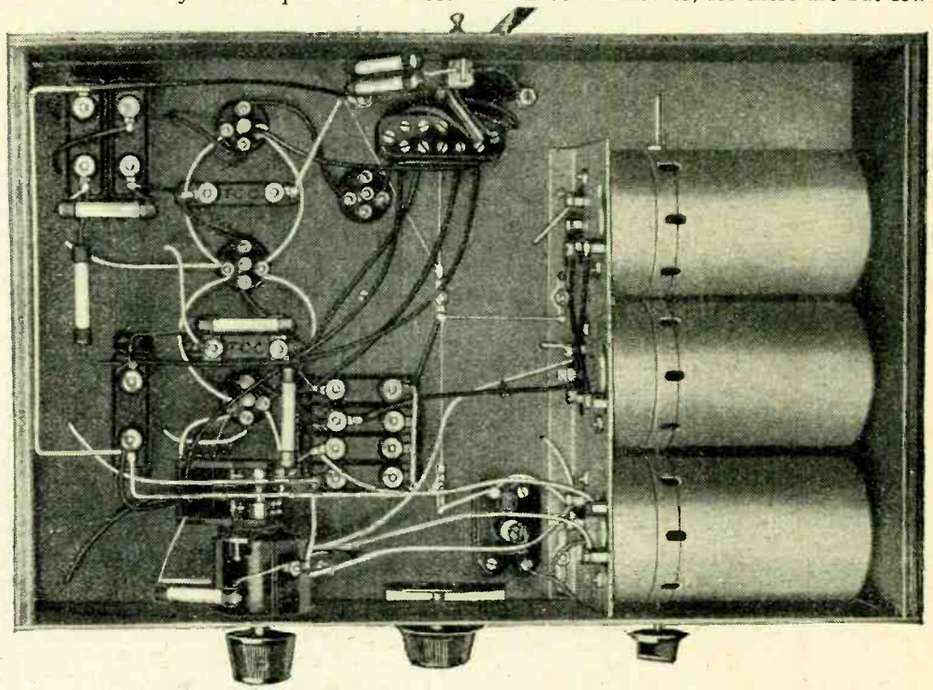
When tested the receiver gave a very good account of itself. Langenberg and Brussels were available at good programme strength in daylight, and after dark literally dozens of stations could be tuned in. The selectivity is such as to remove completely the swamping effect of the local, and it proved possible to receive Radio LL without interference from the London Regional within quite a short distance of the latter. On the long waveband it is barely possible to receive Königswusterhausen while both Radio-Paris and Daventry National are working, but it is available when one of its neighbours has closed down. Whistles are marked by their absence, except at the usual two points corresponding to second-channel interference on the two local stations.

The sensitivity is adequate for most normal purposes, and, considering the small amount of power supplied by the H.T. battery, the quality of reproduction reaches a surprisingly high standard. This is due largely to the choice of a large type of battery pentode, run for economy with a low anode voltage, in preference to a type rated to take a smaller current at a higher voltage. The maximum undistorted volume obtainable depends upon the H.T. battery voltage, and, although it may be increased considerably by employing up to 150 volts, the normal 100 volts will be found generally satisfactory. If a higher voltage be used, of course, the current consumption will increase, and it will be necessary to increase the grid bias on the output valve. In all cases, however, the screen voltage should be maintained at about 45 volts.

It is advised that the specified components be adhered to, for there are but few alternatives which can be recommended. Different valves in particular should not be employed, except perhaps in the case of the I.F. stage and the second detector, where any types of similar characteristics will give a satisfactory performance. Although the usual rules apply to the choice of the output valve, the position is complicated by the necessity for obtaining tone correction, and the use of a pentode must be considered essential.

More latitude is permissible with regard to the loud speaker, although the model specified was selected as combining high sensitivity with the desired response curve when used with the Pen. 220A. output valve. If a different type be employed the quality of reproduction may be altered to maintain the correct overall balance by the adjustment of the I.F. circuits, as already explained. It is highly important, however, that the speaker be of a sensitive type, for the maximum volume which is obtainable depends upon this quite as much as upon the output valve. A large output valve with an inefficient speaker may be no better than a small valve with an efficient speaker.

This receiver is available for inspection at the Editorial Offices, 116-117, Fleet St., London, E.C.4.



Underside view of the chassis showing coil assembly and recoupling components.

For the convenience of readers constructing this set, blue prints are available from the publishers at 1s. 6d. post free.

LIST OF PARTS REQUIRED.

After the particular make of component used in the original model, suitable alternative products are given in some instances.

1 Set of Coils, ganged, for under baseboard mounting **(Colvern Type K.B.L.C., with 1 Type K.53)**

2 I.F. Transformers, 110 kc. **(Wearite Type W.W.I.F.)** Colvern.

5 5-pin valve holders **(Clix chassis mounting type)** Eddystone, W.B.

1 3-gang screened superhet condenser, 0.0005 mfd. and dial **(Utility W.316/3)** Polar.

1 Semi-fixed condenser, 0.00001/0.0001 mfd. **(R.I. "Varicap" No. 2)**

1 Semi-fixed condenser, 0.0005/0.002 mfd. **(R.I. "Varicap" No. 8)** Formo, Goltone.

4 Fixed condensers, 0.1 mfd **(T.C.C. Type 50)**

3 Fixed condensers, 1 mfd. **(T.C.C. Type 50)**

1 Fixed condenser, 0.0001 mfd. **(T.C.C. Type 34)**

1 Fixed condenser, 0.005 mfd. **(T.C.C. Type 34)** Dubilier, Ferranti, Formo, Graham Farish, Lenk, Savage, Telsen.

1 Metallised resistance, 1,000 ohms, 1 watt **(Dubilier)**

2 Metallised resistances, 20,000 ohms, 1 watt **(Dubilier)**

2 Metallised resistances, 100 ohms, 1 watt **(Dubilier)**

1 Metallised resistance, 250,000 ohms, 1 watt **(Dubilier)**

1 Metallised resistance, 100,000 ohms, 1 watt **(Dubilier)** Claude Lyons.

1 5-way insulated connector **(Wilburn)**

1 Wire-wound volume control potentiometer, 25,000 ohms, with mains switch **(Wearite Type Q.V.C. and G.42)**

1 L.F. Transformer, 5:1 **(Varley "Niclet" D.P.22)**

2 Ebonite shrouded terminals **(Belling-Lee Type "B")** Clix, Eelex, Goltone, Igranic.

1 5-pin plug **(Bulgin P.3)**

1 Toggle Q.M.B. Switch **(British Radiophone No. 407)** Bulgin, Igranic, Claude Lyons.

1 5-way battery cable, with plugs and spade ends **(Concord)** Belling-Lee, Bulgin, Goltone, Harbros, Lewcos.

1 pair G.B. battery clips **(Bulgin No. 4)** Burton.

4 Wander plugs, G.B.+, G.B.–1, G.B.–2, G.B.–3 **(Clix Type "B")** Belling-Lee, Eelex, Goltone, Gripso, Lisenin.

H.T. battery, 100 volts **(Pertrix No. 298)**

G.B. battery, 15 volts. **(Pertrix No. 262)**

L.T. accumulator, 2 volts **(Pertrix PXG.2)**

Permanent-magnet speaker, with pentode transformer **(R. & A. "Challenger")** Magnavox, Rola.

Cabinet **(Camco "Empire")**

1 Plymax base, 15-15/16in. by 10in. by ⅜in.; 2 pieces ⅜in. plywood, 9-11/16in. by 3in.; 1 piece ¼in. plywood, 15-15/16in. by 3in.; 1 piece 16-gauge aluminium, 15-15/16in. by 3⅜in. **(Peto-Scott)**

Wood, screws, 2 ozs. No. 20 tinned copper wire, systoflex, etc.

Valves: 2 Mazda Pen. 220A., with 5-pin bases; **1 Marconi HL2; 1 Marconi VS2.**

www.americanradiohistory.com

UNBIASED

By FREE GRID.

Szczebrzeszyn.

MY little note concerning the atrocious mis-pronunciation of the names of European towns, more especially those of Portugal, by the B.B.C. mangling department, has brought me in a host of letters. One in particular comes from Senhor Joao Pereira, of Pomarão, a delightful little village on the river Guadiana, where I once spent a very happy week. He thanks me warmly for my efforts on behalf of his long-suffering countrymen, and gives it as his opinion that the B.B.C. announcers probably learnt their Portuguese in Brazil, that great Portuguese-speaking republic of South America, where, to quote my correspondent's own words, "the local lingo bears much the same resemblance to that of Portugal as does the Chicago dialect to decent English."

"Oh, to be in Szczebrzeszyn!"

I think, however, that the most charming letter I have received is one which has come from Poland. An inhabitant of that fair country writes to support my campaign to make the B.B.C. pronounce foreign names correctly, or, alternatively, to give up their superior airs in pretending that they are equally at home in all languages, instead of frankly admitting when they are stumped and getting as near to the pronunciation of a town in English, as any sensible person would. "I feel a personal interest in this matter," he writes, "as only the other day the B.B.C. announcer who was reading the News Bulletin made a most terrible blunder in pronouncing the name of Szczebrzeszyn, which is my home town."

Now I must confess that when I first received this letter I myself was a little taken aback, as I failed to remember having met with it in my school days, but on turning up a map of Poland there it was as large as life in Latitude 50.42N., Longitude 22.58E. "Oh to be in Szczebrzeszyn now that Autumn's there," as Browning said in one of his inspired moments.

North or South?

I SEE that a worthy inhabitant of Brum has been lamenting in his local Press that a city of such importance does not have a radio show of its own. I presume that the reason is that Birmingham is roughly half-way between Manchester and London, and so the worthy citizens have really the choice of two exhibitions.

What I want to know, however, is this: Do Brumsters consider themselves Northerners or Southerners for radio exhibition purposes?

Your Chance.

THE infinite variety of excuses put forward by pirates when dragged before the beak for having no wireless licence pays great tribute to their ingenuity, which, if devoted to some more worthy object, might have made for them a fortune.

The latest of these which has been put forward by an inhabitant of the North of England seems to be in a class by itself, the offender giving as his reason for not taking out a licence the fact that the B.B.C. were themselves breaking the law by broadcasting programmes on the Sabbath.

If this dragging up of ancient unrepealed laws as excuses for offences is allowed to go on unchecked, goodness knows where it will all end. I offer absolutely gratis to pirates the information that, according to a law still on the Statute Book, it is illegal to eat meat on a Wednesday (this is not a misprint for Friday). It is, therefore, only necessary for the would-be pirate to spy on the Post Office officials, and catch one of them in the act of consuming a juicy steak on Wednesday, and he has a ready-made excuse for not taking out his licence, which will be at least as logical as the one to which I have already referred.

A fat, juicy steak.

A Word About Manchester.

I STAYED in Paris for a couple of weeks' well-earned rest after doing the Wireless Show there, but nevertheless contrived to write my weekly notes from the comfort of a café in the Place Pigalle. From Paris I proceeded direct to Manchester. At the risk of giving offence I cannot help putting on record the fact that my former suspicions that the City of Manchester still lags somewhat behind Paris in the matter of gaiety (more especially on Sundays) were confirmed. It is not with the

Lags somewhat behind Paris.

two cities themselves that I am really concerned, however, but with the respective radio exhibitions which they stage year by year, and I have no hesitation in saying that Manchester knocks spots off Paris not only in the technical excellence of the stuff it exhibits but also in the method of exhibiting it.

There is one great blot on the Manchester Exhibition, however, which I feel bound to mention, as it is apt to detract from the merits of the Show itself. My moan concerns itself with the thoroughly disreputable-looking building in which the Show is held. A couple of years ago I referred to this building in exactly similar terms, but foolishly allowed myself to be persuaded by the soft-hearted Editor into changing the phrase "disreputable-looking" into "uninviting-looking," as any reader who cares to turn up the issue of *The Wireless World* for October 1st, 1930, can himself verify. Evidently the Editor, in his kindness of heart, feared to offend the tender susceptibilities of the Northerners, who are apt to be very touchy about these matters.

I am told that other great exhibitions are held in the same building, and what is good enough for them is good enough for the Radio Show. I feel sure, however, that such an insult will not be permitted to pass unchallenged either by our radio manufacturers or by the great radio public, as it lowers radio to the level of canned fruit and similar exhibitions. In the first place, the present venue of the exhibition is far too small, although it may have been large enough eight years ago, when the first one was held there. What I chiefly object to is the entire lack of suitable accommodation for the needs of the inner man. I actually had to wait in a queue some considerable time before I could get to the feeding troughs.

I can scarcely believe that there is not a larger or more suitable building in such a great and important city as Manchester, but if, indeed, there is not, surely it is up to the radio exhibition organisers to put up a suitable building themselves and hire it out during the remainder of the year to other trades with less initiative and energy.

It would only be emphasising the obvious to say that the Manchester Show was bigger and brighter than ever, and I will, therefore, refrain from saying it.

www.americanradiohistory.com

News of the Week.

Current Events in Brief Review.

Show Fever.

THE season of wireless shows inaugurated by Radiolympia has enjoyed a halcyon period this year. The Manchester, Belfast and Glasgow Shows have been running concurrently; those at Dublin and Bristol preceded them; that at Edinburgh will follow.

At each the tale is the same: greater enthusiasm and bigger turnover than ever before with a general expectation that this is to be a real wireless winter.

Cross-Channel Envy.

FRENCH radio journalists, having read in *The Wireless World* of the new plate at the B.B.C. headquarters commemorating the recent visit of Their Majesties, lament the fact that no President of the Republic ever "inaugurated a new station, a new transmitter, or even a new aerial."

Radio is nobody's child in France. Even ex-President Doumergue — "the first amateur in France"—never watched a station function. As our Paris correspondent remarks, "Republics envy the British in their possession of a Royal House that identifies itself with the peoples' interests."

Paris Transmitter Suppressed

ON pain of death Radio-L.L., Paris, has been ordered by the Post Office to suspend its short-wave transmissions; in other words, failure to comply with the order would mean that the station would be forbidden to continue its medium wave transmissions on 370 metres.

Interviewing a representative of *The Wireless World*, M. Regissaert, the manager of the station, stated that it was totally beyond his prophetic capabilities to suggest when the officials would permit Radio-L.L. to resume its short-wave transmissions.

"Developments in French broadcasting occur only after intervals resembling glacial periods," says our Paris correspondent, "so there is no knowing when a new era for Radio-L.L. will arrive."

The League Calls.

EVERY Sunday night, Radio Nations, the League of Nations station at Prangins, is transmitting messages in three languages —English, French and Spanish—on a wavelength of 40.3 and 20.64 metres. The English broadcast is from 10 to 10.15 p.m., the French from 10.15 to 10.30, and the Spanish from 10.30 to 10.45 (Greenwich Mean Time).

And What of Leipzig?

THE breakage of the valuable 150-kilowatt porcelain-enclosed valves while on the way to Leipzig is said to be responsible for the delay in opening Germany's highest power broadcasting station. We are assured that the giant station will be working before the end of October.

Beograd, Please.

YUGOSLAVIANS are just as sensitive as the denizens of Daventry. They are requesting all European programme papers to print Beograd instead of Belgrade as the former is the actual native name of the town which houses *Radio Belgrade*. The announcers pronounce it "Be-o-grad."

Daring Decision.

RADIO Ljubljana, the Yugoslavian station with the mechanical cuckoo interval call, has decided to answer all letters received from listeners, no matter what language.

German Broadcasting Chaos.

THE German broadcasting companies have ceased to pay dividends, having become purely public utility companies, yet the state of affairs is by no means clear cut. According to our Berlin correspondent, the Radio Rundfunk Gesellschaft is now the central authority and will receive 43 per cent. of the listeners' licence fee.

Despite this centralisation, however, there is still much doubt regarding the general lines of programme policy, and unless the reorganisation is rapidly proceeded with, deterioration is bound to set in.

"The New Tuning Coils."

WIDESPREAD interest has been created in the new Ferrocart coils, first described in *The Wireless World* of September 16th. Our issue next week will contain the second part of the article "The New Tuning Coils," containing particulars of measurements confirming the extraordinary efficiency attainable by these diminutive iron-cored coils.

"We Are Seven."

THE Belgian Government has decided to limit the number of private radio transmitters to seven.

The Blind Listener.

WIRELESS is such an obvious boon to the blind that it could not possibly be overlooked by the National Institute for the Blind in their 63rd annual report. During the past year the Institute has been organising discussion groups, publishing Braille versions of B.B.C. pamphlets and issuing the "Braille Radio Times," the circulation of which is increasing.

It is reported that 20,720 sets have already been supplied by the British "Wireless for the Blind" fund.

The late Mr. Barclay.

WITH deep regret we have to record the death, on September 21st, of our valued contributor, Mr. W. A. Barclay, M.A., whose work for *The Wireless World* and our sister journal, *The Wireless Engineer*, won for him increasing appreciation from amateurs and experts alike. He excelled in devising simple computative methods and short cuts to the solution of intricate radio and electrical problems.

The late Mr. Barclay, who was only thirty-six years of age, suffered indifferent health following war service. He bore the tedium of a long illness with courage and good humour.

A TRIBUTE TO THE POST OFFICE. A Coventry radio trader is using the ordinary P.O. telephone service to demonstrate radio-gramophones and new records to his customers. The idea "works," so why bring up the question of telephone frequency response?

Radio Eavesdropping.

PRESS statements imputing that the Post Office wireless telephony service is not secret must mean that those who make them did not read *The Wireless World* of June 15th, 1927, in which the principle of inverted sidebands as used by the G.P.O. was fully outlined. As the Post Office explains, it not infrequently happens that engineering tests and service communications are transmitted in the form of plain speech, but privacy apparatus is brought into use for conversations between telephone subscribers.

A Post Office statement runs: "It is well known by experimenters that wireless speech can be heard at great distances when conditions are favourable, but it should not be overlooked that there are a number of physical factors which, independently of the use of special secrecy devices, largely restrict the possibility of either casual overhearing or deliberate eavesdropping."

Most listeners are, of course, aware of the clause on their licence forbidding them to divulge or make any use whatsoever of any message not intended for the station.

Radio Conventionette.

A GREAT "get-together" and "rag chew" among Northern radio amateurs, will form a fitting sequel to the Manchester Radio Show which closes to-morrow. The members of the Radio Society of Great Britain, District N.R.1, comprising the counties of Cheshire, Lancashire, Cumberland and Westmorland, are holding their annual Conventionette in Liverpool to-morrow and the day following (October 8th and 9th). The arrangements are as follows:

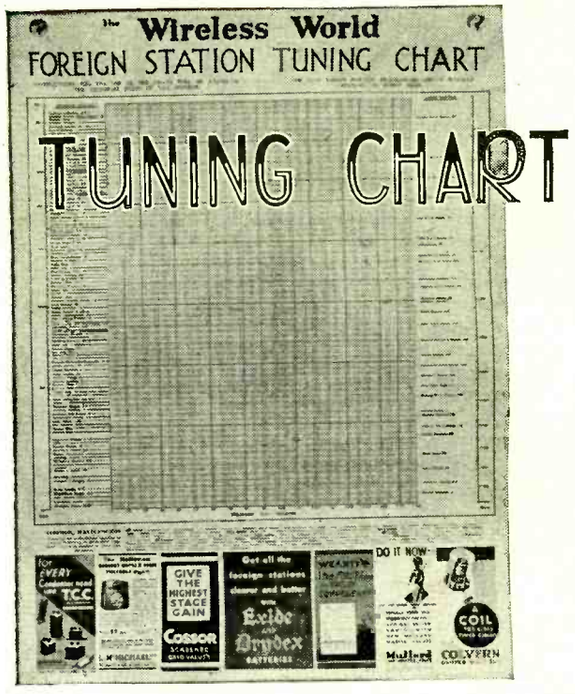
Saturday, 8th, 8 p.m. ..		"Get-together."
Sunday, 9th,	11.45 a.m.	Assemble.
	12 noon ..	Business meeting.
	1.15 p.m.	Lunch.
	2.30 p.m.	Visit to Liner.

The Conventionette is being held at the Angel Hotel, Dale Street. Tickets which cover lunch are obtainable, price 4s. 6d., from I. A. Auchterlonie, G6oM, 14, Chapel Street, Liverpool.

www.americanradiohistory.com

How to use the FOREIGN STATION TUNING CHART

Instructions for Filling In the Curves.



WITH the aid of the tuning chart which accompanies this issue it is possible to make a permanent record of the station calibration of any individual receiver. The chart is intended for use with sets equipped with tuning dials graduated in degrees, and is equally applicable to 100-division dials.

It will be seen that the receiver dial readings are marked along the bottom of the chart, while the positions of medium-wave stations are indicated up the left-hand side and long-wave stations down the right-hand side of the squared paper. The connecting link between stations and dial settings is a curve drawn more or less diagonally across the sheet.

There will be two curves, one for medium waves running from the bottom left to the top right-hand corner of the sheet, and the other for long waves from top left to bottom right. To avoid any possibility of confusion between the two curves the long-wave stations have been arranged vertically in descending order of wavelength so that the long-wave curve crosses the medium-wave curve instead of running parallel with it, and there is consequently no danger of the two curves being superimposed as might otherwise happen. Further, the long-wave stations are printed in red, and it is recommended that the final long-wave calibration curve be drawn in red ink so that it will automatically be associated with the stations on the right-hand side of the chart.

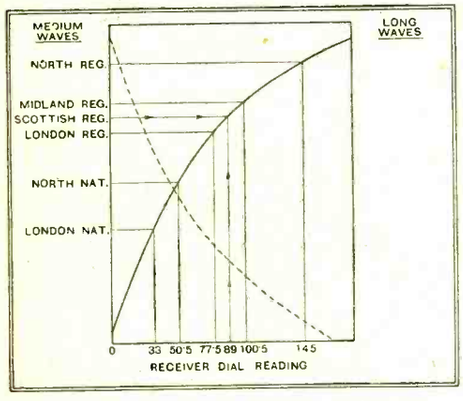


Fig. 1.—Showing the development of the medium-wave curve from the dial readings of known stations. The approximate position of the long-wave curve is indicated by the dotted line.

The positions of the calibration curves are determined by the points where the horizontal lines corresponding to stations intersect the vertical lines representing their dial settings. To begin with, four or five stations of whose identity there can be no question are tuned in accurately and their dial readings noted. The B.B.C. high-powered stations cannot be bettered for this purpose, and Fig. 1 shows how the preliminary points on the curve should be plotted from the following readings taken from an actual receiver:—

Station.	Dial Reading.
North Regional	145
Midland Regional	100½
Scottish Regional	89
London Regional	77½
North National	50½
London National	33

It is, of course, unnecessary to draw in the vertical and horizontal lines shown in Fig. 1, and these are only included to show the method of determining the positions of the key points.

The preliminary curve should be drawn in pencil, and may be extended at each end to give a rough guide to the settings of other stations. As new stations are identified their calibration points will be entered at intermediate positions on the curve, and when a sufficient number have been found the final medium-wave curve should be drawn thinly but firmly in black ink. The treatment of the long-wave calibration follows on similar lines, but in this case the final curve should be drawn in red ink.

It is obvious that the tuning chart can be used not only for tuning the set to any desired programme (assuming, of course, that the range of the set is adequate), but also as a means of identifying stations which have not hitherto been recorded. Referring to Fig. 2, supposing we wish to listen to an important transmission from Rome. Following the horizontal line from Rome until it strikes the black ink curve, we then turn vertically downwards to find that the dial setting for that station is 123 degrees. Alternatively, suppose we discover an unknown station on long waves at 60 degrees on the dial;

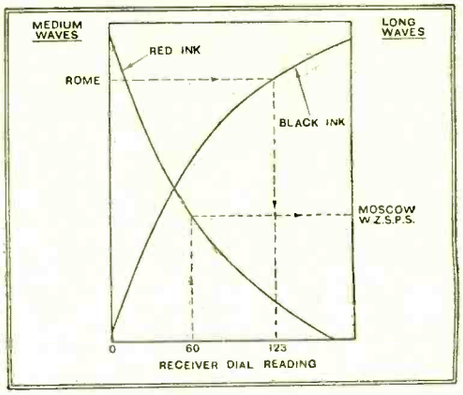


Fig. 2.—Illustrating the use of the curves for setting the receiver to a given station and identifying an unknown transmission.

by projecting upwards to the curve we find that the station corresponding to the point of intersection of the dial is Moscow (W.Z.S.P.S.), transmitting on a power of 100 kilowatts.

There can be no doubt that a calibration curve of this type is capable of a much higher degree of accuracy than the printed wavelength scales fitted to the majority of commercial receivers to-day, for it takes into account all those slight deviations from standard which introduce an element of doubt when trying to identify adjacent stations on standardised receivers.

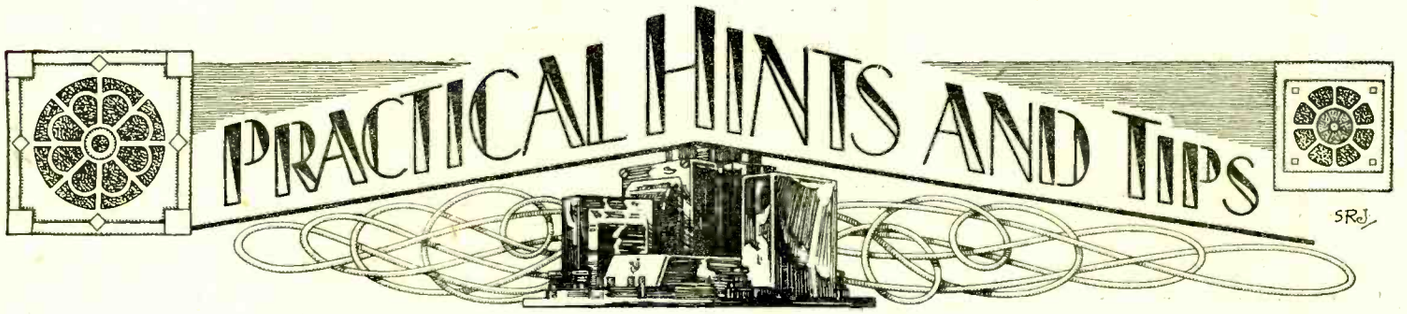
THE FULL WEEK'S FOREIGN PROGRAMMES

from all the principal foreign stations are included in every number of "The Wireless World"

A QUICK REFERENCE GUIDE TO OVER 200 BROADCASTING STATIONS

arranged in order of wavelength, and giving details of power and origin, is another useful regular feature

www.americanradiohistory.com



Simplified Aids to Better Reception.

AS a general rule the transformer which serves to link a modern moving-coil loud speaker with the anode circuit of the output valve is built into the loud speaker itself. When it is desired that the instrument should be mounted at a considerable distance from the receiver, it has been suggested in this journal that it is a good plan to remove the transformer and to install it in the set.

Loud Speaker Extensions.

With matters arranged in this manner (see Fig. 1 (a)) the effect of self-capacity in the extension leads will be much less serious than when connections are made on the alternative and more usual plan shown in Fig. 1 (b), where the output transformer is at the far end of the extension leads.

But even if we adopt the generally preferable scheme of Fig. 1 (a), complete immunity from trouble does not automatically follow. True, the self-capacity of the extension leads will be most unlikely to impair the quality of reproduction, but the ohmic resistance of these leads may well be sufficiently high to introduce an almost equally disturbing effect. The D.C. resistance of the average moving coil may amount to a few ohms only, and its impedance at mean speech frequency may not be very much greater. Unless fairly heavy wire be used for the extension leads, it is fatally easy for their resistance to approach, or even to exceed, that of the coil, in which case quality—and volume—is bound to suffer.

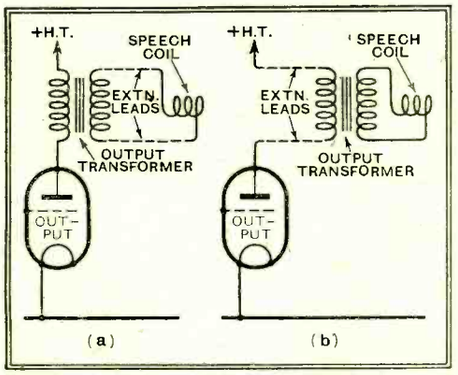


Fig. 1.—Although the output transformer customarily forms part of a moving-coil loud speaker, it may be advantageous to mount it in the set when long extension leads are used (see diagram *a*). The more usual connection is shown in diagram *b*.

THE sensitivity of most modern sets is regulated by means of a variable resistance or potentiometer, which is generally arranged to decrease the sensitivity of the H.F. amplifier by over-biasing the grid of the valve (or valves).

A Combined Volume Control.

Those who have fitted a gramophone pick-up to an existing receiver may have wondered whether it is possible to make this resistance serve the dual purpose of radio and gramophone volume control.

Unfortunately, it is hardly practicable to do this, as a fairly elaborate switching scheme would be required in order to enable the potentiometer to carry out both functions. But if we cannot avoid the use of two potentiometers, we can at least avoid two control knobs by making use of one or other of the many modern components that may be linked together mechanically in such a way that their spindles rotate simultaneously.

Although the "radio" and "gramophone" potentiometers may be mechanically linked—or ganged—it by no means follows that they will be electrically interconnected; as a rule the wiring to each will be entirely separate.

ALTHOUGH the L.F. amplifying valve which succeeds the detector of the "Diode Quality Four" (described last week) had no obvious provision for negative grid bias, it does actually obtain a suitable negative voltage from the rectified carrier wave. This is a truly automatic arrangement, as the negative voltage impressed on the valve will, under all conditions, be sufficient to enable it to deal properly with whatever signal may be applied. The bias voltage which the valve obtains is that developed in the process of rectification across the load resistance, with which the L.F. valve grid circuit is in parallel.

Diodes and Negative Bias.

It is a convenient circumstance that bias may be so easily obtained in battery-operated sets with diode detection, and that the harmful flow of grid current may be avoided without any complications. Luckily, grid current does not commence to flow in the average battery set until the grid is made positive with respect to the filament—a condition that can never obtain in the arrangement under discussion.

But when indirectly heated A.C. valves are used in a receiver with diode detection the position is rather different. The grid of this type of valve has to be appreciably negative before grid current is entirely stopped, and so the simple self-bias scheme applicable to battery valves is no longer practicable. But here again we are fortunate, as with a valve of which the cathode does not form part of the heating circuit it is perfectly easy to arrange bias in such a way that the same negative voltage is not applied to the diode as well; this would impair the performance of the latter valve.

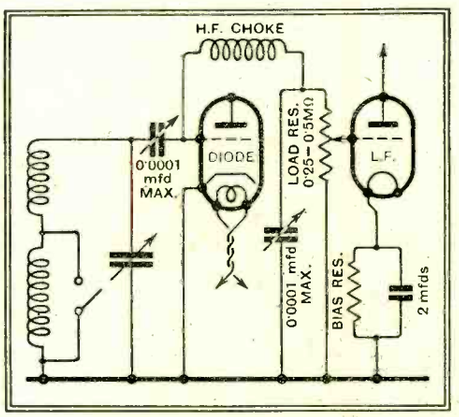


Fig. 2.—Automatic bias for an indirectly heated L.F. valve succeeding a diode detector.

By arranging the bias system as in Fig. 2 the desired state of affairs can be brought about. The insertion of the bias resistor in the cathode lead of the L.F. valve is entirely conventional, the only difference being that its value may be rather lower than usual.

WHEN an A.C. mains set works satisfactory for some time after first switching on, and then exhibits a general falling off after perhaps half an hour, it is generally safe enough to assume that grid emission is the trouble. The most probable cause of this highly undesirable effect is the application of an excessive voltage to the valve heaters when operated in this way, particles of the emissive material may be "spluttered" from the cathode on to the metallic mesh of the grid; the temperature of the latter will also be raised unduly, and it will then act as a kind of secondary cathode.

Overheated Grids.

A fairly definite proof as to whether

www.americanradiohistory.com

Practical Hints and Tips.—

this effect is really responsible for poor performance is afforded by switching off the set and waiting for a few minutes for the valves to cool down thoroughly. Then, if the set behaves satisfactorily when it is again switched on, secondary emission will probably be responsible. It is, of course, quite possible that only one of the valves is defective, and the next step is to attempt to find it by carrying out a series of eliminative stage-by-stage tests.

Two-unit Construction.

MAINS-OPERATED sets of the more ambitious type are, for the sake of convenience, often constructed in two-unit form; one unit consists of the set proper, while the other comprises the power supply equipment, and more often than not the output stage as well.

It would often be convenient to mount these two units at a considerable distance from each other, but it is hardly practicable to use very long connecting leads between them. The limiting factor is usually the connecting wires which pass current from the power transformer to the heaters of the valves; the current here is considerable, and the inclusion of even an appreciable fraction of an ohm may have serious results.

Another source of danger is the L.F. feed lead to the output stage (if this be included in the power unit). Should this lead have a high capacity to earth, quality of reproduction is likely to be impaired, and if it is not screened hum voltages may be introduced from the household electrical system.

The position is rather different when the power unit includes nothing but the H.T. supply equipment. In this case there would be no insuperable objection, if one wished to do so, to installing the set in the attic and the eliminator in the basement. But it might be necessary to run the connecting leads in lead-covered cable in order to prevent pick-up interference.

News from the Clubs.

Opening the Season.

THE beginning of October usually ushers in the wireless club season, and this year offers no exception to the rule.

The Leytonstone and Woodford Radio Society recently held its opening meeting, at which the President, Mr. E. J. Turbyfield, F.L.A.A., gave the presidential address. Meetings are to be held regularly during the winter on Thursdays at the Prince's Hall, High Road, E.11. Lectures and demonstrations by trade experts and well-known amateurs have been arranged, while on certain nights a course of lectures on Elementary Electricity is to be held for the benefit of beginners.

Joint Hon. Secretaries: Mr. H. O. Crisp, 2, Ramsey Road, Forest Gate, E.7; Mr. W. H. Crown, 1, Thornton Road, Leytonstone, E.11.

A Lanarkshire Club.

THE Shotts (Lanarkshire) and District Radio Society has commenced operations for the season, and a very promising series of lectures and demonstrations is being arranged.

All particulars can be obtained from the Hon. Secretary, Mr. E. M. Thomson, Cwmbach, Shotts.

For Slough Enthusiasts.

ANOTHER Society which has maintained interest during the summer is the Slough and District Radio Society. Recently Mr. Fitzgibbon, of Messrs. J. J. Eastick and Son, gave an instructive lecture and demonstration on transmission problems.

The new Hon. Secretary, to whom all communications should be addressed, is Mr. S. Becket, 3, Melbourne Avenue, Farnham Road, Slough.

The "Never-Stop" Society.

UNIQUE among British radio clubs is Slade Radio, Birmingham, in continuing its meetings at weekly intervals throughout the summer. This active Midland society has arranged a characteristically energetic programme for the coming months. On September 29th Mr. W. L. Hartshorne, of Messrs. A. C. Cossor, Ltd., described the new season's products.

An exceptionally good series of lantern slides was shown at a recent meeting at which Mr. P. W. S. Valentine, A.M.I.E.E., of the Mullard Wireless Service Co., Ltd., lectured on "The Meaning of Valve Characteristics." The illustrations dealt with component parts, assembly and characteristics.

Full particulars of the Society's activities can be obtained from the Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

Awaiting Enquiries.

MISS E. MACLEAN, of 106, St. James's Road, Southsea, is the hon. secretary of the Portsmouth and District Wireless and Television Society.

All the Year Round.

FORTNIGHTLY meetings throughout the summer have been held by the North Middlesex Radio Society, which meets at the Lower Clubroom, St. Paul's Institute, Station Road, London, N.21.

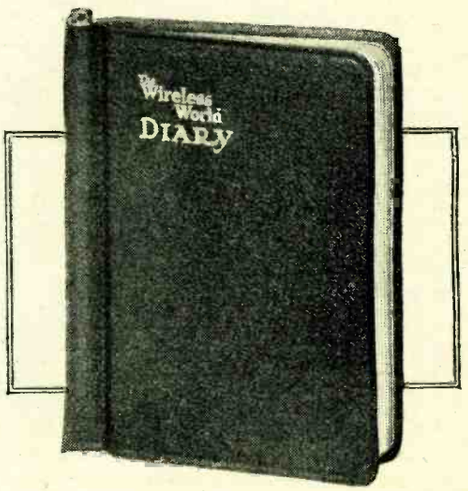
Particulars of membership can be obtained from the Hon. Secretary, Mr. E. H. Laister, Windflowers, Church Hill, N.21.

A Club for Constructors.

SOMETHING new in wireless societies is promised by the formation of the Radio Constructor's Club, at Memorial Buildings, Roscoe Street, Bunhill Row, London, E.C.1. The club was inaugurated on Monday, September 19th. We understand that meetings are being held on Wednesdays from 8 to 10 p.m. A good workshop is available and technical lectures are being arranged. Definite instruction will be given to beginners. It is hoped that the general public will take advantage of the facilities offered for obtaining first hand instruction in the building of modern receivers.

All enquiries should be addressed to the Hon. Secretary, Mr. E. H. Harman, B.Sc., 2, Noel Street, Islington, London, N.1.

The Wireless World DIARY FOR 1933.



THE forthcoming issue of our popular Diary follows, in the main, the lines which have proved so acceptable to our readers in previous years. The regular features have been carefully revised and brought up to date, new circuit diagrams drawn where necessary, and the invaluable "Hints and Tips" and "Matching Output Valve and Loud Speaker" sections thoroughly overhauled. Among the new features will be found instructions for tracing hum in mains receivers, and two pages prepared for calibration curves for long-wave and medium-wave receivers. The lists of European and short-wave broadcasting stations have been revised and corrected up to the time of going to press, and the Diary concludes, as usual, with comprehensive valve data, with regard to which we wish to express our gratitude to the various manufacturers who so kindly furnished us with information about their valves for the coming season and revised the rough proofs of this section.

The Diary, comprising 192 pages, is obtainable from all booksellers, stationers, and bookstalls, or direct from the publishers. Price 1s. 6d., or by post 1s. 7d.

The Wireless World INFORMATION BUREAU.

Conditions of the Service.

(1) THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

(2) Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Tudor Street, E.C.4, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.

(3) The fee of 5s. covers the reply to any wireless technical difficulty, but in special cases, where the enquiry may involve a considerable amount of investigation, an increased fee may be necessary. In such cases a special quotation will be made.

(4) Questions should be clearly written and concisely worded in order to avoid delay. Where enquiries relate to trouble experienced in receivers built to specifications in *The Wireless World* a complete account should be given of the trouble, and especially the symptoms.

(5) Where reference is made to published articles or descriptions of apparatus, the title of the article, the date of publication in *The Wireless World*, and the page reference number should be given, in order to facilitate reply.

(6) Full circuit diagrams, constructional details of apparatus, or values of components for home-designed receivers cannot normally be supplied, but circuit diagrams sent in with queries will be checked and criticised.

(7) Particular makes of components cannot, in general, be recommended, but advice will be given as to the suitability of an individual component for a particular purpose specified by the enquirer.

www.americanradiohistory.com

BROADCAST BREVITIES.

By Our Special Correspondent.

Synchronisation Tricks.

THE children of Bournemouth seem to be the chief sufferers from the decision to place Scottish National on the wavelength of 288.5 metres. Only the casual reader will rub his eyes at such a statement; the informed listener will not need reminding of the daring test, which is really still in progress, to see whether the new Scottish National transmitter, operating on the common relay wavelength, can upset the distant relay transmitters on the same wave at Bournemouth, Plymouth, and Swansea.

Bournemouth's Position.

There is unmistakable interference, I hear, at Bournemouth; not unpleasant enough to suggest a wavelength change, but likely, under certain conditions, to be so irritating that the powers that be have deemed it wise to cut out the Bournemouth Children's Hour, which reveals signs of "mush" from Falkirk, and substitute for it the London National Dance music. The latter, presumably, could not possibly be spoilt by mush.

When Mush Occurs.

One part in five million, they tell me, is the maximum error yet recorded in the synchronisation between Scottish National and Bournemouth, so it is not surprising that the fashionable watering place has not yet registered any complaints. Interference is noticeable after nightfall, however, at distances above 2½ miles from the Bournemouth transmitter.

Hobson's Choice.

Testing is now to go on in the neighbourhood of Plymouth and Swansea.

No one really likes this synchronisation with different programmes, but, as the "pirate" said, if you haven't got the wherewithal, what can you do?

My Italics.

THE B.B.C.'s next little joke is the programme of *Chamber Music* to be given in the *Concert Hall* of Broadcasting House on October 15th.

Admitting the Public.

The occasion will be interesting in that it will be the first time that the public are admitted to a concert in the new building. It will be the first time, too, that the new little box office is brought into use.

Tickets (including tax) will be from 7s. 6d. downwards, so that for the price of three annual wireless licences four people could spend two hours or more in the best seats.

A Classical Programme.

The Catterall Quartet will play a Haydn, Mozart and Schubert programme made up of one by each master. Two will probably be broadcast.

I understand that it is hoped to give many more public concerts at the B.B.C. headquarters, but a lot will depend upon the popular response.

"Stop that Crackle."

THIS is the title of the first of the series of technical talks to be given on the National transmitters on Saturdays at fortnightly intervals.

I understand that Mr. Watson Watt, Superintendent of the Radio Research Board station, who opens the series to-morrow evening at 7.5, will discuss the origin and cure of noises in a receiver, with practical demonstrations.

Concerts from the Wharf.

I REGARD it as a piece of good news—whispered to me last week—that the B.B.C. Music Department have definitely decided to use the Wharf Studio (No. 10) for the Sunday evening orchestral concerts this winter.

There is a resonance—or a "zip," as one man put it—about the Wharf Studio that has not yet been quite achieved at "B.H."

New Mikes at "B.H."

CAPTAIN H. J. ROUND, of microphone and loud speaker fame, is enjoying himself these days in the development of "hissless" mikes for the B.B.C. A modified Reisz microphone on which he has been working was used for the first time last week for a vaudeville programme, Captain Round being warned at the last minute by 'phone that his mike was about to be switched in.

I hope he was as satisfied as I was.

Strange Objects at the Queen's Hall.

The microphones which were used at the Queen's Hall for the "Prom" broadcasts looked like infernal machines or miniature torpedoes. Actually they were of the ordinary Reisz type specially screened to exclude dust.

"Coming Shortly."

MR. E. G. D. LIVEING'S "embroidered catalogue," as he called it, of coming events on the North Regional wavelength made my mouth water on the Tuesday of last week when I picked up the talk on a portable while *en route* for Manchester. Mr. Liveing, who is, of course, the B.B.C.'s North Regional Director, gave me the impression that northerners take their broadcasting more seriously, and extract more pleasure from it than listeners in the South.

A Good Showman.

He communicated the feeling that the northern fireside will offer the best possible delights this winter, when many of us will "begin to turn to an object which looks like a piece of furniture in the corner of the room, switch on a knob and appraise or criticise that which broadcasting brings."

Spoken like a good showman, Mr. Liveing! The opportunity to appraise and criticise offers half the attraction.

M. Jean Roy, the well-known annouucer at Radio-Toulouse.

What Manchester Thinks To-day . . .

Incidentally, the Northern Regional Director revealed that not all the original thinking is confined to Broadcasting House, London. Creative programme work is being given serious thought in Piccadilly, Manchester, and more and more use is to be made of original productions written specially for the microphone.

Bravo, again, Mr. Liveing. Centralisation in London has more than once threatened to take the heart out of provincial broadcasting, and I am glad that the Manchester Region, for one, is determined to express itself in a manner appealing to its own people.

Worth Tuning In.

SIR EDWARD ELGAR, Master of the King's Musick, pays his first visit to Northern Ireland in a few days' time, and will personally conduct his "Enigma Variations," and "Dream of Gerontius," to be broadcast from the Ulster Hall, Belfast, on Friday, October 21st.

A Political Advisory Committee.

THE B.B.C. is wise in avoiding responsibility for the choice of political talks and talkers. With the approval of the Prime Minister it is inviting the co-operation of a small Parliamentary Committee composed of unofficial members of both Houses, for the purpose of advising the Corporation on matters connected with political talks, other than those at the time of a General Election.

Why Only Wales?

I SUPPOSE Wales will get her way one day. Once more a resolution has been passed, this time by the Union of Welsh National Societies, claiming that one B.B.C. director should be a Welshman.

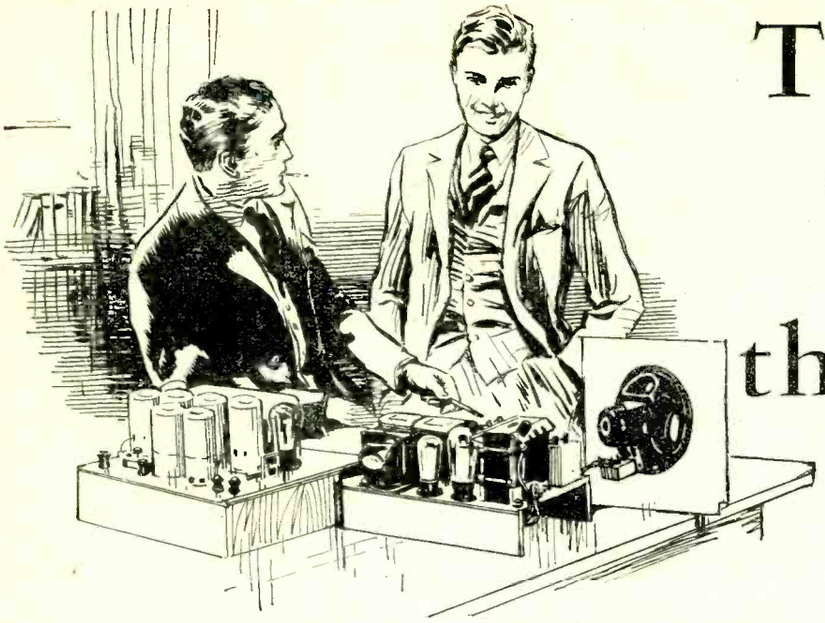
But what about Scotland? And Ireland? Most of the present Governors hail from Northern England.

Which Way's the Wind?

FROM a letter to the B.B.C.:—

"I may state that I receive the transmissions from this station with remarkable clarity except that I am unable to pick up the 11.15 p.m. performances until about 11.40."

www.americanradiohistory.com



The Signal Through the Receiver.

Part I.
The Nature of the Signal.

THE ability to form a mental picture of the signal wave and the changes it undergoes on its passage through the receiver helps immensely towards a clear understanding of radio reception. This article is the first of a series, illustrated with simple diagrams, showing the nature of the signal and how it is detected and amplified. The purpose of each component will be discussed as well as the parts played by the different circuits.

IN tracing the path of the signal through the receiver, as promised in the title of this article, it is really very difficult to know where to begin. If the aerial terminal of the set is taken as the starting-point, all the various happenings in the transmitting circuits, in the transmitting and receiving aerials, and in the space between them, must obviously be omitted. This would perhaps not matter much, but for the fact that unless these various processes are traced, even if only in the sketchiest outline, it is not easy to arrive at a clear conception of the nature of the received signal. As this signal is the raw material which the receiver is designed to handle, we must have a reasonably clear mental picture of its nature before the function of the set and its various component circuits can be grasped.

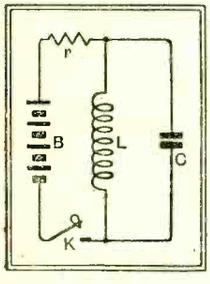


Fig. 1.—A circuit which can be used as a basis of discussion of high-frequency currents.

For our purposes in discussing the transmitter we shall think of it in three main divisions, of which the most fundamental is the generator of high-frequency oscillations. How it works is not our present concern, but a knowledge of what it produces is very definitely necessary. The simple circuit of Fig. 1 will serve as a basis for a brief discussion of the nature of a high-frequency current.

In this diagram there is shown a coil L connected in parallel with a condenser C, making a closed circuit. We will imagine, for illustrative purposes only, that a battery B is connected across the whole, the circuit being made and broken as required by the key K. Further, we will have in the circuit a resistance r, compared with which the resistance of the coil L will be regarded as negligible, since L is to be thought of as wound with heavy gauge copper wire. If the key K is depressed and raised again almost immediately, what happens? To all appearances, nothing at all; but suitable electrical instruments could have detected a whole series of interesting phenomena.

It is clear enough that a current, determined in magnitude primarily by the voltage of the battery B and the value of r, will flow through the coil L. Everybody has heard of an electromagnet, which consists primarily of a coil of wire through which a current is passed. The coil L evidently comes under this description; we know therefore that so long as the current is flowing the coil takes to itself the properties of an electromagnet. Fig. 2 shows this diagrammatically, the lines of magnetic force surrounding the coil during the passage of the current being indicated by dotted lines.

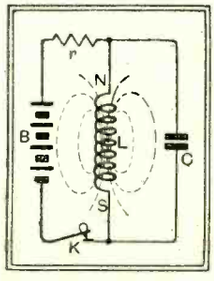


Fig. 2.—The circuit of Fig. 1 with the key K closed. Note the magnetic field round L.

At the instant when the current is interrupted again by lifting the key K, the magnetic field contains stored energy. While the field is in process of collapsing it tends to maintain through L a current in the same direction as that which has just been interrupted. This current flows into the condenser C, which thereby becomes charged as indicated in Fig. 3. The absence of magnetic lines round the coil in this figure indicates that the state of affairs represented corresponds to the moment of cessation of current, the whole energy of the magnetic field having been transferred in the form of charge to the plates of the condenser.

Clearly this is not a stable condition; the condenser will now discharge through L, driving a current through it in a direction opposite to that of the current originally provided by the accumulator, and building up anew the magnetic field, though now with its North and South poles interchanged. When the condenser is completely discharged, as indicated in Fig. 4, the current in the coil is at its greatest value, and the energy drawn out again from C is once more in the form of a magnetic field round L. Just as before, the magnetic field takes over the duty of driving the current onwards until it has totally collapsed, transferring the energy once more to C in the form of a charge opposite in polarity to that shown in Fig. 4.

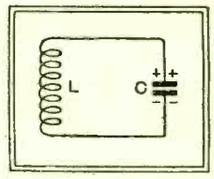


Fig. 3.—The collapse of the magnetic field round L has caused a current which has charged C.

Effect of Resistance.

If it were not that the circuit contains resistance in one form or another, the coil and condenser would continue for ever to play battledore and shuttlecock with the original supply of energy, and the current would never cease surging in and out of the condenser, travelling backwards and forwards through the coil for all time. In practice, such an experiment as that suggested would produce an oscillation that would die away in a very

www.americanradiohistory.com

The Signal Through the Receiver.—

short time, the energy being dissipated after a very few interchanges by the inevitable resistance.

By using a valve in some such circuit as that shown in Fig. 5 a little of the current passing through L is fed back into L_1 by the fact that the magnetic field of L passes also through L_1, the changes in the field already described therefore inducing voltages in both coils. Due to the amplifying action of the valve, these small voltages in L_1 are reproduced again as large currents in L, so that as the resistance in the tuned circuit absorbs energy, more is drawn by the valve from the H.T. supply and passed into the tuned circuit to reinforce the oscillations. They are therefore maintained at full amplitude as long as the valve is running.

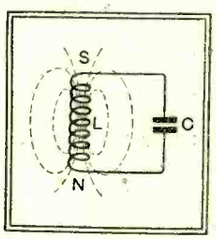


Fig. 4.—The discharge of C has driven a current through L, evoking a magnetic field opposite in polarity to that of Fig. 2.

Explaining Transmission.

The basis of the signal sent out by a transmitting station consists of a continuous valve-maintained oscillation, which, as we have seen, is fundamentally nothing more than the continual to-and-fro surging of a current in a circuit of the very simple type shown in Figs. 3 and 4. It is customary to represent such a current by a "sine-curve" such as that shown in Fig. 6.

In this figure, lapse of time is indicated by distance from the left of the diagram, while magnitude and direction of current are shown by vertical distance from the line OBD the height of which means zero current. A dot anywhere on the surface of the paper would thus mean a certain current at a certain time, while series of dots could be obtained by following the variation of a changing current instant by instant. If we were to follow the current in the oscillating circuit L C of Fig. 5, and mark out the dots corresponding to the measurements made, and then join up the dots with a continuous curve to fill in the gaps between measurements, we should arrive at a curve like that of Fig. 6.

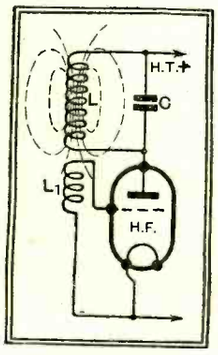


Fig. 5.—Using a valve to maintain the oscillations. The magnetic field of L is now used to induce voltages in the grid coil L_1.

On the diagram, A represents the moment of maximum current, when the magnetic field of the coil is at its greatest. From A to B the field is collapsing, and the current is decreasing until at B the current is zero and the condenser fully charged. At B the current reverses as the condenser begins to discharge again, the reversal of direction being shown by the fact that the curve is now below the zero-line OBD. At C the current has again reached its maximum value, while the charge on the condenser is gone. So the process continues until E is reached, when conditions are an exact duplicate of those existing a moment earlier at A.

The curve is thus a faithful record of the progress of events in the tuned circuits, but only in that sense can it be said to be a picture of the high-frequency wave.

It must be understood that the enormous rapidity of alternation of the current is very imperfectly conveyed to the eye by the representation of Fig. 6; on the supposition that the wavelength of the oscillation depicted is 300 metres, the widely spaced figures along the time-scale represent millionths of a second. As we shall see later the frequency of alternation depends on the values allotted to the inductance and capacity of the tuned circuit.

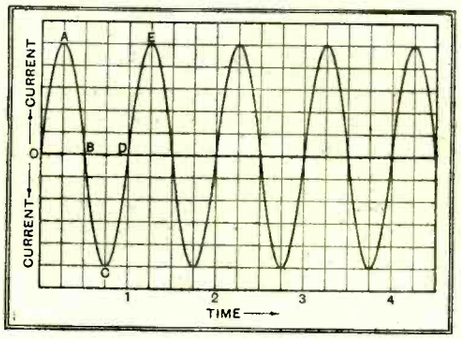


Fig. 6.—A curve showing the variation of the current in an oscillating circuit with time.

Electro-magnetic Waves.

In the transmitter, these currents are conveyed to an aerial in some such manner as that suggested in Fig. 7, the constants of the aerial and of the coil coupling it to the transmitter being such that it resonates to the frequency of the oscillation to be sent out. Unlike the tuned circuit we have been discussing, the aerial and earth system can radiate freely, sending out into space an electro-magnetic wave consisting of electric and magnetic fields which travel outwards from the aerial with the speed of light. At any point to which these fields reach in their travels the intensity varies with time in exactly the same manner as does the intensity of the current in an oscillating tuned circuit. Fig. 6 will therefore serve to represent this wave, although the curve is no more a physical picture of the wave than it was of the behaviour of the oscillating circuit; it is simply a record of the way in which the intensity of the field varies with time.

If a continuous wave of this type were sent out from a transmitter it could convey no more information than a continuous beam of light from a lighthouse. Lighthouses are accustomed to announce their identity to the navigator by periodic rhythmic interruptions of the light, sending out in that way a sort of "call-sign" of long and short flashes. In just the same way a wireless transmitter can convey messages by periodically interrupting its wave, breaking it up into the short and long bursts of transmission that represent the dots and dashes of the Morse code. Satisfactory though this is for its purpose, something more elaborate is required if music and speech are to be sent out, though the continuous oscillation, known as the "carrier-wave," is still the basis of this more advanced type of transmission.

Modulation.

The speaker or the orchestra planted in front of the microphone causes the latter to deliver minute electric currents the magnitude of which at any instant is an exact copy of the compression or rarefaction of the air caused by the sound-wave. Both the sound and its corresponding current could therefore be represented by a curve on the lines of that of Fig. 6. These sound-duplicating currents have now to be amplified up to a suitable extent and mixed in with the fundamental oscillations of the carrier-wave in such a way that when the latter is radiated from the aerial it bears the impress of the speech or music that it is required to transmit.

Taking a simple case, we will imagine that a pure note, free from harmonics, is being sounded in the studio. The sound-wave, and the corresponding microphone currents, would then have a form like the curve of Fig. 6, though the time-scale would be profoundly different. If the note were fairly high, the units marked might be thousandths of a second instead of the millionths of a second that correspond with the high-frequency carrier oscillations.

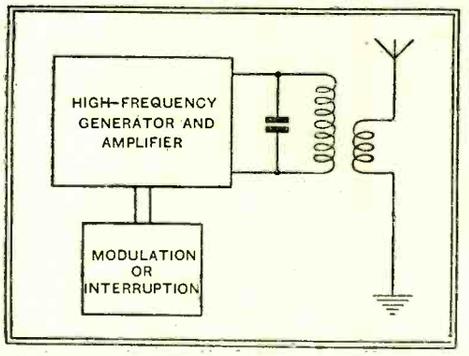


Fig. 7.—Crude scheme showing how the oscillations in a tuned circuit are conveyed to an aerial for radiating.

Fig. 8 shows what happens when carrier and musical note are superposed. *a* is a representation of the way in which the high-frequency current varies with time, while *b* represents in the same way the musical note, the pitch of which is shown by the time-scale to be 1,000 cycles per

www.americanradiohistory.com

The Signal Through the Receiver.—

second. In *c* is shown the result of adding the two together.

It will at once be noticed that the composite wave consists of the original high-frequency wave, but this is now no longer constant in amplitude. The variations of its amplitude are such that the tips of the modulated wave outline an exact replica of the low-frequency modulating current—this outline, or envelope, is brought out in the diagram by a dotted line.

There is one important inaccuracy in this diagram; it does not show up clearly enough the enormous difference in frequency between the carrier and the modulation. If, as suggested, *b* shows a 1,000-cycle note, *a* represents a 16-kc. carrier—wavelength 18,750 metres. To show a 1,000-kc. carrier (300 metres) in its correct

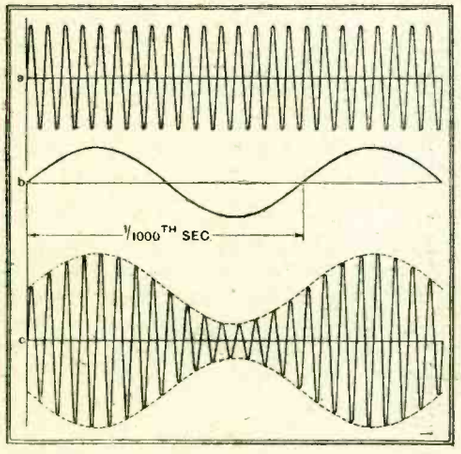


Fig. 8.—How a continuous wave is modulated by a vibration of low frequency. The unmodulated carrier is shown at (a), the low frequency to be transmitted at (b) and the modulated carrier bearing the impress of (b) is given by the composite wave (c).

relationship to *b*, there should be 1,500 complete high-frequency cycles on the diagram in place of the 24 shown. A little imagination must therefore be applied to Fig. 8 before it becomes a fair representation of a normal broadcast wave.

Even so, *c* represents nothing more exciting than a tuning note; for music or speech the form of *b* is extremely complex, and this complexity is faithfully reproduced in the envelope of the modulated carrier *c*. But, even with these limitations, the diagram of Fig. 8 gives a very fair mental picture of the nature of the modulated carrier which, after being applied to and sent out from the aerial of the transmitting station, forms the signal with which our sets have to deal.

A WEEKLY SERVICE.

Each issue of *The Wireless World* contains a carefully considered report on the design and performance of a commercial receiver.

Next week:

The Gecophone Four-valve D.C. Mains Receiver. Nomad Model.

DISTANT RECEPTION NOTES.

SIX years ago American medium-wave stations, though none of them so far as I can recollect was then rated at more than about 5 kilowatts, were so strongly received in this country in the small hours that many of them were commonly heard on single-valve sets, and there was even one apparently well-authenticated case of direct reception of KDKA with a crystal receiver. From that time until last winter conditions were not so good. American broadcasting stations could be heard, but more often than not this was a feat requiring (a) the burning of far-beyond-midnight oil, (b) the possession of a very sensitive receiving set, and (c) the ability to split hair-breadths in the matter of tuning. During the winter of 1930-31 a very great improvement was noticed. There were few nights when certain transatlantic stations could not be picked up, and under really good conditions "running round" the waveband between 200 and 550 metres was almost as productive of results between one and two o'clock in the morning as it had been earlier in the evening when European stations were one's quarry. I have heard more than thirty American stations on several occasions.

American Stations Already.

Since 1926 there has been an all-round increase in output rating in America comparable with that which has taken place on this side of the Atlantic. There are now at least a couple of dozen stations rated at between 10 and 50 kilowatts, and one or two stations have been experimenting with outputs very much higher than the latter figure. It is not, therefore, surprising, particularly as reception conditions are so good this year, that American medium-wave stations have already begun to be reported. Amongst those most frequently heard so far are WPG, WGY, KDKA, and WTIC. Amongst the most remarkable of American stations, in that they are regularly heard over here, though their power is comparatively small, are WPG, working on 272.6 metres and rated at 5 kilowatts, and WIOD with a wavelength of 230.6 metres, and an output rating of but a single kilowatt.

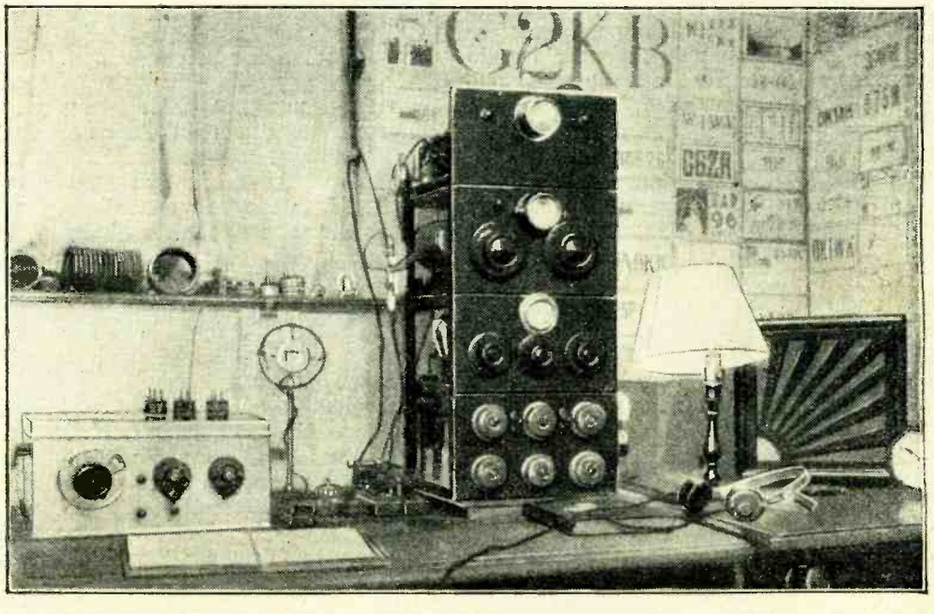
In Europe.

Heterodynes apart—and would that they really were apart!—long-distance reception conditions for European stations are infinitely better than I have ever known them to be so early in the autumn. With a set that is at all sensitive there are stations to be heard all round the dials on both the medium- and the long-wave bands. On the long waves Oslo is suffering rather badly from the attentions of Russian stations, and the Eiffel Tower is still frequently jammed. With these exceptions stations are wonderfully received. The list of first-raters by day or night includes Kalundborg, Motala, Warsaw, Zeesen, Radio-Paris, and Huizen. Moscow can always be logged when working, but since the programmes are so largely devoted to interminable propaganda speeches they have little programme value so far as I, at any rate, am concerned.

Between 200 and 400 Metres.

If only some of the unruly little stations working below 240 metres would use and adhere strictly to the wavelengths assigned to them there would be a great deal to hear towards the bottom of the "broadcast band." Even as it is there is a great deal to be heard, but it is not the kind of thing that one wants to hear. There is nothing really worthy of attention below Nürnberg, and even this station is liable to be jammed on occasion. Trieste, Heilsberg, Bratislava and Hilversum are the pick of the stations up to 300 metres. Between this and 400 metres there is an excellent hunting ground. Genoa, Göteborg, Breslau, the Poste Parisien, Milan, Brussels No. 2, Brno, Strasbourg and Barcelona represent the big game that may be bagged, and there are many smaller fry worth a try.

D. EXER.



A COMPACT STATION. G2KB, owned by Mr. H. K. Bourne, at Hillmorton Paddox, Rugby, has been designed to be as compact as possible. The transmitter, measuring only 27 ins. in height × 11 ins. square, is built in four units. The station works on the 20-, 40- or 80-metre wavebands, with an input of 10 watts, and communication has been effected with countries all over the world.

www.americanradiohistory.com

This Daventry Project.

How Australia Looks at Empire Broadcasting.

By C. DANVERS WALKER (late of the Australian Broadcasting Co., Ltd.).

HERE is a convincing answer to those who question the Empire's response to an Imperial Broadcasting Scheme. The author, who has spent many years in the Commonwealth, has just returned to England after a period of service as talks manager and announcer with the Australian Broadcasting Company. He writes: "All remarks on the subject (Empire broadcasting) are coloured with the thought that the new service would be a means of intensifying the affection for the Motherland."

DO the peoples of the Empire really want an Imperial broadcasting service? My experience enables me to answer the question only from the point of view of the Australian listener, but, the enthusiasm in the Commonwealth being so intense, it is not difficult to imagine that very much the same outlook will be found in other parts of the British Empire.

Undoubtedly there are sceptics who maintain that the proposed service is not receiving favourable comment in Australia. Yet, judging from my three years of experience in Australian broadcasting, I unhesitatingly declare that the advent of the proposed transmissions from the Mother Country will create a new flame of enthusiasm for wireless throughout the Commonwealth and answer for ever the question as to whether the Australian people are favourably minded towards this project.

Home Ties.

Shortly before I left Melbourne last May the question of Empire broadcasting was on every lip as a result of the news of the B.B.C. plans at Daventry, and all the remarks on the subject were coloured with the thought that the new service would be a means of intensifying the affection for the Motherland. The greater percentage of Australians have very close ties with England. There are those who were here during the War, and there are tourists who have returned from pleasurable visits; there are the emigrants, and there are the numerous people who cherish an inherent pride in their British ancestry although they may not themselves have entered the land of their fathers. All these people are accustomed to turning their thoughts to London, "the centre of the Empire," and to those who live in the Metropolis it may be difficult to imagine the wonderful thrill which the Commonwealth would feel at hearing even the characteristic noises of Piccadilly Circus or Trafalgar Square.

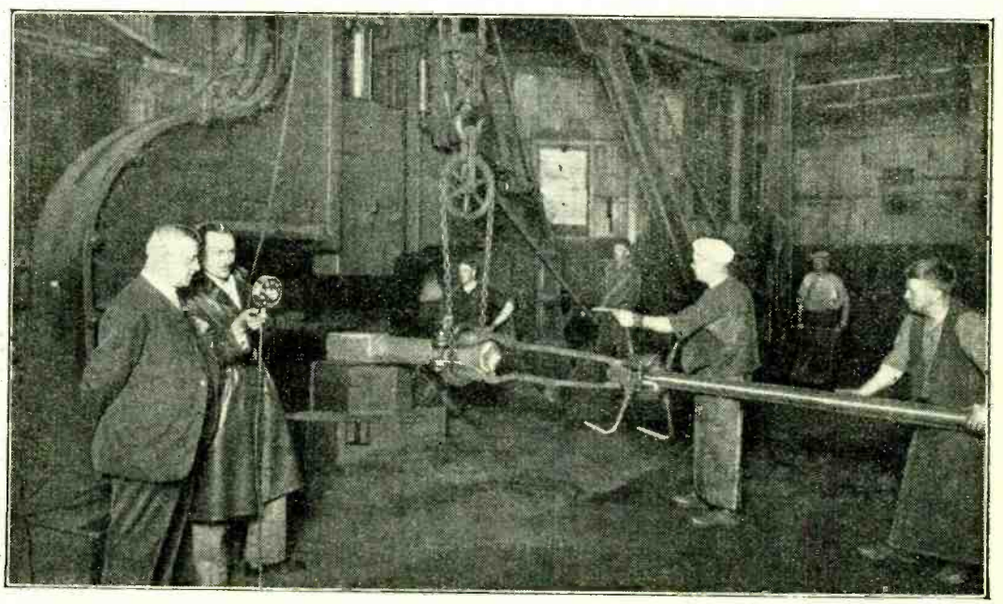
What greater illustration of enthusiasm do we want than that of the eagerness with which Australian listeners sat up all through the night to hear the relay of the speech of H.M. the King at the opening of the Indian Round Table Conference? Nearly as much enthusiasm was aroused by the first wireless telephone conversation from England to Australia when Mr. Ramsay MacDonald spoke to Mr. J. H. Scullin, and there have been eager followers of the commentaries on the Test matches in England, while extraordinary enthusiasm has been roused by the transmission from a Surrey wood of the song of a nightingale.

The wise ones may shake their heads and say: "Yes, it would be splendid to have broadcasts of this kind for a month or two, but the novelty will wear off, and then what will become of your grandiose broadcasting scheme?" My reply is that transoceanic broadcasting of this kind would not depend upon its supposed novelty appeal. After all, the task of any broadcasting organisation is to maintain the interest of the listener, and the same problem exists when the transmissions are being made at Oxford Circus and picked up in Balham as when the transmitter is at Daventry and the listener is in Melbourne.

Since my return to England I have been amused here by people complaining about the standard of the B.B.C. programmes. Complaints against the fare offered by the broadcasting organisation seem to be pretty general throughout the world. Certainly there was never a better instance of the truth of the saying, "A prophet is not without honour save in his own country," as in this question of broadcasting. In Australia British programmes are beyond reproach, while the local effort cannot hope to escape criticism, and yet when I reach England I find that, while the B.B.C. programmes are just bearable, people search farther and farther into the foreign ether in their quest of the ideal programme.

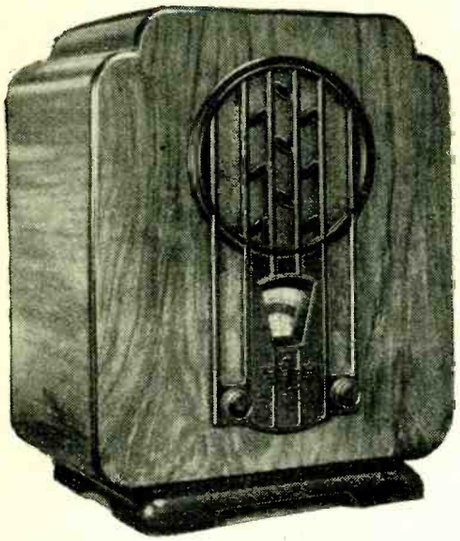
What the Dominions Want.

What sort of programme does the Australian listener hope to expect to receive from the Mother Country? I venture to say from my own experience (and it is not an original opinion) that it is impossible to gauge to a nicety the requirements of any broadcasting audience. When one has to consider the likes and dislikes of peoples half-way round the world the problem assumes bigger proportions. An eminent authority before the days of broadcasting has said that it is impossible to please everybody all the time. Nevertheless, there are certain features which would have a very strong appeal to all listeners in the British Commonwealth of nations. They are public events which stand out as the possession of the Empire, and here in London I can visualise the excitement that would be felt by my colleagues and listeners on the other side of the globe when listening to a transmission of, say, the Aldershot Tattoo, the Ceremony of the Keys at the Tower of London, a concert at the Royal Albert Hall or in the Covent Garden Opera House, Evensong in Westminster Abbey or St. Paul's Cathedral. Of course, it is easy for Australian listeners to say what they would like, but perhaps we have not always considered how much work and how much expense would be entailed in broadcasting such events as those I have mentioned, but I do feel that the unselfish action of the B.B.C. in offering broadcasting programmes to Australia, Canada, South Africa, New Zealand and all the other far flung countries of this great world family will reap its reward in a world-wide revival of interest in broadcasting and a strengthening of the bonds which knit the Empire together.



Outside broadcasts in which the microphone is taken to unfamiliar places are very popular with listeners in Australia. The author is here seen giving a description of an iron foundry for the benefit of Melbourne listeners.

www.americanradiohistory.com



Philips "SUPER-INDUCTANCE" RECEIVER

TYPE 630A.

Description and Test Report of a Much-discussed New Set.

DESIGNERS of manufactured sets generally contend that many of the refinements which appeal to the knowledgeable enthusiast are quite out of place in their products or, at any rate, that their inclusion would be commercially impracticable. The set which forms the subject of the present review tends to refute this argument, as it may fairly be described as a commercial version of an enthusiast's receiver. Its undoubtedly exceptional performance is due mainly to the inclusion of tuned circuits of an efficiency that is probably not to be found in any other set on the market. The makers have proved that it is possible to attain this high standard in a "production" set and, moreover, that it can be done at a reasonable price.

It would take much more space than is available to discuss all the finer points of the circuit arrangement, and so the interested reader must be referred to the accompanying diagram, and our comments must be confined to those details which are especially unconventional.

The H.F. amplifier as a whole is unique. Double-capacity-coupled filters and a total of four tuned circuits in a "two-H.F." set are common enough, but the arrangement of this number of circuits as two filters, the first acting as an input tuner and the other as an intervalve coupling, certainly breaks new ground. Avoidance of losses is the keynote in the radio-frequency section of the set; to this end, exceptionally efficient coils, wound on glass formers with Litz wire and of appreciably larger dimensions than is fashionable nowadays, are used throughout; in order that these coils may work under the most favourable conditions, meticulous care has been taken to restrict the external damping applied to them. For instance, the grids of both H.F. valves are tapped down, and the inevitable loading effect of a power grid detector is avoided altogether by the bold step of fitting a semi-aperiodic coupling between the second H.F. valve and the detector.

A Constant-sensitivity Device.

The aperiodic coupling device is arranged to resonate at 600 metres on the medium band, and, by the inclusion of a condenser which is automatically thrown into position by the operation of the change-over switch (S in the diagram), at about 2,000 metres on the long-wave band. The efficiency of all conventional tuned circuits tends to fall off as wavelength is increased, but the aperiodic coupling introduces compensation, with the result that sensitivity is more or less equal at all wavelengths.

There is nothing particularly unconventional in the resistance-capacity coupled L.F. amplifier, but the arrangement of the H.F. filter, which is also a resistance-capacity combination, in the detector anode circuit should be noted.

The tone control, which consists of a fixed condenser, is thrown into action at will by the operation of switch S_1, and is intended for using only in cases where heterodyne interference is encountered.

The high efficiency of the tuning coils would be a handicap rather than a help if all windings were not accurately matched. The ganged tuning condensers must also be in exceptionally accurate alignment. We have had an opportunity of seeing these sets in course of construction at the Philips' factory at Mitcham, and were greatly impressed by the measures taken to ensure accurate matching and "ganging." The tuning condensers are of exceptionally small size and beautifully made; each unit is fully screened and, contrary to the usual practice, is insulated from its neighbour. As a result, circuit alignment seems to be as perfect as is humanly possible; the tradition that "good" circuits cannot be effectively ganged has been finally disposed of.

FEATURES.

General.—*A self-contained 5-valve table-model receiver with built-in moving-coil loud speaker of the permanent-magnet type. For operation on A.C. mains and with an external aerial. Provision for extra loud speaker and gramophone pick-up.*

Circuit.—*Input filter, double-capacity coupled; 1st H.F. stage coupled by a similar filter to a second H.F. valve, which is linked to a power grid detector by a semi-aperiodic system. Two-stage resistance-coupled L.F. amplifier and pentode output valve, which feeds the loud speaker through a choke-fed transformer. Full-wave power rectifying valve.*

Controls.—*(1) Combined tuning control and wave-range switch. (2) Combined volume control and on-off switch. (3) Tone control switch.*

Price.—*23 guineas.*

Makers.—*Philips Lamps Ltd., Philips House, Charing Cross Road, London, W.C.2.*

Low-loss construction is everywhere in evidence. Bakelite is used comparatively sparingly, the material used for insulation at high-potential points in the H.F. circuits being Isolantite, which has exceptionally good dielectric properties.

Possibly one of the most interesting—and controversial—points in construction is the tuning dial. Instead of the conventional scale, roughly calibrated either in station settings or wavelengths, the 630A has a double indicating dial, the object of which is to allow of the accurate recording of station settings. In addition, there is a third dial which gives a rough indication of the wavelengths to which the set is tuned.

For the accurate "logging" of stations, a "letter" scale is used in conjunction with a micrometer dial which is geared up from the main condenser drive, and by this simple scheme has an effective diameter that would otherwise be impossible of attainment. It may be said that an arrangement of this sort is too complicated for the non-technical user, but with this opinion we can hardly agree; surely it is no more difficult to memorise the adjustment of a station as "E50" than as 60.5 on a dial calibrated into degrees, and it is certainly much more definite than "about 370 metres," as the same station might be recorded on a wavelength dial.

Results of Comparative Tests.

Even before testing the set, it was fairly obvious from the specification that selectivity should be of a high order, but it was hardly expected that it would rival the superheterodyne in this respect. But it actually does so, and is certainly the most selective commercial "straight" set that *The Wireless World* has tested officially.

At five miles from the Brookmans Park station, and literally within sight of the aerials, only four transmission channels—those immediately adjacent to the twin local stations—are lost, and in each case the transmissions in the next-but-one channel were definitely receivable, although two of them were subjected to slight interference. A more conventional four-circuit receiver, itself no mean performer, made a very bad showing in this respect when subjected to a comparative test.

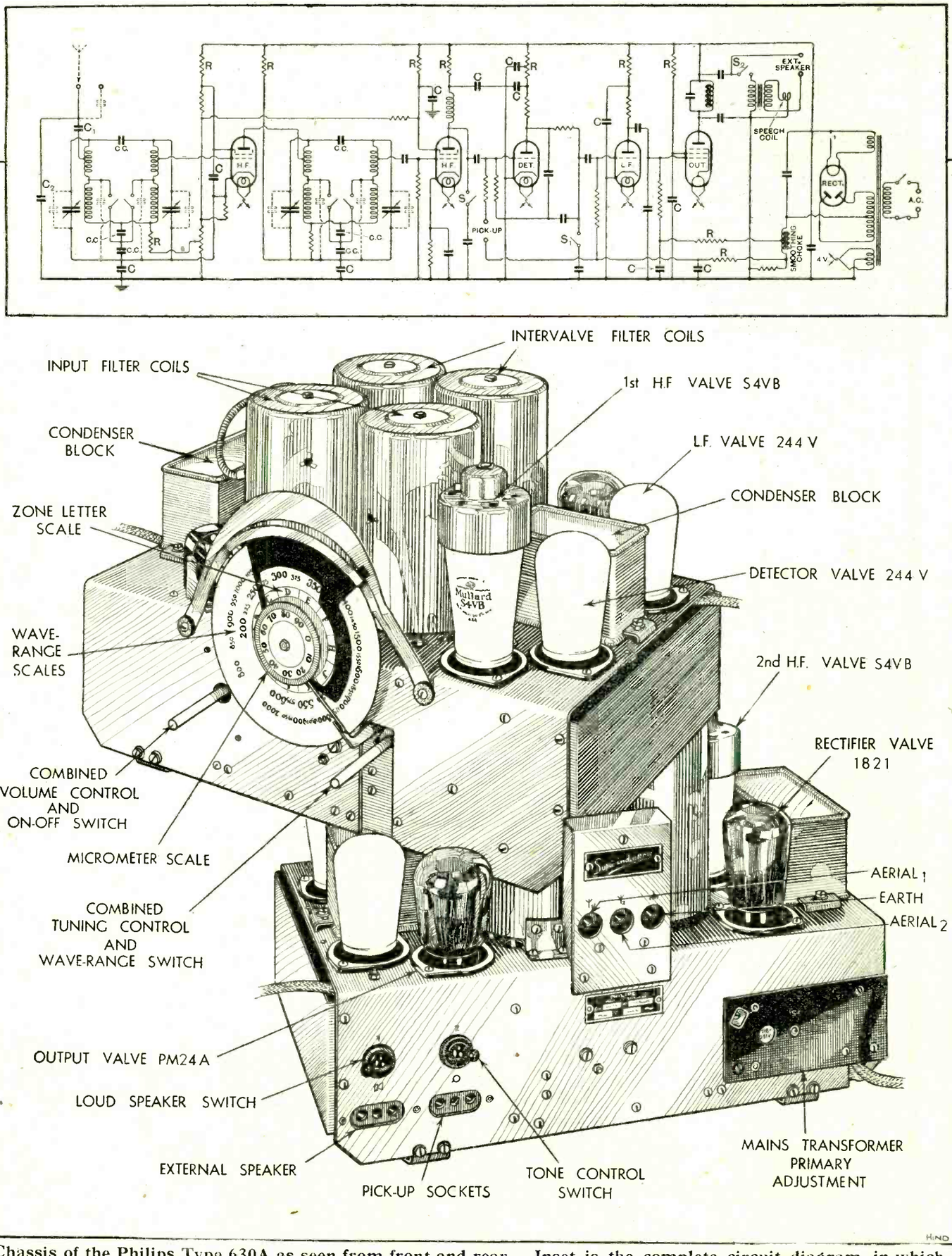
Selectivity should properly be judged in terms of sensitivity, and with regard to the latter quality the 630A was appreciably "down" on the other set, but not as much as might have been expected, in view of the fact that one of its H.F. stages is semi-aperiodic. The "standard" set, with its sensitivity artificially reduced to that of the Philips receiver, was still vastly inferior in selectivity.

On the long waves, all-round performance was found to be even better than on the medium band, probably because the aperiodic stage provides more amplification. Daventry, Königswusterhausen, and Radio Paris were separated perfectly, and as there is no reaction, operating skill does not come into the picture.

Quality of reproduction is eminently satisfactory, and is surprisingly brilliant in view of the undoubtedly high selectivity. The fact that frequencies up to 4,500 or 5,000 cycles are reproduced can only be accounted for by a system of tone correction in the output stage in which the pentode, the output coupling, and the loud speaker itself all play a part. Speech is crisp and intelligible, and bass is sufficient without any obtrusive resonances. Volume, without being overpowering, is satisfying.

www.americanradiohistory.com

A "STRAIGHT" SET WITH SUPERHETERODYNE SELECTIVITY.



Chassis of the Philips Type 630A as seen from front and rear. Inset is the complete circuit diagram, in which resistances which are essentially for decoupling or voltage-absorbing are marked R; the associated by-pass condensers are indicated by C. The aerial is fed through a form of capacity potentiometer consisting of C_1 and C_2. S_1, Tone corrector switch; S_2, loud speaker isolating switch. CC, filter coupling condensers.

www.americanradiohistory.com

Correspondence.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

Empire Broadcasting.

MAY I heartily endorse the plea put forward by Mr. M. W. P. Laws in your issue of August 12th, for the introduction of the short-wave band in the various types of receiving sets advertised by manufacturers in *The Wireless World*, and for more battery-operated sets of the long-range type? When it is remembered that selectivity is no factor in this country of long distances, the need for long-range sets becomes self-evident.

Mr. Mann, from Kenya, has really "spoken out" on Empire Broadcasting. Mr. Laws has invoked the aid of the manufacturers. May I, for my part, express the wish that *The Wireless World* will, as it has done in most others, give a lead in the matter of producing efficient long-range short-wave sets?

In joining the host of those who have expressed their appreciation of the recent additions to your valuable weekly, may I suggest your devoting a section to amateur transmitters as well?

N. MAHALINGAM.

V.W.O., Madras (India).

B.B.C. Quality.

AS so much of your correspondence is on the subject of "The Quality of B.B.C. Transmissions," I thought that possibly a letter from a Midland reader might be of interest.

Why is the quality from the old National transmitter so different from that of all the new transmitters? Obviously, because it is an old transmitter; but why doesn't someone do something about it? I know that my loud speaker favours notes round about 100 cycles in frequency, not too badly, however, and all the new transmitters have enough upper register to mark this resonance; but often from 5XX speech is almost painful to listen to. And those high notes, I often wonder if they are there at all.

What do other Midland listeners do? Are there any others like me who often listen to Brookmans Park, heterodyne, atmospherics, and all, sooner than the "dull" stuff from the local? Or even late dance music from the Scotch transmitter!

Rugby. J. GOODACRE.

The Tuning Note.

I WAS very interested to read your Editorial on the Tuning Note, and also S. Falloon's thoroughly practical letter in your September 16th issue. The suggestion certainly ought to be put into practice, as it should be invaluable not only to the amateur constructor, but also in aiding more serious research.

Might I suggest that it would be a trifle more convenient to arrange the rise at such a rate that the logarithm of the frequency should increase by .01 per second; the actual frequency at any time would be obtained by dividing the time in seconds, dividing by 100, and referring to logarithm tables. Mr. Falloon's scheme could be retained for rough measurements, as the only modification would be that the note would rise by an octave in 30.1 seconds instead of 30, as he suggests.

In addition, if the 1,000-cycle "pip" which you suggest should mark the beginning of the transmission is to timed as to occur half a second before the time when the frequency is exactly 32, we should have, t seconds after this,

$$\log_{10}(\text{frequency}) = 1.50 + \frac{t}{100}$$

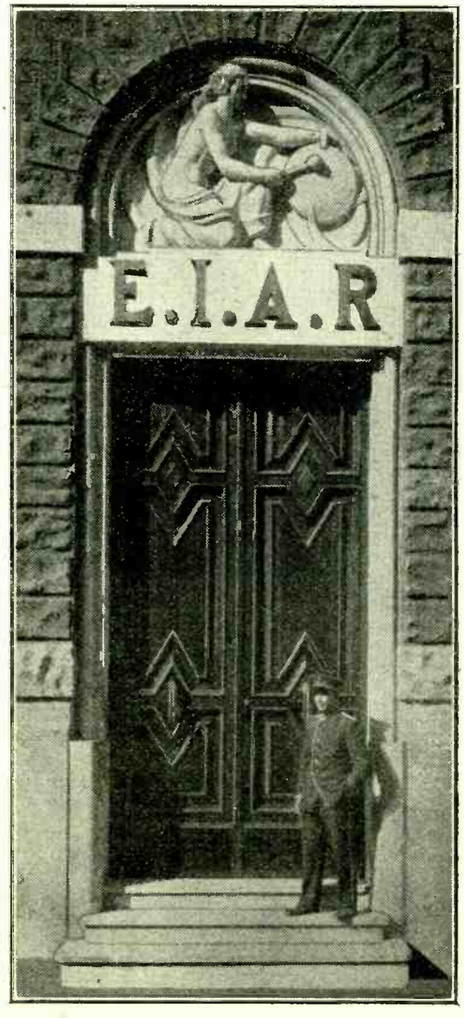
since $\log_{10} 32 = 1.505$. This "pip" might be preceded by a warning note of the present type, if this is necessary for the adjustment of transmitters, which would also prepare us for the "pip" itself.

Finally, it would be important to maintain the degree of modulation constant, or if it is varied to conform to the frequency characteristics of the station, the latter should be published. C. H. WESTCOTT.

Theale, Berks.

B.B.C. and Canned Music.

MR. MARTIN WOODROFFE'S complaint that too much "canned music" is broadcast by the B.B.C. is not particularly impressive.



RADIO HOUSE, ROME. The entrance to the new Rome studios strikes the architectural note which is sustained throughout the building.

In the first place, gramophone recitals, owing to their unusual scope for variety, seem to be among the most popular items broadcast, and make a welcome change from the light orchestral concerts which they usually replace,

Secondly, an analysis of the Daventry National and London Regional musical programmes for August 14th week shows that only 7 per cent. is provided by records, the remaining 93 per cent. being given by orchestras and soloists. Surely this, especially when compared with the figures for most Continental stations, is convincing enough proof of the unreasonableness of Mr. Woodroffe's allegations. J. E. HEALEY.

Muswell Hill, N.10.

BOOK REVIEW.

EVERYMAN'S WIRELESS, by C. L. Boltz, B.Sc. Pp. 335+208 Figs. Harrap and Co., Ltd., London, 1932. Price 7s. 6d. net.

To write a popular account of the elements of wireless which shall be at once informative, accurate, not unduly highbrow, and yet not unduly "condescending," is a task before which the most highly trained expert might well quail. We believe, however, that in this volume Mr. Boltz has very nearly, if not wholly, succeeded in accomplishing it. As stated in the Preface, "this book is for the person who is intelligent but ignorant of the principles of wireless reception." Such a person will be anxious to acquire his knowledge by the easiest and most direct route, and in pointing the way he should go, he will find in Mr. Boltz a painstaking and reliable guide, possessing, moreover, a nice sense of humour.

The author's third chapter—on Graphs and Mathematics—should prove of great assistance to those who have hitherto been deterred from the study of wireless through a fear of mathematics. The book, however, is not mathematical, although the advantages which accrue from a knowledge of elementary algebra are kept well in view.

Subsequent chapters explain lucidly the functions of the various components of the receiver, dealing in detail with the valve in its different aspects of amplifier and rectifier. The practical constructor will find much to interest him in the chapter on Circuits and Set-building, while the following chapter deals broadly with the main principles of "fault-finding" in the radio sense of that term.

One of the most important chapters in the book is that devoted to Eliminators and Battery Chargers, where the various methods of utilising the electric power supplied by mains and the precautions to be observed are carefully described. The volume concludes with an interesting chapter on the Baird system of television.

The fine large type and carefully drawn diagrams in this book make it a pleasure to read, while misprints are remarkably few. Intending readers may like to know of two. On p. 51 the continued product should read $2a^3b^2c^2$. On p. 161 there is a more serious slip, where the phrase "C and L" should be deleted in the eleventh line from the foot, and the words "expression in brackets" substituted.

Altogether a very promising book.

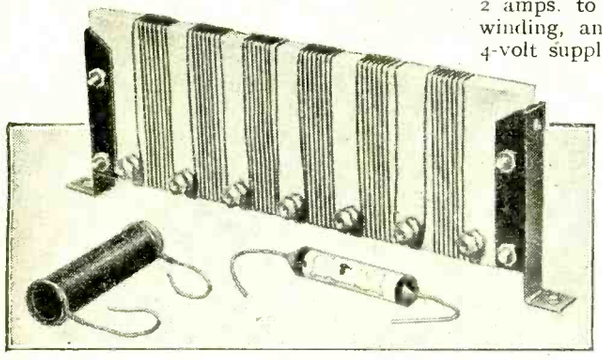
www.americanradiohistory.com

LABORATORY TESTS.

New Radio Products Reviewed.

SERADEX RESISTANCES.

THESE resistances are made in three different forms; there is a moulded type listed as an anode resistor, a wire-wound model intended for use in grid bias circuits,



Selection of Seradex resistances comprising moulded type, biasing model, and charging resistance.

and a heavy-duty resistance, certain models of which are suitable for use in D.C. mains sets.

The moulded resistor is comparatively small, considering it is rated to dissipate 2 watts, for the overall size is but 1⅝in.×⅝in. A current of 8 mA. caused an appreciable rise in temperature in the case of the 25,000-ohm specimen tested, yet the resistor appeared quite capable of carrying this current without stress, but the value of the resistance decreased by approximately 5 per cent.

With 1 watt only dissipated, there was very little change either in resistance value or in temperature. This type is made in all the usual values, and each costs 10½d.

A specimen 500-ohm bias resistance wound on a glass tube was capable of handling a current of 0.1 amp. without an excessive rise in temperature when well ventilated, but under normal conditions of use in a set it might be well to limit the current to about 70 mA. for the 500-ohm size. They cost 1s. 6d. each.

One of the heavy-duty models is intended for use in L.T. battery chargers, and is wound on a rectangular former made of heat-resisting material. The specimen tested was a tapped model wound with six equal sections and having a total resistance of 18 ohms. It will carry a current of 1 ampere and remain quite cool when mounted in the open. These models cost 4s. 6d. each, and supplies are obtainable from Trevor Pepper, 48, Wake Green Road, Moseley, Birmingham.

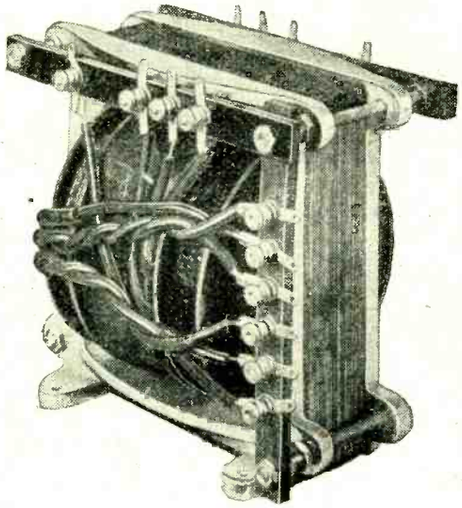
CHALLIS TRANSFORMERS FOR NEW WESTINGHOUSE RECTIFIERS.

THE range of mains transformers made by O. M. Challis, 22, Park Road and Wells Street, Rugby, Yorks, has recently been augmented by the addition of three new models designed especially for the Westinghouse rectifiers H.T.9, H.T.10, and H.T.11. The specimen sent in for test is intended for use with the last-mentioned model and is provided with three alternative output tappings giving 200, 250, and 300 volts A.C. respectively. This should prove a very useful feature, as it enables the D.C. output to be varied between quite wide limits.

Our tests were made with the rectifier connected to the 300-volt tapping, a voltage doubling circuit was employed, and the D.C. output measured with the L.T. windings shunted by resistances which allowed 2 amps. to flow in the case of the 6-volt winding, and 4 amps. in the case of the 4-volt supply.

The D.C. output was then measured at various current loads up to the maximum of 150 mA. In the curve shown on the graph a correction has been made for the voltage dropped across the smoothing choke, and the values given therefore represent the D.C. voltages appearing between the points X and Y on the diagram. Suitable correction can now be made for any individual case, since it is necessary only to calculate the voltage lost in the particular choke used and deduct this from the values obtained from the curve.

If a super power output valve is employed requiring some 400 volts H.T., and the total

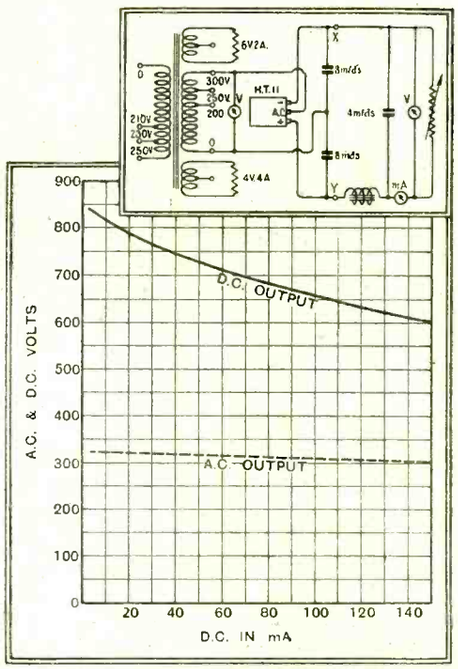


New model Challis mains transformer for use with Westinghouse H.T.11. rectifier.

anode current is about 100 mA., the transformer will provide an ample surplus for energising the field winding on the loud speaker by utilising it as the smoothing choke, and yet leave sufficient to meet the requirements of grid bias.

The A.C. output from the L.T. windings is very well regulated indeed, for the low-tension voltages are not influenced to any appreciable extent by the load on the H.T. circuit. These voltages are substantially correct when 100 mA. are drawn from the rectifier, as the supply for the A.C. valves is then exactly 4 volts at 4 amps., while the power valve supply measured 5.9 volts at 2 amps.

Between maximum and minimum H.T. loads the L.T. voltages change by 0.05 volt only. Both L.T. windings are centre tapped, and the tappings are provided also on the primary winding to suit standard supplies between 200 and 250 volts A.C. at 40 to 100 cycles. The price of this model is 50s.



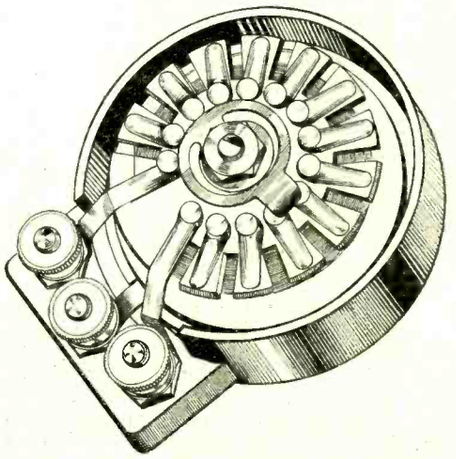
Regulation curves showing the D.C. and A.C. output from Challis transformer, using Westinghouse H.T.11. rectifier.

TUNEWELL WIRE-WOUND POTENTIOMETER.

IN the new Tunewell wire-wound potentiometer contact with the fine resistance wire is made at 14 points and the tappings are brought out to a diminutive stud switch embodied in the bobbin on which the resistance is wound. Although this does not provide a continuous change in resistance the tappings are sufficient in number to afford a variation quite adequate for the requirements of volume control, or for such other functions as are usually assigned to resistances of this type in modern receivers.

The obvious advantage of this design is that the resistance wire is not subjected to the slightest mechanical stresss.

The type P is rated to dissipate three watts and the resistance is tapped at equal intervals throughout. These are more suitable for voltage control. In the type V the resistance is tapped to give a logarithmic change in value, so that this model would be used normally as a volume control. They are made in all the usual values, and the price is 5s. 6d. in each case. The makers are Tunewell Radio, Ltd., 54, Station Road, New Southgate, London, N.11.



Tunewell wire-wound potentiometer fitted with a 14-point stud switch.

www.americanradiohistory.com

READERS' PROBLEMS.

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which particulars, with the fee charged, are to be found on page 342.

Using a Microphone.

THOSE who have tried the experiment of connecting a microphone to the input end of their L.F. amplifiers do not need to be told that great care should be taken to prevent acoustic reaction between this instrument and the loud speaker. The effect of such reaction is a "howl" which gradually builds up in intensity. To a reader who wishes to try this arrangement we would offer the advice that the microphone and loud speaker should be as far apart as possible, and that particular care should be taken so that sound-waves from the loud speaker do not impinge upon the microphone. Loud speakers of the horn type which are, of course, strongly directional, help to reduce this form of interaction, provided they are properly mounted.

There is also a possibility of trouble through electrical feed-back between the output and input leads of the amplifier, and it is as well to connect the microphone by means of screened leads, the metal screening being, of course, earthed.

Short-wave By-pass Condensers.

IT has been suggested that, to be on the safe side, it is often a good plan to use mica-dielectric by-pass condensers in short-wave receivers, in order to avoid the risk of instability that may be brought about by those of the paper-dielectric type if they are not entirely non-inductive.

A correspondent, who is perhaps inclined to attach rather too much importance to this suggestion, enters a mild protest at the cost of mica condensers of the capacity usually specified for H.F. by-pass purposes in broadcast sets. Obviously, he is under the impression that the right value of by-pass condenser in a short-wave receiver is the same as that in a set designed to cover wavelengths between, say, 200 and 2,000 metres.

This is a mistake. Ignoring altogether the possibility of inductive properties, a capacity very much lower than that customarily used is suitable for a set which deals only with the higher frequencies. For most short-wave sets a capacity of 0.01 mfd. is quite as effective as the value customarily employed in broadcast sets. Mica condensers of this value are anything but expensive.

Continuous Volume Control.

SEVERAL readers have asked how a "continuous" volume control may be arranged in various types of receiver. They refer, of course, to the form of control in which a variation of sensitivity ranging from inaudibility to "maximum reaction" may be obtained by the operation of a single knob.

As an example of a very satisfactory method of single-knob control, we can hardly do better than take the arrangement included in the latest G.E.C. "Music Magnet." The essentials of the arrangement embodied in this set are shown diagrammatically in Fig. 1; the volume-reaction regulating potentiometer is so connected that it both controls the aerial input and the extent of reaction feed-back.

This system is not difficult to understand; if it be imagined that the potentiometer slider is at the end of the resistance marked X, it will be realised that the aerial is virtually short-circuited to earth, and, further, by tracing out the reaction circuit from the anode of the detector valve, it will be seen that the maximum available amount of resistance is in series with this circuit. Thus it follows that reaction effects are also at minimum.

As the potentiometer slider is moved towards the end of the resistance element marked Y, the aerial short-circuit is progressively removed, and simultaneously an increasing amount of H.F. energy is allowed to pass from the detector anode through the reaction coil and back to earth.

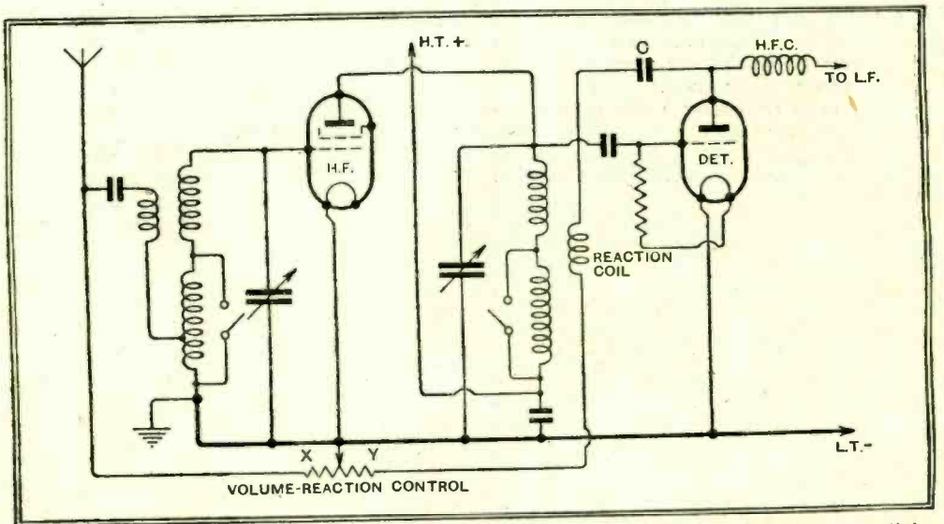


Fig. 1—Double-acting volume control: Sensitivity may be reduced by imposing a partial short-circuit between aerial and earth and simultaneously by increasing the amount of resistance in the reaction circuit.

The basic principle of this double-acting control device is applicable to almost any set, but it should be realised that a certain amount of finesse is necessary in the proportioning of the reaction coil to the tuned windings, both with regard to the number of turns and its relative position; the value of the control potentiometer must also be carefully chosen, and the capacity of the feed condenser C (which incidentally prevents an H.T. short-circuit) also enters into the picture.

Why 110 kc.?

HAVING lately interested himself in the fundamental principles of the superheterodyne, a querist asks why a frequency of 110 kc. seems to have been chosen almost universally for the intermediate-frequency amplifier of sets of this type. He goes on to say that surely the matter of frequency is not of very great importance.

With this last statement we can hardly agree. As a result of a great deal of experimental work it has been decided that under present-day broadcasting conditions in this country the use of an intermediate frequency of 110 kc. confers the maximum possible immunity from the various forms of interference—second channel, beat, and I.F. harmonic.

As the subject is one which cannot be treated adequately in these columns we must ask our querist either to accept this bald and unsupporting statement, or else to read articles on the subject which appeared in our issues of May 15th and 20th, 1931, and March 2nd, 1932.

Unbiased.

IT is not unusual for us to receive letters stating that the sensitivity of a set is improved by disconnecting the grid bias cell, or more often the connection to an automatic bias resistor.

The obvious thing to say in such cases is that the bias normally applied is incorrect for the other working conditions, or that the valve itself is defective.

In theory, and sometimes in practice, the result of interrupting the grid return lead is to allow the grid to become so negatively charged that the valve is choked. In this case practically no signals will be heard; but incidental leakages generally prevent this choking effect, and it may be that, by interrupting the return circuit, the grid assumes by chance a more correct negative potential than that applied from the normal source of bias.

Although there may be a temptation to do so, this is hardly a case for "leaving well alone." For one thing, the incidental leakages which will determine the grid circuit operating conditions are likely to vary, and so when this effect is encountered it is wise to make a careful check of the operating conditions of the anode, screening grid, and grid circuits.

www.americanradiohistory.com

The Wireless World

A PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 685. FRIDAY, OCTOBER 14TH, 1932. VOL. XXXI. No. 15.

Editor:
HUGH S. POCOCK.

Proprietors: ILIFFE & SONS LTD.

Editorial Offices:
116-117, FLEET STREET, LONDON, E.C.4.
Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:
DORSET HOUSE, TUDOR STREET, LONDON, E.C.4.
Telephone: City 2846 (15 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.
Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS.

EDITORIAL COMMENT.

Too Many Valves.

A Case for Weeding Out.

IF a wireless set could be compared to a dog, and the valve to the dog's tail, we could say, without fear of contradiction, that in England it is the tail which wags the dog and that this is a position quite the reverse of that which holds good in America and, in fact, in most countries on the Continent of Europe as well.

Because the section of the industry devoted to valve manufacture was developed long before any organisation started to take shape amongst manufacturers of complete sets, the designers of receivers have invariably started work with the choice of the first components of their set, namely the valves, already settled for them, and around the valves available the sets have had to be designed. In America it has been the set manufacturers who dictated to the valve designers and told them what particular valves they required for their sets of the next season. It would be a little difficult to decide arbitrarily which of the two systems is to be preferred, but undoubtedly in this country the fact that valve manufacturers have had a free hand to develop valves of extremely high performance has resulted in British sets being more efficient in terms of the number of valve stages than equivalent sets in America.

The time has come now, we think, when valve manufacturers, before proceeding to the development of still better valves than those which are at present available, should do something to put order into the present position. There are to-day included in manufacturers' lists far too many types of valves which are either actually obsolete or at least of comparatively little importance. In our view, as a result of the great improvements in the two-volt filaments which have been made during the past year, practically all the four-volt and six-volt battery valves could be regarded as obsolete and be retained merely for old receivers requiring valves of these voltages as replacements. In addition, there are a number of individual valves still shown in manufacturers' lists which have been replaced by others of similar but better characteristics.

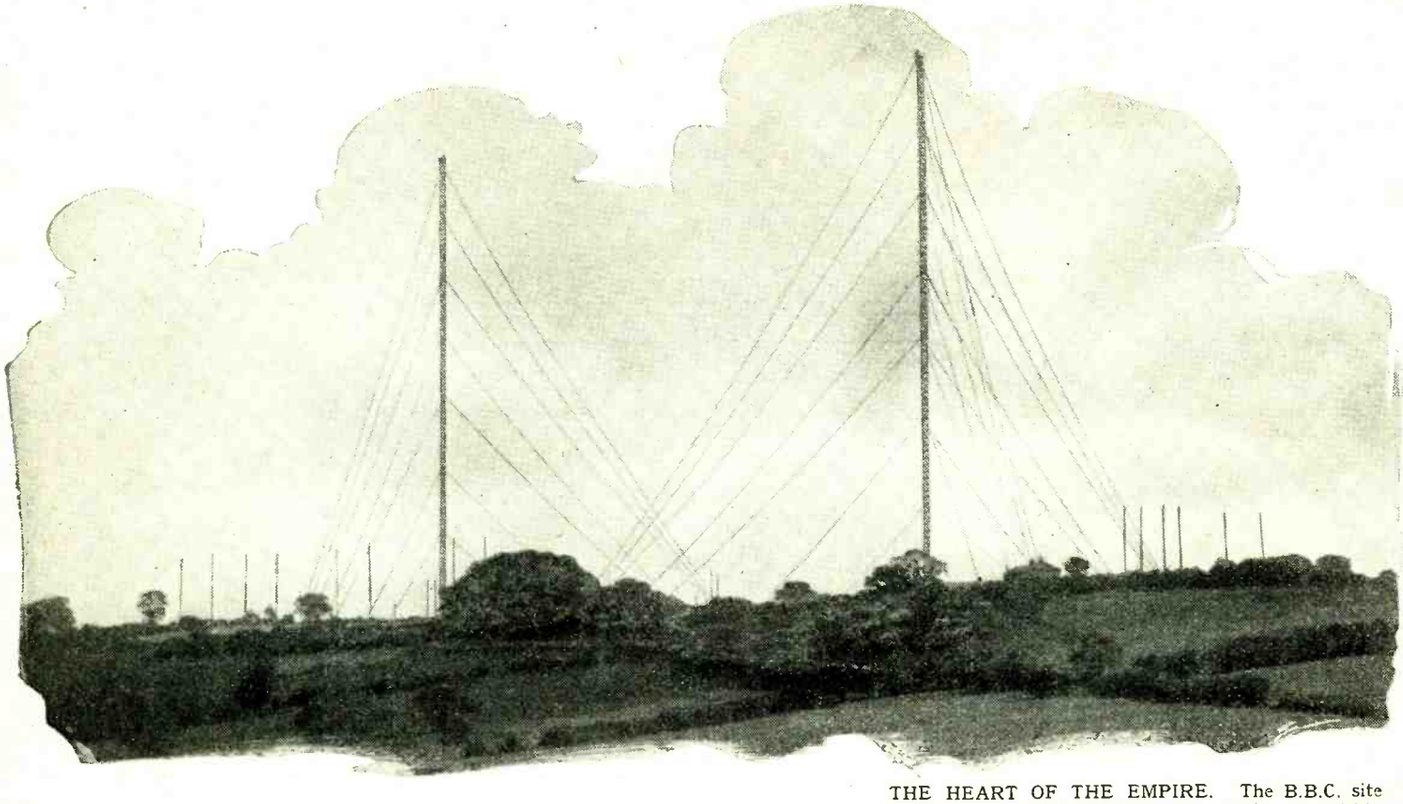
We would urge, for the consideration of the valve manufacturers, that in future they should list only such valves as are required for present and future receiver designs, and that all other types should, if listed at all, be included in a supplementary list not for general distribution. Only in this way will it be possible to accustom the user to making his choice of valves from a smaller selection, although, in point of fact, he will still have the same variety of operating characteristics from which to choose valves suited to his purpose.

The Next Step.

When once this first weeding out has been achieved, then the next step for the consideration of valve manufacturers might well be a grouping of the remaining valves under headings indicating the purpose for which they are suitable, and some uniform type marking would be a further welcome improvement.

There have at various times been efforts made by individual valve manufacturers to standardise the type markings so as to indicate the characteristics of individual valves, but so far these efforts have been of little value, due in large measure to the apparent unwillingness of valve manufacturers collectively to adopt the same system.

www.americanradiohistory.com



THE HEART OF THE EMPIRE. The B.B.C. site at Daventry, which will become world famous within the next few months. The small masts are intended for Empire broadcasting.

The Facts About Empire Broadcasting.

How the Zone System Will Work.

By E. C. THOMSON

THAT *The Wireless World* should display an almost paternal interest in the plans now going forward to supply all parts of the Empire with a broadcasting service is not surprising. The new service, which the B.B.C.'s Chief Engineer hopes to inaugurate on an experimental basis before the end of the year, represents the fruition of a scheme for which this journal has fought ever since the subject—indeed, the very term "Empire Broadcasting"—received first public mention in its pages. In our issue of July 14th, 1926, it was written:—"We feel that steps should be taken without delay to arrive at some solution which would meet the present demands of the Colonies for a broadcasting service from the home country." *The Wireless World* continued to hammer out the demand, and after several years had the satisfaction of seeing the question discussed at Imperial and Colonial Conferences.

It is doubtful whether, when the British Broadcasting Corporation submitted proposals to the delegates of Empire in the summer of 1930, the possibilities of the scheme were even then fully envisaged. For the scheme concerns not merely the British Empire, but the whole world. It provides for the most influential, if not the biggest, radio network yet planned. Fortunately, the B.B.C. did not attempt to dazzle the delegates with mere theory; the Corporation engineers could point with satisfaction to the practical pioneer work of 5SW, Chelmsford, which began its transmissions on November 5th, 1927. No one would contend that these experiments have ever justified any other name, but nevertheless, 5SW can to-day be heard at some time or another in practically all parts of the world, although it is restricted in wavelength to the 24-metre band. No fewer than eight different wavelengths will be utilised in the new scheme, ranging from 13.97 to 49.586 metres. With these, used in relation to a carefully thought out system of zones and times, there will be little doubt that no part of the Empire, and perhaps no part of the globe, will be left outside the range of British programmes.

MORE than six years ago "The Wireless World" opened a campaign which will reach its consummation in December next with the inauguration of a regular Empire broadcasting service from Daventry. This article describes the zone system devised by the B.B.C. engineers to ensure, as far as possible, that every listener in the Empire can hear a two-hour programme from the Mother Country on every day of the week.

With characteristic care Mr. Noel Ashbridge, Chief Engineer of the B.B.C., and his technical staff have worked on a scheme in which the Empire is divided into five zones, the divisions depending principally upon the time factor and also influenced by considerations of direction and distance. The five zones are as follows:—

Zone 1.—Australia and New Zealand and the Pacific Islands.

Zone 2.—India, Burma, and the Malay States.

Zone 3.—Iraq, Egypt, East Africa, and South Africa.

Zone 4.—West Africa, including Nigeria and the Gold Coast and the Atlantic Islands (Tristan da Cunha and the Falkland Islands).

Zone 5.—Canada, West Indies, Trinidad, British Guiana, and the Pacific Islands.

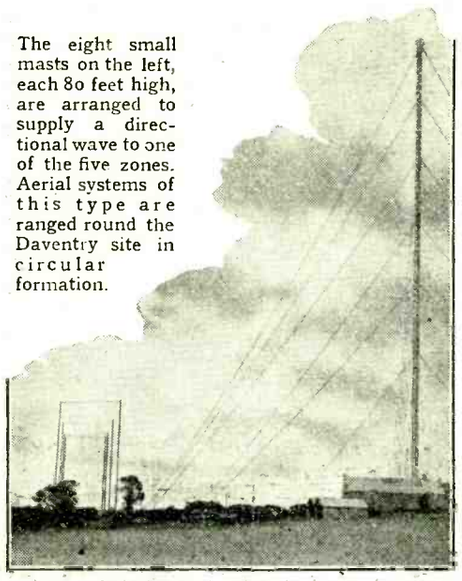
www.americanradiohistory.com

The Facts About Empire Broadcasting.—

And how are these zones to be effectually covered? Some of them require more wavelengths than others, the choice being based upon results already noted in short-wave transmission and reception. It has been found, for example, that Zone 1 will require only one wavelength, i.e., 25 metres, experience with 5SW on approximately this wavelength having shown its suitability for the Antipodes. It is understood that the actual wavelengths to be used at Daventry are the following:—

K.c.	Metres.
6,050	49.586
9,510	31.545
9,585	31.297
11,750	25.532
11.865	25.284
15,140	19.815
17,770	16.88
21,470	13.97

Using these wavelengths the B.B.C. will seek, as far as possible, to provide every listener within the Empire with a two-hour programme between 6 p.m. and midnight local time. At one extremity of the zone a programme may be received between 6 and 8 p.m., whereas the identical transmission may be entertaining listeners at the other end of the zone between 10 p.m. and midnight. This six-hour "swing" provides a certain amount of elasticity in the arrangement of programme timing. Zone 1, as already mentioned, will require a single wavelength of 25 metres. Zone 2 will require three wavelengths, one each in the 17-, 25-, and 32-metre bands. Zone 3 will have two wavelengths—14 metres for daylight working and 32 metres when the whole or portion of the route is in darkness. Zone 4 will need two wavelengths, viz., 32 and 48 metres; while Zone 5 will require three wavelengths, viz., 19, 32 and 48 metres.



The eight small masts on the left, each 80 feet high, are arranged to supply a directional wave to one of the five zones. Aerial systems of this type are ranged round the Daventry site in circular formation.

It is natural with such an abundance of wavelengths and with so many directions to be served that a complex aerial system is necessary. The masts seen in the illustrations are each 80ft. in height. In all, there are seventeen aerials, eleven of which are directional. They are ranged in groups to form a circle around the B.B.C. ground at Daventry.

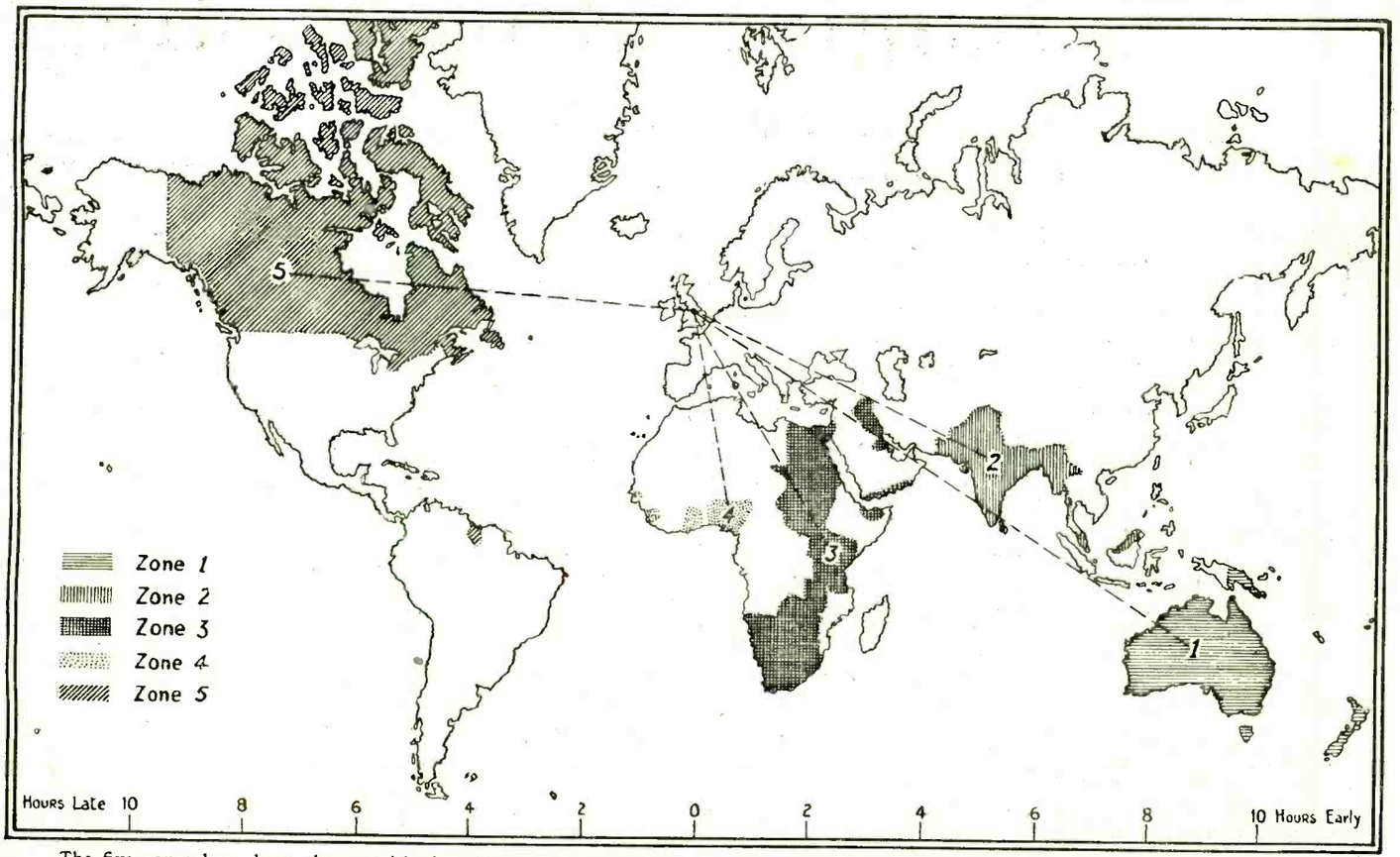
Fortunately, it should at no time be necessary to transmit to all zones simultaneously; thus two transmitters capable of being transferred rapidly from one aerial system to another are considered sufficient. These are being installed by Standard Telephones and Cables, Ltd., and the power of each will be of the order of 15 to 20 kilowatts.

To keep wavelengths stable quartz crystal drives will be used, ensuring an error not exceeding one part in 25,000, and altogether some eighteen separate crystals will be necessary.

A Warning.

While reasonably good quality may be expected, Mr. Noel Ashbridge has himself made an engagingly frank statement virtually warning Empire listeners not to expect too much. The aim will be to provide musical quality equal to that of medium-wave transmitters with a good overall frequency characteristic and high peak modulation without distortion. But—and this is the substance of the warning—the service will not usually be so good

THE EMPIRE BROADCASTING SCHEME AT A GLANCE.



The five zones have been chosen with the object of ensuring that every listener in the Empire can hear a daily British programme of two hours' duration at reasonable strength and clarity. Directional transmission, and a multiplicity of wavelengths to take into account such factors as time and distance, should bring about the desired result. Zone 4 includes the island of Tristan da Cunha (in the Southern Atlantic) and the Falkland Islands. It will be seen that Zone 5 includes an isolated portion, viz., British Guiana, in addition to Trinidad.

www.americanradiohistory.com

The Facts About Empire Broadcasting.—as that available in parts of Great Britain where the reception of our National stations is least satisfactory. Quality such as would please a musical critic will not be looked for, though, as frequently happens in wireless, there may be freak occasions when an expert listener in Kenya will hear the Gershom Parkington Quintet in London very much better than persons who have forgotten grid-bias or other little matters in, say, Lewisham or Wigan. It is understood that performances by symphony orchestras and other large musical combinations will be excluded from the Empire microphone.

Already a comprehensive reception checking system is being organised; selected listeners in all corners of the Empire are being instructed to tune in at stated times and send in reports to headquarters in London. The services of these "watchers" will be retained for a long time to come, as it seems to be universally recognised that for at least six months the service will be experimental. It could hardly be otherwise. If Mr. Ashbridge and his assistants, working with pencil and paper in one of those top rooms at Broadcasting House, could have devised an Empire system giving perfect results at the outset, they would not be engineers but magicians.

Arranging the Programmes.

The management of programmes for the new station will involve some quite novel problems. Mr. Cecil Graves, the Director of Empire Broadcasting, will make it his aim to supply Empire listeners, as far as possible, with direct performances, i.e., transmissions direct from the studio at the moment that the performance is taking place. Naturally, this will be easier to achieve in the case of programmes for Zones 3 and 4, where the time difference is immaterial.

In the case of the Antipodes, a problem of topsy-turvydom presents itself. Australia, for example, would be relishing "physical jerks" or rousing breakfast-time music just when people on the Greenwich longitude are feeling the need of inaction. It will therefore be necessary to make extensive use of the Blattnerphone recording apparatus, which will enable listeners in the different zones to hear the identical programme within a few hours of each other.

News, with a capital N, will be the mainspring of the Empire broadcasting service; and, in addition to the speedy reporting of the day's happenings, the News Department will take under its wing relays of historic and national events.

It is understood that the first test signals from Daventry will go out towards the end of November on one or other of the wavelengths already mentioned. *The Wireless World* readers all over the globe will listen eagerly for the inaugural signals, and it will be interesting to discover which corner of the Empire first becomes alive to the supreme importance of "Daventry, England."

SELECTIVITY *and* TONE CORRECTION.

Complete Confirmation of "The Wireless World" Attitude to this Hitherto Controversial Subject.

DURING the last year or two there has been a great deal of controversy over the possibility of using highly selective tuning circuits in conjunction with tone correction in order to obtain simultaneously freedom from interference and high quality reproduction of broadcasting. This discussion has arisen as a direct result of the proposals put forward by Dr. James Robinson in connection with what he has termed "stenode" principles of reception. Many adherents of the earlier tuning systems have believed that the replacement of the desired high modulation frequencies by the application of tone correction would result also in the replacement of the interference, and so give no effective improvement. On the other hand, statements have been promulgated by certain advocates of the tone-correction principle to the effect that it was the solution to all interference problems, and would even permit the elimination of heterodyne whistles.

In view of the disagreement which has existed the recently published Report No. 12 of the Radio Research Board[1] is specially valuable. This report contains a mathematical analysis of the action of a highly selective circuit in conjunction with both square law and linear detectors, and it is shown that *tone correction in the low frequency circuits is fully effective in restoring the high modulation frequencies to their correct level in relation to the low frequencies.*

An analysis is also made of the effect of a number of the more common forms of interference, and the conclusions reached are of the greatest importance in receiver design. Briefly, it is possible to obtain almost any desired degree of freedom from interference when this is due to a heterodyne action which does not involve the carrier of the wanted station, and this without any sacrifice in the overall response to the modulation of the desired station. On the other hand, it is not possible to obtain any appreciable freedom from interference which is due to a heterodyne action involving the carrier of the wanted station, except by methods which affect the modulation frequency response to the desired station.

Heterodyne Whistles.

In practice, *this means that intelligible modulation interference and that portion of sideband heterodyning due to the beating of the sidebands of the wanted station with either the carrier or the sidebands of the unwanted station, can be completely avoided.* The heterodyne whistle between adjacent carriers, however, the sideband heterodyning due to the sidebands of the unwanted station beating with the wanted carrier cannot be reduced. Indeed, the degree of interference from the latter sources is almost exactly the same with a tone-corrected receiver as with an ordinary unselective set when both have the same modulation frequency response.

These conclusions are not only important in themselves, but are of interest in their complete confirmation of statements which have repeatedly appeared in *The Wireless World* during past months, when the paper stood alone in supporting the principle of high selectivity with tone correction. In an article entitled "Superheterodyne Improvements"[2] it was pointed out that "tone correction is theoretically capable of the better results (i.e., better than the band-pass filter), for there is no necessity as regards modulation inference for imposing the foregoing upper limit to the frequency response. . . . Unfortunately, however, modulation interference is the least serious trouble encountered at the present time." It was further said that "with any method of reception limits to the frequency response are imposed by the necessity for avoiding heterodyne interference, for there is no known method by which heterodyne whistles may be removed without also losing notes of the same frequency."

Amplitude Distortion.

In the section dealing with the quartz crystal type of highly selective circuit, however, it is shown that it is possible to eliminate a single fixed frequency whistle when this is due to interference on one side of the desired carrier only by an adjustment of the crystal circuit. This adjustment renders the resonance curve asymmetrical, and musical notes of the same frequency as the whistle can be received through one only of the sidebands of the wanted station. The asymmetry of the curve introduces amplitude distortion and necessitates a considerable alteration to the normal degree of tone correction necessary for an even response.

The results arrived at on theoretical grounds are confirmed experimentally, and it is shown that no modification of ordinary theory is necessary to account for the action of highly selective tone-corrected receivers. The measured overall response curve of a set of this type is given, and it is flat within 2 decibels for frequencies up to 8,000 cycles. The highly selective circuits used in the experiments were obtained chiefly by the aid of reaction, and it is mentioned that such circuits are reasonably stable and behave just as though the low resistance were an inherent property, provided that the impressed voltage does not exceed a certain figure.

An important note is included with regard to square law detection. This has rather fallen into disrepute because it usually introduces amplitude distortion. It is pointed out, however, that the degree of distortion depends upon the modulation depth of the input, and as this is reduced very considerably by the action of a highly selective circuit, the actual distorton in the detector output may be negligible. Although tone correction will inevitably accentuate any harmonic content of the detector output, there is still a considerable gain, and in the example quoted the total distortion is only 5 per cent. for a 100 per cent. modulated input. It thus seems permissible from a quality viewpoint to use square law detection in highly selective tone-corrected sets.

Not only is the theoretical investigation very complete, but the range of experimental research, which was carried out chiefly at the National Physical Laboratory, covers a wide field, and the report forms a valuable addition to existing data on the subject.

[1] Department of Scientific and Industrial Research, Radio Research, Special Report No. 12. "A Theoretical and Experimental Investigation of High Selectivity Tone-corrected Receiving Circuits" by F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. H.M. Stationery Office. Price 1s. 3d.

[2] *The Wireless World*, April 6th, 1932, p. 338.

www.americanradiohistory.com

NEWS of the WEEK.

Currents Events in Brief Review.

The Rising Tide.

EVERY listener can take satisfaction from the thought that he has in the world 139,999,999 colleagues, according to figures announced at the Madrid Radio Conference. The value of the individual wireless sets servicing these 140 million people is estimated at 200 million pounds. About £30,000 is spent annually throughout the world in broadcast transmission.

Tall and Persuasive.

BEWARE of "a tall and persuasive man" who describes himself as a Post Office representative. He is said to be touring the Midlands during the daytime and asking wives, in the absence of their husbands, to allow him to take the wireless set away for a day or two in order to overhaul it. Strangely enough, neither the man nor the set is seen again!

Our Stupendous Knowledge.

MANY readers of *The Wireless World* must be included in the encomium delivered last week by Mr. J. R. Eccles, headmaster of Gresham School, Holt, Norfolk. "Modern youths," he declared, "make one feel ignorant. Their information in certain directions is stupendous. I am daily astonished at their understanding of wireless and at the wonderful and ingenious sets they make."

Verb. Sap.

THE wireless trade will be well advised to take the warning of Mr. J. H. Whitley, chairman of the B.B.C., in his speech at the opening of the Northern Radio Exhibition at Manchester. Mr. Whitley expressed disappointment that so few radio manufacturers advertised short-wave sets specially designed for the Empire listener, despite the fact that the new service would be started before the end of the year. It would be a pity, he added, if this great new market was left to the foreigner.

The Pirate Campaign.

ZERO hour for the great Post Office drive against wireless pirates is still being kept secret, but it is understood that the officials at St. Martin's-le-Grand will shortly announce the date on which operations are to start all over the country. The distinction between this campaign and others is that the comings and goings of the detector vans will, according to a Post Office statement, be kept secret. This implies that the detection apparatus has reached such a pitch of efficiency that there is no further need to rely upon the psychological effect of the van's appearance. The famous "ghost car" is, in fact, "an ordinary looking limousine with an extraordinary inside."

We shall be ready to concede the latter point when the car succeeds in tracking an unlicensed listener without recourse to panic tactics and Press propaganda. Much of the success of previous campaigns has undoubtedly been due to the wholehearted co-operation of the Press.

Amateurs and a Non-stop Flight.

AMATEURS are to have another opportunity to co-operate in one of the most spectacular flights yet attempted. This will be the non-stop flight of the long-distance monoplane from Cranwell to Cape Town, which the Air Ministry hopes to commence between November 9th and 15th, or, failing suitable weather, between December 9th and 15th next.

The airplane, using the call-sign GEZAA on a wavelength of 33.71 metres, will transmit every two hours commencing at 0600 hours G.M.T. or the first even hour after the start, using the form CQ CQ CQ v. GEZAA GEZAA GEZAA, followed by the position. Since the transmission range is approximately 1,000 miles, readers of *The Wireless World* situated at different points along the route should have an excellent opportunity of picking up the 'plane on its journey via Berre, Tunis, Duala (Cameroon Mountain), Boma, St. Paul de Loanda, Walfish Bay, and Cape Town. The speed of the aircraft under normal conditions will be 90 to 100 miles an hour.

It is hoped that any British amateurs picking up messages from the aircraft will forward them to Head of Signals, Air Ministry, Kingsway, London, W.C.2. If a distress call should be intercepted, notification should be made by telephone immediately to Holborn 3434, Extension 383 or 370, or otherwise communicated to the Air Ministry by the quickest means available.

Post Office and Ultra-Short Waves.

THE first of the projected Post Office wireless telephones links using ultra-short waves will probably be established in the near future between South Wales and the West of England. We understand that 5-metre transmitters and receivers of the type exhibited at Radiolympia are being used at Lavernock on the Glamorgan side of the Bristol Channel, and at Brean Down on the Somerset side.

Brain Wave.

THE alarming increase in fatal accidents at railway level crossings in France has led to the suggestion that the trains themselves should operate light and sound signals at the crossings by interrupting a beam of light on a photo-electric cell some distance from the danger point.

This seems about the next best thing to abolishing the level crossings.

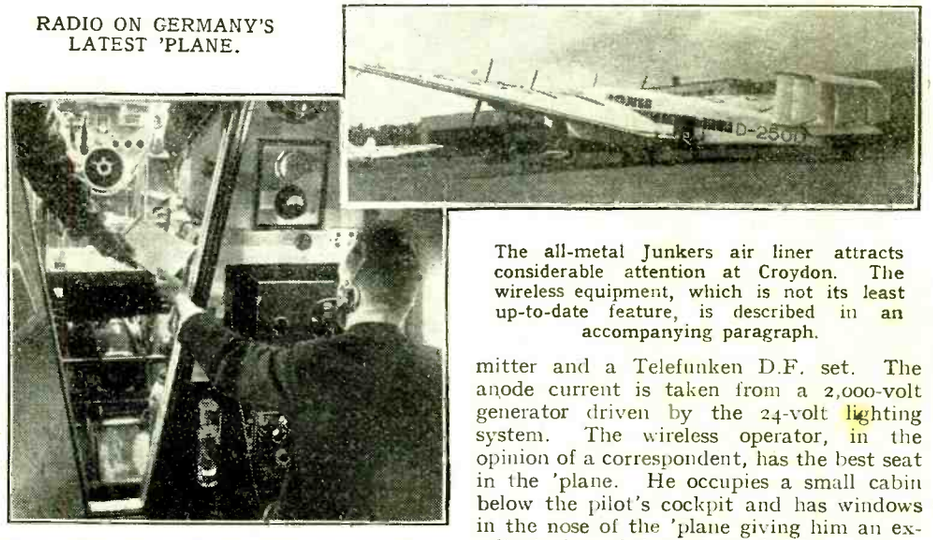
Radio on the Junker G38.

THREE wavelengths are used on Germany's latest giant aeroplane, the Junkers G38, which regularly covers the International line from London to Amsterdam. For direction finding the wavelength is 870 metres; telegraphy is conducted on 900 or 930 metres.

The 'plane uses a 100-watt Lorenz transmitter and a Telefunken D.F. set. The anode current is taken from a 2,000-volt generator driven by the 24-volt lighting system. The wireless operator, in the opinion of a correspondent, has the best seat in the 'plane. He occupies a small cabin below the pilot's cockpit and has windows in the nose of the 'plane giving him an excellent view of the country below.

An interesting gadget is a foot-brake pedal with which the operator can orientate the direction-finding aerial while his hands are free to manipulate the other controls.

RADIO ON GERMANY'S LATEST 'PLANE.



The all-metal Junkers air liner attracts considerable attention at Croydon. The wireless equipment, which is not its least up-to-date feature, is described in an accompanying paragraph.

Germany's "O.B." School.

A NEW school has arisen in Berlin for running commentators. It is being organised by the Berlin Funk-stunde to provide ordinary announcers with that professional touch which makes all the difference between a vivid report and a "tame" one.

Broadcasting Saves Costs.

IT is revealed in a supplementary budget of the League of Nations that Mr. de Valera's speech as President of the Council cost the League nothing. The additional annual expense of the broadcasts is counterbalanced by a reduction of expenses for publications for free distribution.

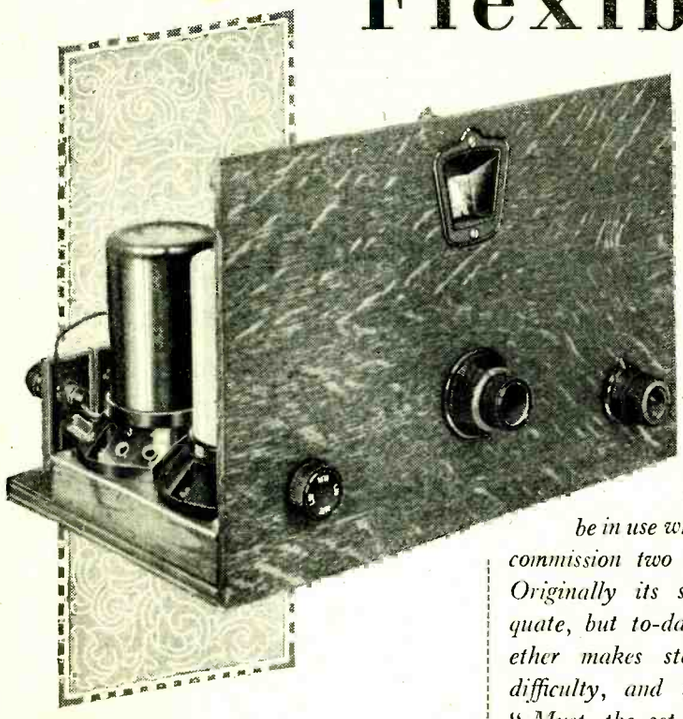
Using *Radio Nations*, the short-wave station at Prangins, the League can now tell the world of its activities at a fraction of the cost required for printing its news bulletins before the station was taken over. The messages are transmitted every Sunday night on 40.3 and 20.64 metres.

www.americanradiohistory.com

Flexible Band-Pass Unit.

A Simple Two-range Aerial Filter with Variable Selectivity Control.

By H. B. DENT.



MANY a receiver must still be in use which was first put into commission two or three years ago. Originally its selectivity was adequate, but to-day congestion in the ether makes station separation a difficulty, and the question arises, "Must the set be scrapped?" A happier alternative is to attach a highly selective unit of the type here described.

THERE must be many receivers in general use to-day which, although possessing adequate sensitivity for long-range reception, have been reduced to the status of local station sets solely because they lack the requisite selectivity to cope with the conditions obtaining to-day on the broadcast wavebands. This state of affairs need not necessarily continue, for with but little alteration to the receiver its selectivity can be greatly enhanced and made adequate for the reception of a reasonable number of foreign programmes.

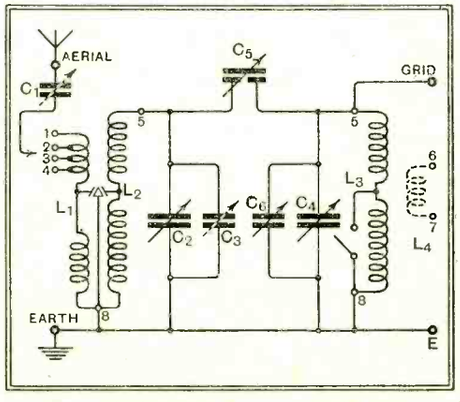
This can be achieved in one of two ways: either the H.F. resistance of the tuned circuits can be reduced or they can be increased in number. So far as the first mentioned alteration is concerned it is very doubtful if a very marked improvement can be effected in this direction just at present. When the new type of coils described in *The Wireless World* a few weeks ago become available for general use consideration might then be given to this course, but in the meantime we must look to the latter suggestion for the solution of the present difficulty.

Little Alteration to the Set.

Since it would seem that an increase in the number of the tuned circuits is the most satisfactory line of attack, the next consideration is how best to apply this without drastic alteration to the receiver. A single tuned circuit interposed between the aerial and the set offers a ready solution, but as there would then be three tuned circuits all adjusted to resonate at the same frequency—assuming one H.F. stage is employed—it is highly probable that the quality will show distinct signs of deterioration due to the attenuation of the side bands with three fairly sharply tuned circuits in cascade.

To preserve the quality it would then be necessary to apply compensation to the L.F. amplifier, but this entails considerable alteration to the set and would hardly seem justified in view of the fact that the additional unit can be designed to provide quite adequate selectivity without impairing the quality of reproduction.

So far as this matter is concerned the writer would venture the opinion that the addition of the band-pass filter to a set not so equipped will lead to an improvement in the tonal quality as well as affording a degree of selectivity not possible of attainment with the simple aerial tuning systems in vogue but a year or so ago.



Theoretical circuit diagram of the unit.

The general arrangement of the circuit employed for the unit is shown in the theoretical diagram.

Coils L_1 and L_2 are wound on the same former and form an H.F. transformer with an aperiodic aerial winding. Four tappings are provided on the medium-wave section for attachment of the aerial lead, and these, in conjunction with the compression-type variable condenser C_1, enable the input circuit to be adjusted for the best operating conditions in all localities and with every type of aerial. The secondary coil of this transformer is tuned by the condenser C_2, which is one member of a two-gang assembly, while its companion, C_4, is employed to tune the second coil L_3 in the filter. Both sections are fitted with small trimmers, one of which is controlled from the panel by a small knob concentric with the main tuning control. This section tunes the second coil (L_3) in the filter.

Top Capacity Coupling.

As it is essential that the coupling condenser C_5 should have a very low minimum capacity, a small air-dielectric condenser having two sets of fixed plates and one rotor was chosen for this position. The connections are made to the two sets of fixed vanes, and it is employed as a series-gap condenser. Used in this manner its minimum capacity is approximately 1.5 m-mfds. only, while the maximum value is of the order of 25 m-mfds.

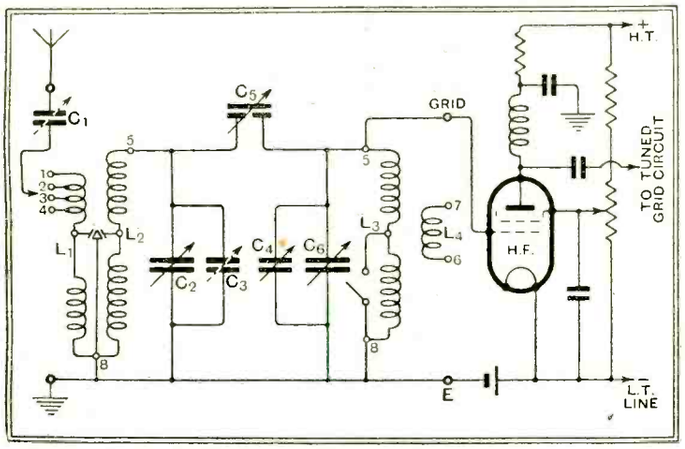
Set to the minimum value the unit can be used as a simple two-circuit tuner giving a very selective response curve, but, with the vanes just engaging, the unit assumes a band-pass characteristic giving a peak separation of about 8 kc. at 250 metres. At higher wavelengths more capacity will be required at C_5 to maintain this order of band width.

Since the unit replaces the existing aerial circuit in the receiver the first step is to remove all wires joined to the grid of the first valve. Should the set be a battery-operated model embodying an H.F. stage, grid bias for the first valve can be obtained by connecting a small cell of suitable voltage between the terminal E on the unit and the L.T. negative leg of the valve. In the case of a mains receiver where the grid bias is derived from a resistance in the cathode lead, E is connected direct to the negative line in the set. The output terminal marked "Grid"

www.americanradiohistory.com

Flexible Band-Pass Unit.—

is in all cases joined to the grid of the first valve in the set.

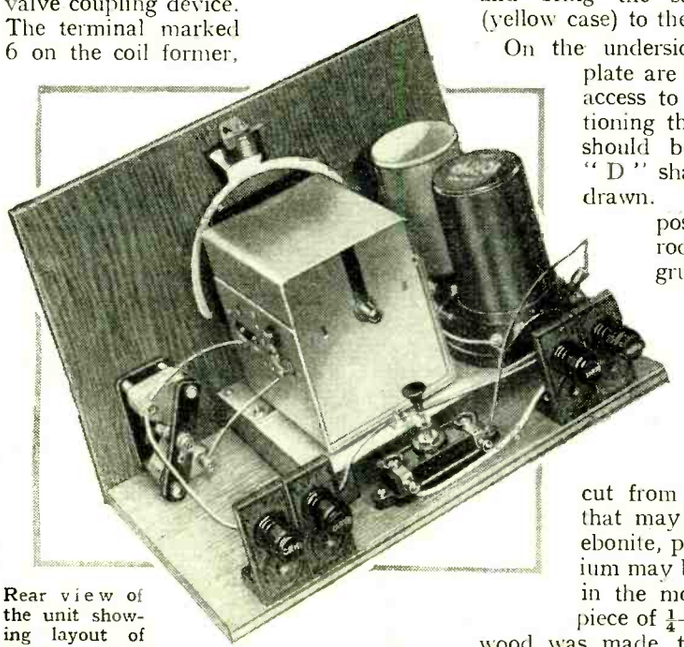


Showing the method of connecting the unit when an H.F. stage is used.

It will have been observed that the second coil in the filter is provided with a reaction winding which is brought into use only when the unit precedes a receiver in which the first valve functions as a detector. Assuming grid rectification is employed, all wires joined to the aerial side of the grid condenser are removed and the high potential output terminal connected to this point in place of the existing tuned circuit. The reaction winding L_4 is then connected so that the terminal marked 7 on the coil former is joined to the anode of the detector valve.

In all probability a reaction circuit would have been included in the original design, in which case an H.F. choke will be connected between the anode of the detector valve and the primary winding of the L.F. transformer or other inter-valve coupling device.

The terminal marked 6 on the coil former,



Rear view of the unit showing layout of the components.

which is the low potential end of the reaction winding, should be joined to the fixed vanes of the reaction condenser and a lead then taken from the moving vanes' terminal to the L.T. negative or earth line. Before making these changes all wires joined to the reaction condenser must be removed, but, of course, if the moving vanes are joined already to the earth line there will be no need to disturb this connection.

The construction does not call for a detailed description as it is perfectly straightforward. A baseboard layout is adopted, but it was thought advisable to mount the small aluminium plate on which the two Formo coils and the gang condenser are assembled on $\frac{3}{4}$-in. battens to bring the control knobs into a more accessible position on the panel. The coils required are the two band-pass models. These can be identified by the colour of their screening pots; a green case is fitted to the aerial, or first coil of the filter, while the second coil is enclosed in a yellow screen. As supplied by the makers the green-cased coil is mounted adjacent to the panel, but before assembling the unit it will be necessary to transpose the coils and bring the second band-pass coil (yellow case) to the front.

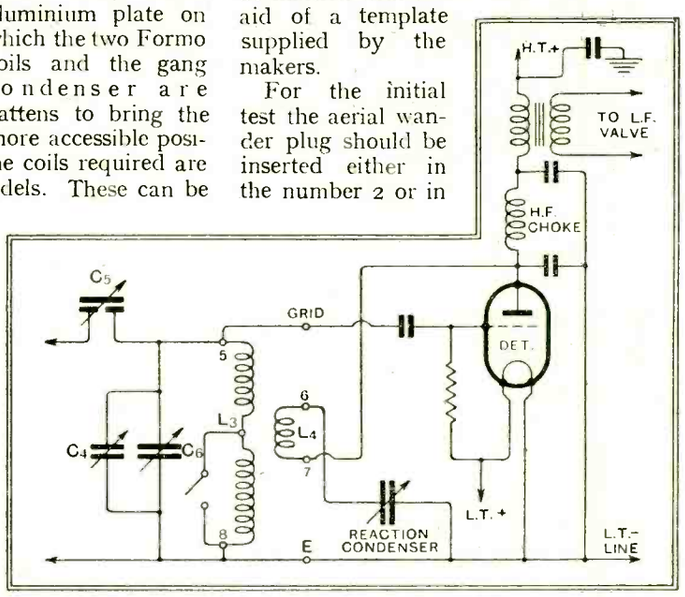
On the underside of the aluminium plate are two small holes giving access to the grub screws positioning the switch rod. These should be loosened when the "D" shaped rod can be withdrawn. After changing the position of the coils the rod is replaced and the grub screws tightened, but this operation is carried out with the screws fixing the coils in position sufficiently loose to enable them to be correctly aligned.

The panel can be cut from any suitable material that may be available, such as ebonite, paxolin or even aluminium may be employed, although in the model illustrated here a piece of $\frac{1}{4}$-in. oak-faced three-ply wood was made to serve the purpose. This measures 12 ins. long and 7 ins. high and is fixed to the baseboard by four wood screws $\frac{5}{8}$ in. long.

It would be advisable to complete as much of the wiring as possible before fixing the panel to the baseboard as some difficulty might be experienced in gaining access to the terminals on the two coil formers if this operation is left until the panel is in position.

There are three controls only on the panel, and these are arranged symmetrically with the condenser drive in the centre. On the left is the wave-change switch, while the right-hand knob operates the small coupling condenser. The position of the two first mentioned controls can be scaled off from the Formo chassis, allowing an additional $\frac{3}{4}$ in. in height for the small battens on which it is mounted. Having determined the position of the hole for the condenser spindle the aperture through which the scale is viewed can then be marked with the aid of a template supplied by the makers.

For the initial test the aerial wander plug should be inserted either in the number 2 or in the number 3 socket on the base of the aerial coil former, and the coupling condenser C_5 adjusted to its minimum position.



The reaction coil is connected as shown when the detector is the first valve in the set.

Adjustments.

The air-dielectric trimmer is set to about the mid-way position and the local station tuned in. Adjustments are then made to the other trimming condenser until signals are received at maximum strength. During this operation the main condenser

LIST OF PARTS.

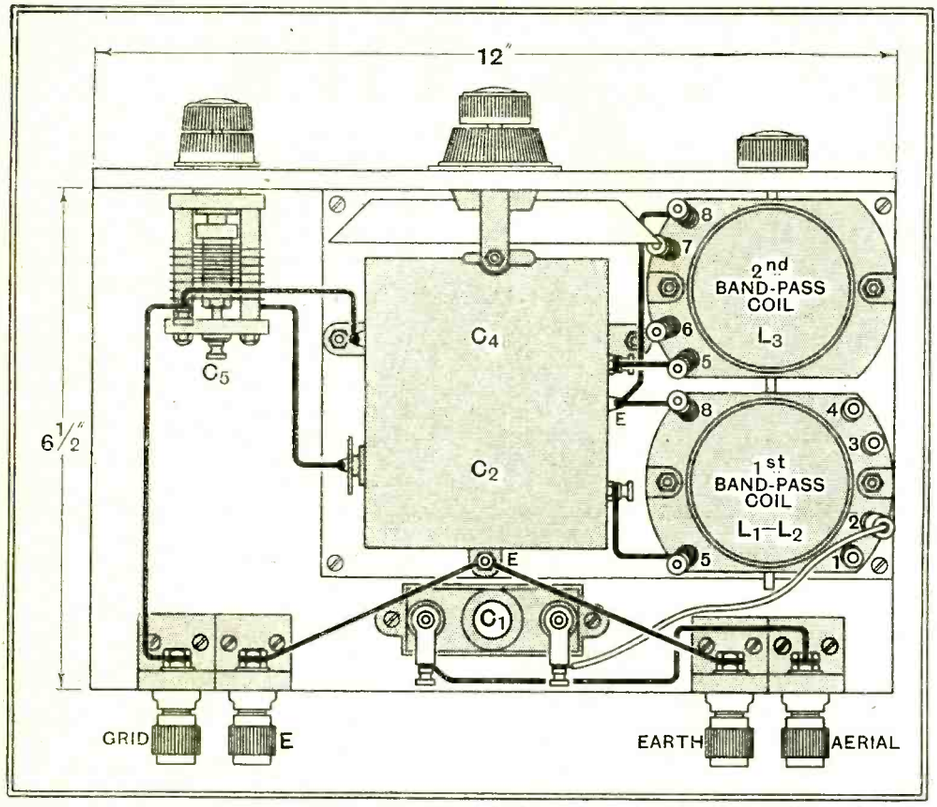
The parts shown below were actually used by the designer, but alternative components can be employed in most cases.

1 *Band-pass unit* comprising two coils and gang condenser assembled on aluminium base = = = = = (*Formo*)
1 *Compression condenser*, Type J. (*Goltone*)
4 *Single terminal mounts* = (*Goltone*)
4 *Terminals* = = = (*Belling Lee*)
1 *Slow motion midget condenser* (*Ormond*)

This unit is available for inspection by readers at the Editorial Offices, 116, Fleet Street, London, E.C.4.

www.americanradiohistory.com

Flexible Band-Pass Unit.— should be adjusted from time to time to maintain the circuits in resonance.



Practical diagram of the connections, also dimensions of the baseboard.

A dial light is included in the condenser assembly, and should it be desired to utilise this to illuminate the scale a pair of flex leads can be taken either to the L.T. wiring in the set or to one of the 4-volt windings on the mains transformer if the receiver is A.C. mains operated.

A FIVE-METRE "FOURSOME"

Two-way Telephony Over Fifty Miles.

(By a Special Correspondent.)

FOUR transmitting amateurs have just co-operated in important two-way telephony tests on the 5.35-metre wave over distances up to fifty miles. They are S. G. Morgan (G6SM), H. E. Smith, and John Ferguson, of G6UH, and H. L. O'Heffernan (G5BY).

After 5GBY's forty-one-mile single-way contact on 50 MC, described in *The Wireless World* of July 29th, 1932, preparations were made for two-way communication on telephony.

Portable transmitting permits for 56 MC having been granted to G6SM and G6UH, both these stations became available for this purpose, and after a preliminary two-way contact over eighteen miles had taken place, communication was attempted between a hill near Dorking—upon which both G6SM and G6UH were located—and G5BY, situated on the South Downs near Eastbourne—a distance of thirty-six "air" miles.

Communication took place right on the scheduled time, G6SM's signals with 3 watts input to the oscillators being clearly *readable* some six feet from the 'phones, *using a receiving aerial only eight feet in length.* Signals from G5BY were clearly readable about 30ft. away from the loud speaker. Immediately afterwards communication was established with G6UH, whose signals were somewhat weaker than those of G6SM's, but always 100 per cent. readable.

Tests carried out at G5BY showed that it was possible to receive G6SM perfectly when the former's transmitter was in operation only fifteen yards away from the receiver, and also that signals could be plainly understood when the 8ft. receiving aerial was *coiled up and placed on the ground.*

Although it had been decided to conclude the tests before dark, in order that G5BY could regain the road in daylight, the enthusiasm created by the wonderful results obtained caused this to be forgotten, and it was quite dark when G5BY commenced the return journey. After twenty minutes vainly spent in trying to locate the road, the car was suddenly stranded, having run on to a ridge, which caused the back axle to ground, at the same time applying the brakes on the rear wheels.

After some really valiant efforts, the car was got off at 2.30 a.m., and the homeward journey commenced. The night's troubles were far from over, since just after 4.15 a.m., and when a few miles south of Godstone, the magneto timing of the car stripped, leaving the occupants completely stranded—from which predicament they were rescued by John Ferguson, of G6UH, who arrived in response to an urgent SOS at 6 a.m. G5BY and the junior operator of G2BM reached home at 8 a.m.—just twelve hours after the commencement of the 56 MC test!

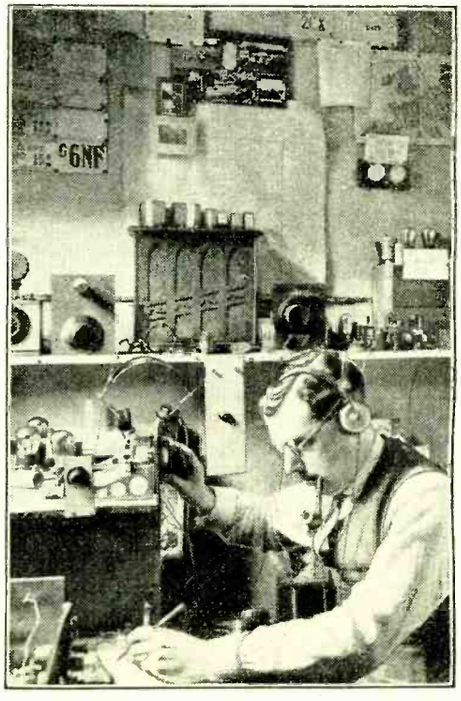
The success of this test encouraged still further experiments, and a few days ago, in the hope of obtaining two-way contact over a greater distance, G5BY went into operation on a hill a few miles east of Swindon, while G6UH was erected on high ground near Dunstable. The distance between the two stations was just over fifty "air" miles.

For a whole hour after the scheduled time nothing whatever was heard at G5BY, and, with a view to finding a more favourable position, the receiver was moved to another part of the hill, but still no signals resulted. Suddenly, whilst the headphones were lying on the ground, a voice was clearly heard; and, upon donning the 'phones, it was instantly recognised as being that of John Ferguson of G6UH. Immediately his call finished, G5BY was started up, and a 100 per cent. two-way 'phone contact lasting nearly two hours resulted. It then transpired that G6UH had been delayed in reaching his destination, and that his first transmission had taken place when G5BY's 'phones were on the ground—the receiver by some amazing coincidence being then tuned to G6UH's frequency.

Signals at both ends were R7-8, and always 100 per cent. readable—the receiving aerials at G6UH and G5BY being 12ft. and 8ft. long respectively—both being semi-vertical.

The transmitter used by G6UH employed DE5 valves as oscillators with 7 watts input from dry batteries, modulated by a P.625 valve operating at 350 volts H.T. The aerial system was the usual 8ft., centre-fed. G5BY's transmitter used AC.084 valves in push-pull with 9 watts input, modulated by a PM.24D. High tension was 340 volts, derived from an electro-dynamic dynamotor fed from a 12-volt car battery. Both receivers used the circuit described in the June 8th issue, but with certain modifications which experience had shown to be desirable.

Plans are now under way to attempt still further ranges, and any progress made will be recorded as soon as possible.



"GETTING DOWN TO IT." Here is Mr. A. G. Cole (2ACO), of 33, Grosvenor Road, Wallington, Surrey, testing a 2-metre receiver. He welcomes co-operation with other amateurs.

www.americanradiohistory.com

Practical HINTS and TIPS.

AIDS TO BETTER RECEPTION.

Distant Sensitivity Control.

AN important but rather neglected property of the variable-mu H.F. valve is that it allows the installation of a volume control device at a point remote from the receiver. With these valves control is always carried out by changing the sensitivity of the valve by variation of its grid bias; this operation in nearly every case is effected by means of a potentiometer.

In the simplest case, all that one has to do in order to arrange for a remote control scheme is to remove the potentiometer from the set, to instal it at the distant point, and to extend the existing leads; this is shown diagrammatically in Fig. 1 (a), which will be recognised as the conventional control circuit.

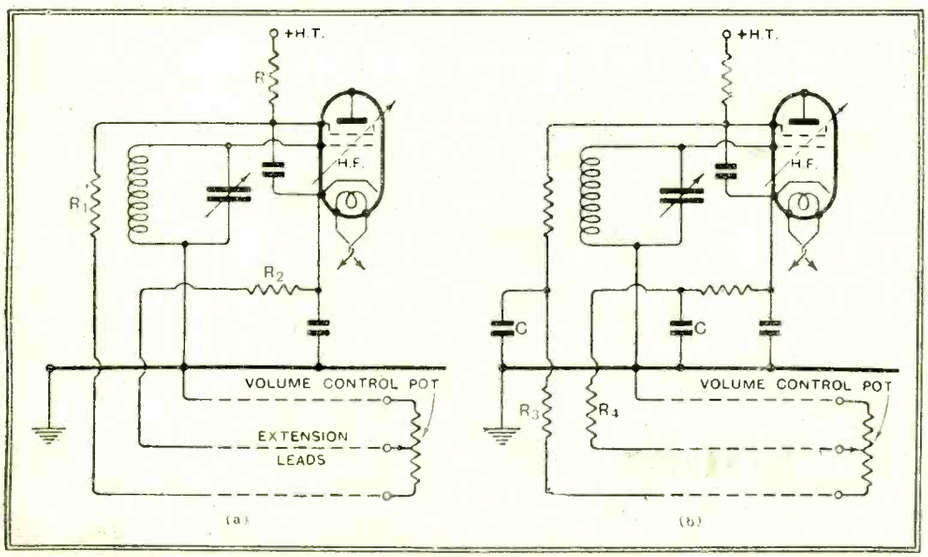


Fig. 1.—Volume control from a distance; the connecting leads of a bias-control potentiometer may be extended to a distant point. Diagram (b) shows the addition of decoupling. R, R_1, screening grid feed potentiometer; R_2, cathode bias resistance.

It will be observed that three wires are connected between the receiver and the distant control point, but one of the conductors may be omitted by making use of an "earth return," if convenient to do so; for instance, where a distant control is permanently installed the connections might be made with twin lead-covered wire, of which the metal sheathing will serve as an "earth." Capacity between the control wires and to earth is of no importance, but there is a faint possibility that hum may be introduced, at any rate if the wires are unshielded.

In many cases it may be considered desirable to connect the remote control leads to the set through a plug-and-socket device in order that a "local" control potentiometer may be substituted.

Although the connections to the volume control potentiometer are all at low potential, and so there should be no risk that they might cause instability, it is a fact that energy is transferred between grid and plate circuits in many unaccountable ways, and experience shows that there is a slight possibility that instability may be introduced by the fitting of extension leads. Should this trouble arise it may quite easily be prevented by the fitting of decoupling, as in Fig. 1 (b), in which the extra components required for this purpose are indicated by C, R_3, and R_4.

As a general rule all the additions shown will not be necessary, and a start may be made merely by fitting the by-pass condenser C in the screening-grid circuit. If this fails to remove instability completely, the next step is to insert the resistance R_3, which may be of 500 or 600 ohms; this extra resistance will not sensibly affect the voltage distribution of the circuit. As a next step the extra condenser C in the cathode circuit should be added, and finally the resistance R_4. There is some slight difficulty about the addition of this resistance; in the very unlikely event of it being necessary, it seems best to divide the existing cathode resistance into two parts of equal ohmic value; one of these resistances is used in the normal position, and the other serves as the decoupling resistance R_4.

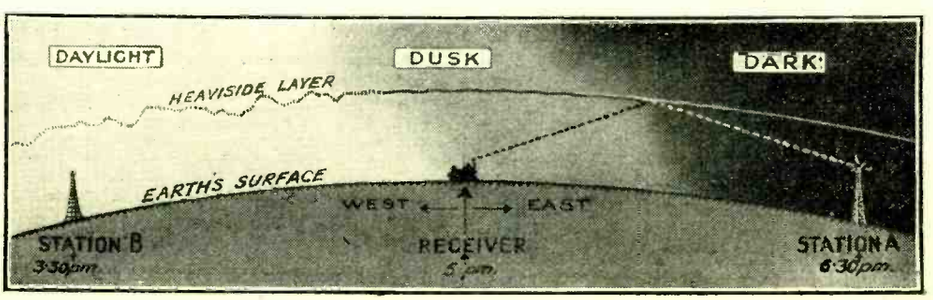
The Earliest Direction Finder.

IT does not need a lengthy acquaintance with the art of wireless reception to appreciate the fact that the range of a transmitting station is enormously greater at night than by day. For this very useful increment to the effective sensitivity of our receivers we have to thank the so-called Heaviside layer, which can most conveniently be conceived as a conducting stratum existing at a height of about 60 miles above the earth. Under the influence of the sun's rays this layer is ill-defined, but at night-time it assumes a state of relative stability and acts as a reflector of electro-magnetic waves.

An appreciation of these facts enables us to realise that, if we desire to tune in a station that lies to the eastward of the receiver, and which is normally beyond the range of daylight reception, it is quite possible that it may be receivable some time before darkness has actually fallen at the receiving end. At any rate, it will be worth while to try. Conversely, night effects are never likely to set in, so far as reception of stations to the westward are concerned, until a considerable time after sunset at the receiving point.

This is due to the difference of time, and is best explained by the diagrammatic sketch which appears on this page. For example, sunset in Poland is about 1½ hours earlier than at Greenwich; a listener who attempts to tune-in Wilno at or slightly before dusk can depend on a good deal of assistance from the Heaviside layer, as a large part of the signal path will be completely dark at that time.

In connection with these manifestations of "night effect," an interesting sidelight on wireless history is recalled by a member of *The Wireless World* staff. In the early days of the War, long before the practical development of direction finding,



The effect of darkness and difference of time on wireless transmission.

www.americanradiohistory.com

it was realised that careful observation of signal strength around the times of sunrise and sunset would yield a clue as to whether the transmitter was east or west of the receiver. Useful opinions were actually formed as to the position of enemy ships by intercepting their wireless telegraphic signals.

Matching Push-pull Valves.

VALVE manufacturers are usually willing to supply pairs of valves specially matched for working together in push-pull circuits, and so it might appear that there is little point in making provision for separate bias control of each output valve in the manner that has been suggested in the pages of this journal.

But there is another aspect in the matter that may appeal to the enthusiast in pursuit of extreme efficiency; all valves inevitably deteriorate in use, and it is a fact that they do not always deteriorate at the same rate. Consequently, a pair of valves that are perfectly matched when new may have appreciably dissimilar characteristics after a period of use. We have here a further argument in favour of separate bias control, as the performance of the output stage may be kept at maximum by making an occasional adjustment as it becomes necessary.

Tone Control and Magnification.

ALTHOUGH it is inherent to all methods of tone control in common use that their inclusion in a receiver results in some loss of general amplification, it is worth while to point out that the principle may often be applied to a set with a resistance-coupled L.F. amplifier without the need for making any appreciable sacrifice. The substitution of a proprietary tone-control transformer in place of one of the resistance couplings is often quite a practical expedient, and even if the transformer control be set to give quite a large measure of correction, the general level of amplification may actually be higher rather than lower than before.

In practice one almost always employs tone correction for the purpose of increasing the relative amplification of the higher frequencies, mainly in order to compensate for attenuation of these frequencies in the H.F. circuits. If the alteration that is here being suggested be made to a receiver in which very little compensation for side-band cutting is necessary, it may happen that the general level of amplification is so much increased that the existing decoupling devices are insufficient to cope with it; as a result, instability may occur. If it does, there is practically no alternative but to increase the efficiency of decoupling. As a rule resistances of higher value will be ruled out, and so it only remains to use larger by-pass condensers. But it should be remembered that the likelihood of this course becoming necessary is remote; an existing decoupling system is only likely to prove ineffective when the amplification of frequencies below 100 or 200 cycles has been increased.

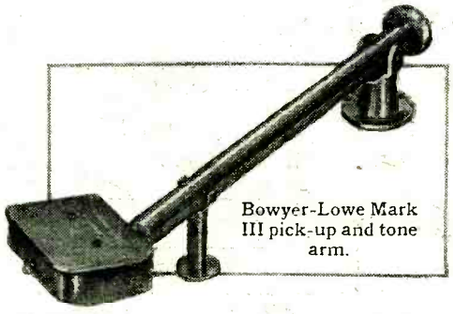
LABORATORY TESTS.

New Radio Products Reviewed.

BOWYER-LOWE MARK III PICK-UP.

TWO of the most outstanding features of this pick-up are its exceptional mechanical silence and freedom from record wear. When taking the characteristic curve with special constant frequency records, which are much more deeply cut in the bass than the average record, the needle followed the curve without the slightest distress down to 46 cycles.

It will be seen that the output is substantially flat in the middle register, and rises steadily towards the bass, while the principal armature resonance results in an increased output between 3,500 and 4,500 cycles, which is sufficiently high to avoid the high-pitched resonance in the majority of moving-coil loud speakers. A sharp cut-off above 6,000 cycles ensures freedom from needle scratch. The unit as a whole is beautifully finished in Florentine bronze, and all the tone arm joints are free from rattles. The price is 30s., and the makers are Bowyer-Lowe and A.E.D., Ltd., Coombe Road, Brighton.



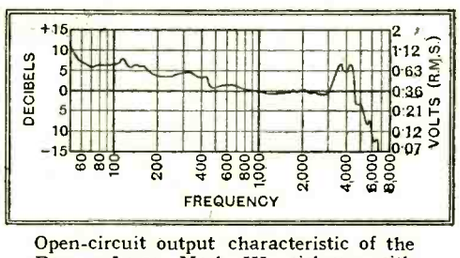
Bowyer-Lowe Mark III pick-up and tone arm.

LAMPLUGH MOVING-COIL LOUD SPEAKER.

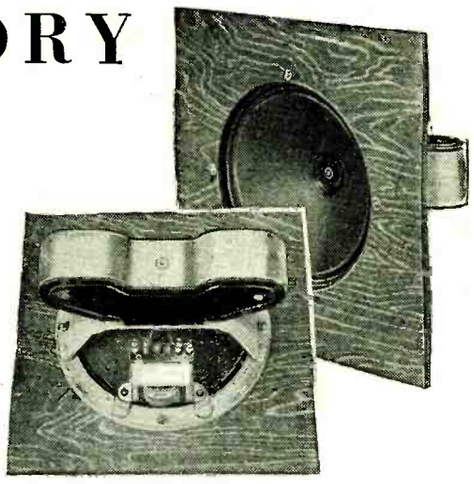
THE permanent magnet in the Lamplugh "Silver Ghost" loud speaker is of exceptionally large size for its class. A chrome-steel alloy is used and the length of magnetic path is greater than usual. The sides are enclosed by green moulded end plates to prevent the ingress of dust, and the finish and appearance of the unit as a whole is neat and workmanlike. A three-ratio output transformer is supplied and the unit is fitted with a small baffle to facilitate installation in a cabinet or larger baffle.

On test the sensitivity was found to be above the average for its class. The reproduction is bright, and there is just the required amount of bass to give good balance. Speech is crisp, and the highest possible intelligibility may be expected under adverse receiving conditions. The bass resonance is at 90 cycles and a full response is obtained up to 5,000 cycles, above which there is a gradual tailing off up to 10,000 cycles.

The price in chassis form is 35s., and the makers are S. A. Lamplugh, Ltd., 89, Little Park Street, Coventry.



Open-circuit output characteristic of the Bowyer-Lowe Mark III pick-up with H.M.V. loud needle.

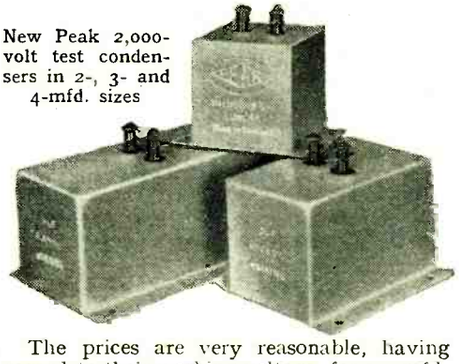


Lamplugh "Silver Ghost" permanent magnet moving-coil speaker.

NEW SERIES PEAK CONDENSERS.

WILBURN AND CO., 23, Bride Lane, London, E.C.4, have recently introduced a new series of Peak condensers of the non-inductive type, tested at 2,000 volts D.C., and rated at 800 volts D.C. working potential. These are now available in sizes ranging from 0.25 mfd. to 6 mfds.

This series is particularly well suited for use where the new Westinghouse H.T.11 rectifier is employed, and in all receivers and amplifiers embodying the "C" type valve rectifier, since they afford an adequate factor of safety despite the high value of the H.T. voltages employed.



New Peak 2,000-volt test condensers in 2-, 3- and 4-mfd. sizes

The prices are very reasonable, having regard to their working voltage, for a 1-mfd. size costs but 4s. 6d., while the 2- and the 4-mfd. sizes cost 7s. 3d. and 12s. 6d. respectively.

Next Week's Set Review:—

LOTUS BAND-PASS RECEIVER, A.C. Model.

www.americanradiohistory.com

UNBIASED

By
FREE GRID.

A Marvellous Circuit.

IN the course of a lifetime one occasionally comes across some instances of pure genius, more especially in matters pertaining to radio. One such instance has come my way, and I intend to inflict it upon you whether you like it or not.

A reader of these notes, who has supplied me with all needful documentary evidence in this matter, was troubled by the fact that the contacts on his thermal delay switch did not open until the best part of half an hour had elapsed after switching off. It needs but little knowledge to see that with this fault unremedied he was tempting fate if he switched on again before the thermal apparatus had come into operation. (In common justice to manufacturers of these devices, which very rarely give trouble, it ought to be explained that this was altogether an exceptional case, and, moreover, the manufacturer concerned is one who has not been sufficiently daring to send one in to *The Wireless World* for test purposes.)

After examining the switch twice and encountering the same fault each time, he wrote to the makers suggesting that the trouble was due to the fact that the receiver stood in an ill-ventilated corner of the room. This hypothesis was immediately seized upon by the sorely harassed manufacturer with as much relief as a drowning camel is reputed to seize upon the last straw which breaks his back.

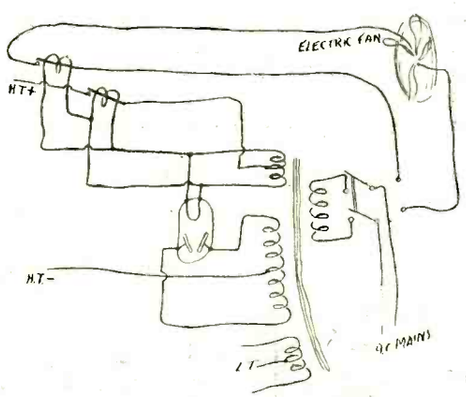


Figure (or diagram).

It was in *solving* this knotty problem, however, that the genius of the manufacturer asserted itself. Briefly, the solution was to buy an extra thermal delay switch and to connect it together with a double-pole switch and a small electric fan or lady's hair drier in the manner shown in the accompanying circuit, which I have tried to draw as clearly as possible. The fan would, of course, have its draught focused on to the two thermal delay switches. I feel that it would be an anti-climax and an insult to the technical abilities of my readers if I were to explain the action of this marvellous circuit, which can be readily deduced from a brief study. If, however, any reader is still in doubt I will gladly furnish details.

In this manner, not only was the trouble completely cleared up, but the manufacturer in question did sterling service to his country in this time of trade depression by making two thermal delay switches do the work of one, and selling a fan and double-pole switch into the bargain. I have impounded all the documents in this case, and I intend forwarding them to the United Salesmen's Association with a strong recommendation that a diploma be awarded.

A Backward Tendency.

THE demonstration given by the Post Office last August during the progress of the Radio Show at Olympia was exceedingly helpful to a large number of people, but as a result of it a bitter moan has come to me from a reader who has followed the advice given, with distinctly unsatisfactory results.

Although on A.C. mains, he uses in his newly constructed radio gramophone a commutator motor which he managed to obtain for a mere song a little while ago. The old saying that nothing worth having is cheap once more proved itself here, for no sooner had he got it home and installed it than he found that horrible noises were set up in his loud speaker due to the fact that the motor had a badly "pitted" commutator. The words of wisdom offered by the B.B.C. demonstrator put new heart into him, and, acquiring a couple of large-capacity fixed condensers, he duly connected them up, only to find that the gramophone motor reversed its direction of rotation immediately he switched on. As he pointed out in his letter to me, this does not matter a scrap, so far as his collection of dance records is concerned, as modern dance music sounds just the same whether played backwards or forwards. In the case of more serious music, however, things sound rather disastrous, although his wife, who is apparently a dance fanatic, is far from displeased, since it has automatically converted his whole collection of classics into dance records.

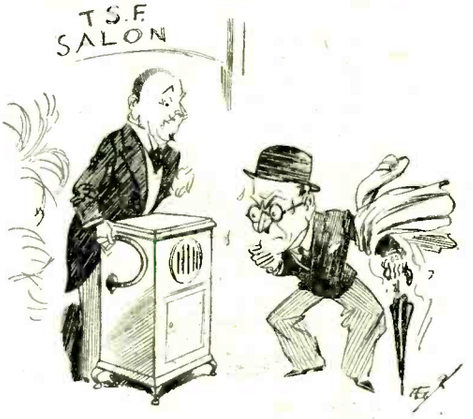
The phenomenon is, of course, not at all strange, as all that he has done is to bring about a phase-shift.

Effortless Winding.

I RECANTED an earlier vow not to visit the Paris Show, but found there was really nothing of outstanding interest in the Grand Palais; there did, however, appear to be an unusually large number of radio-gramophones shown, and more of the battery-driven type, with spring motors, than we are accustomed to see in this country. It was in connection with one of the latter instruments that I stumbled across a truly ingenious and epoch-making invention.

I had noted that the winding crank of several of the machines on exhibit was not straight, as is found in the case of instruments sold in this country, but was of a somewhat elaborate pattern, in many cases like the letter "S," and I naturally concluded that this was merely for ornamentation. There was one particular case, however, in which the crank was a perfect semicircle, and as I could see neither beauty nor efficiency in such an arrangement I ventured to question the stand attendant in somewhat halting French.

To my astonishment he claimed that with a semicircular crank much less energy was needed to wind the motor. When I demurred at this answer he at once plunged into voluble explanations. He first got me to agree that the longer the crank arm the



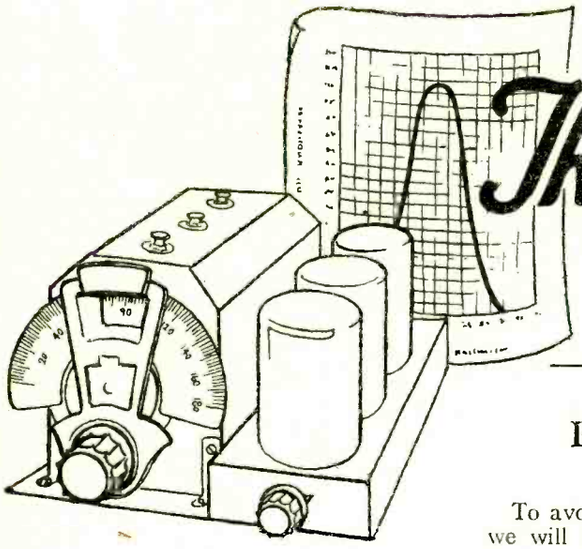
Had noticed the crank handle.

greater the leverage secured, and afterwards got me to assent to the fact that an unduly long crank arm was really impracticable, as gramophone users would have to make a wide sweep of the arm as in turning a mangle. "Now," he went on, "what we have done is to give you the benefits of the longer arm without calling upon you to make a wide circular sweep when winding. The length of the semi-circular crank arm is πr times that of a straight arm."

After much mental arithmetic I assented to this mathematical profundity. His explanations ceased abruptly at this point, and he sat back with an expression on his face rather like that of a harassed teacher dealing with a singularly unintelligent child. He would pay no heed to my remonstrances that in spite of the so-called invention the effort needed to wind up the gramophone was just the same.

I thought, however, that I had bowled him out when I told him that over thirty years ago someone who mistakenly thought he would make a fortune in the same manner brought out a bicycle with semi-circular pedal cranks. But the salesman's face lit up as though he had been given a brilliant inspiration, and, beckoning a colleague to him, he soon forgot my presence as he excitedly propounded to him his new idea for an almost effortless push-bike.

www.americanradiohistory.com



The Signal through the Receiver

Part II.—Resonance Curves and Tuning.

THIS is the second article of a series describing in simple terms the part played by each component in a receiver as the signal passes from aerial to loud speaker. The problem of tuning, which is often regarded as highly complex, is seen in the accompanying instalment to fall within the bounds of a straightforward explanation and simple diagrams.

AFTER radiation from the transmitting aerial, the wave in free space consists of a travelling electro-magnetic field which, at any point to which it reaches, varies in magnitude and polarity in the same manner as the aerial current that gave it birth. The intensity of this field is generally reckoned in terms of micro-volts per metre, a mode of description that is considerably more graphic than it appears at first sight. If we say that the field-strength at any point is 10μV/m., we mean that two points one metre apart have between them a potential difference of 10 microvolts.

Typical Three-valve Set.

An aerial-earth system is nothing more than a device to tap off this potential difference and make it available for operating the receiver. It consists in effect of a condenser of large physical dimensions, the earth forming one plate and the aerial itself forming the other. As the wave passes the aerial, the voltage in the space in which the aerial is situated varies in the manner pictured by the shape of the curve already reproduced (Fig. 8c). This voltage is communicated to the aerial, as to all other objects past which the wave flows, and as the aerial is made of a conducting material and has its other end held at earth potential, this voltage causes a current to flow down from aerial to earth. Like the voltage from which it is derived, and the wave which in turn produces the voltage, this aerial current is an exact replica in miniature of the current flowing in the aerial, and hence also in the tuned circuits of the transmitter.

Having followed the signals to the aerial terminal of the set it will be necessary, if we are to trace the passage of them through the various stages of amplification that they still have to undergo, to take some concrete circuit as an example. There are innumerable possible circuits, so that any description of the remaining history of the signal would have to be so general as to be almost meaningless if some quite definite set were not specified as a basis for discussion.

To avoid such unprofitable generalities we will choose for discussion a typical modern three-valve receiver, of which Fig. 9 gives the full circuit with the exception of wave-range switching. The diagram shows a set in which the aerial is coupled by a separate primary, L_1, to the first section of a mixed filter, the coupling between this and the second section being partly provided by the condenser C_3 common to both tuned circuits, and partly inductively through the link-coils L_4 and L_5. The signal-voltage across the second section is applied to the grid of a variable-mu valve, the grid-bias to which is controlled through the resistance R_1 by variation of the volume-control potentiometer R_2 shunted across the bias battery. The variable-mu valve is coupled by a choke-fed tuned grid circuit to the detector V_2, reaction being provided from this valve into the intervalve tuned circuit. The detector is followed by a resistance-fed transformer, the secondary of which is connected to a pentode fitted with a tapped output choke L_{10} and a tone-corrector C_{12} R_5. The whole makes up a typical modern set.

When the aerial and earth are connected to their respective terminals the coil L_1 is interposed in the path of the signal-currents flowing. In passing through this coil, the currents set up round it an alternating magnetic field, similar in every way to the field surrounding the coil discussed in Part I. L_2 is contained in the same screening-box as L_1, the two being so placed that the magnetic field surrounding L_1 passes also through the windings of L_2. The rise and fall of this field, which takes place in exact sympathy with the rise and fall of the aerial currents passing through L_1, sets up in L_2 a corresponding alternating voltage. Put in the usual brief

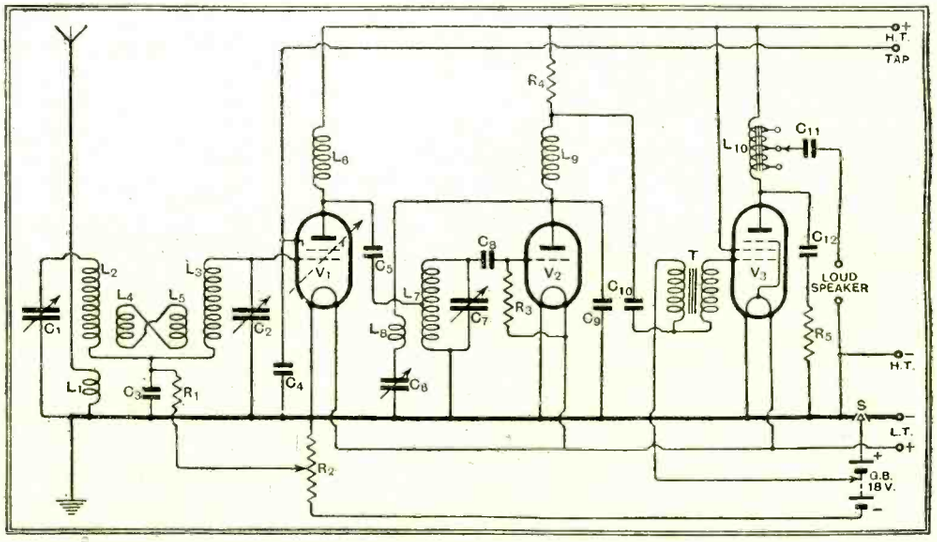


Fig. 9.—A typical modern 3-valve circuit for battery operation with 2-volt valves. Waveband switching has been omitted. It is through this set that the passage of the signal will be traced.

www.americanradiohistory.com

The Signal Through the Receiver.—

terms of the wireless listener, the current in the primary induces a high-frequency voltage in the secondary.

Given this voltage, it is clearly necessary to make the most effective use of it, for which purpose it is necessary that the inductance of L_2 and the capacity of C_1 (leaving C_3 out of account for the moment) should be very accurately adjusted to one another. If we simplify the

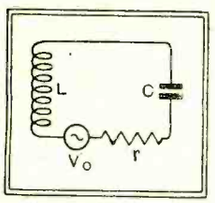


Fig. 10.—Simplified version of the circuit L_2C_1 of Fig. 9. The generator V_0 represents the voltage induced into L_2 from L_1.

circuit into which the voltage is induced we find that, omitting C_3, it consists of L_2 and C_1 in series with one another as shown in Fig. 10. In this figure the voltage set up in L_2 by the currents in L_1 is symbolised by the conventional sign for a generator.

In such a circuit the current driven round the circuit by the generator—which, we must imagine, is generating high-frequency voltage with the characteristics we have already discussed—does not depend solely upon the voltage and the characteristics of the circuit. It depends also upon the frequency to which the generator is set. If we had a generator of constant voltage but variable frequency we could set it to a number of frequencies in succession, note the current circulating round the circuit at each frequency, and plot our readings as a curve similar to that of Fig. 11.

As the frequency is increased from 500,000 per second (500 kc.) the current in the circuit gradually rises, but this rise gets more and more rapid as we approach 900 kc. Between this point and 1,100 kc. the curve rushes up to a maximum at 1,000 kc. and down again, finally tailing off to its original tiny value by the time 1,500 kc. is reached. In the receiver, it is evidently going to be well worth while to try to arrange matters so that the signal we are receiving produces its maximum current, since the music will then naturally be at its loudest. Even apart from this reason, which could after all be made unimportant by using valves enough to magnify up the weaker signal, it is going to pay us to operate at the peak of a curve such as that shown because the signal we want (1,000 kc.) gives a far greater current than a signal of any other frequency which may simultaneously be picked up by the aerial. We thus use the characteristics of the receiver to pick out the station we want, giving it far more amplification than any other station receives.

In the ordinary set it is not practicable to vary the frequency of the signal until we set it at that to which the set responds best, because the frequency, and hence the wavelength, of each carrier-wave is fixed at the transmitter. Instead, we have to vary the receiver. The frequency to which a circuit such as that of Fig. 10 responds best is determined by the product of the inductance of L and the capacity of C; to "tune" the set accurately to any desired wavelength we must have one or other of these continuously variable. Convenience dictates that the variable element shall be the condenser, though variable inductances are equally sound theoretically and have been extensively used in the past.

Reverting to the circuit of the set, it will be seen that there are three tuned circuits in all; they are L_2C_1, L_3C_2, and L_7C_7. If each of these had the characteristics of the tuned circuit taken as an example in Fig. 11, then, since the required signal is selected by each in turn, we should expect tuning to be three times as sharp as the curve implies.* Casual inspection would suggest that no increase of sharpness over that indicated by the curve is necessary, for the peak seems to be very high and very sudden. Curves, however, are misleading things unless the scales are looked at closely, and in reality the tuning characteristics indicated by this particular one are those of a very flatly tuned set indeed. Approximately, in fact, that of a det-L.F. set without reaction, which no one would claim to be the last word in knife-edge selectivity.

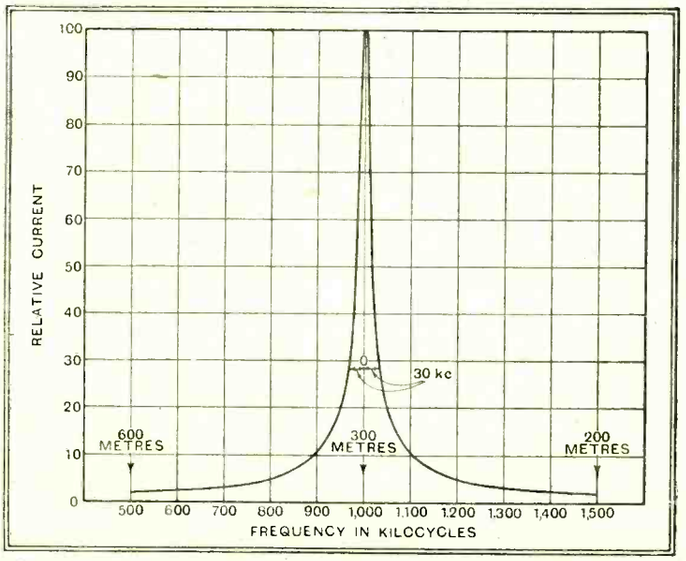


Fig. 11.—Relative currents in a tuned circuit like that of Fig. 10 at different frequencies (or wavelengths).

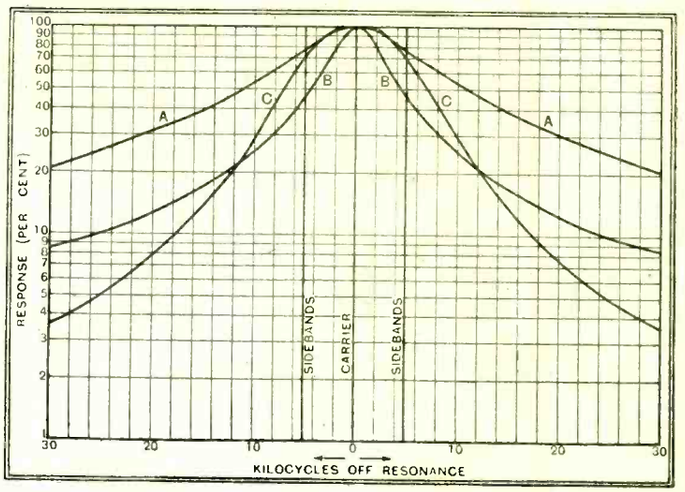


Fig. 12.—Resonance curve of a circuit of moderately high losses is shown at A. It tunes more sharply than that shown in Fig. 11. B is a highly efficient "low-loss" circuit (m = 200) whilst C is a band-pass filter for comparison.

Some more tuning curves are plotted in Fig. 12, the scales being very different. The whole diagram now only embraces a range of 60 kc. round the signal frequency, and the vertical scale has been made logarithmic for the reason that a curve on such a scale gives the eye much the same impression as that which the tuned circuit represented gives the ear when tuning the set. Here there is no doubt that the tuning of curve A is terribly flat; yet it is sharper than that of Fig. 11. Close inspection of the latter will reveal a little line marked 30-0-30; the response for this detuning is 32 per cent. Curve A of Fig. 12 shows a response of just over 20 per cent. for the same 30 kc. from resonance; this being less than 32 per cent., sharper tuning is indicated. The curve *looks* flatter only on account of the different scale.

H.F. Resistance.

Now both these tuning curves are correctly calculated to represent the behaviour of a circuit tuned to exactly 1,000 kc. (300 metres). Why have they different heights at 30 kc. off tune? A glance at Fig. 10 will show another part of the tuned circuit that has not been mentioned—the resistance *r*. This is inserted to indicate the inevitable losses that must be present in any coil-condenser combination that we may construct. Although *r* never appears in circuit diagrams it is always present in the set, inherent in the coil, the tuning condenser, and all other components connected to L or C.

* Actually, the height of the curve at any point would be the cube of the height shown. Whether this would be "three times as sharp" depends on the definition of that conveniently vague phrase.

www.americanradiohistory.com

The Signal Through the Receiver.—

There is a whole literature on the subject of losses in tuned circuits, but it is enough to say here that the selectivity of a tuned circuit depends very largely upon the value of the resistance it contains. Curve A of Fig. 12 refers to a circuit in which the resistance is little more than half of that implied by the curve of Fig. 11, while curve B belongs to a circuit with only one-quarter of the resistance of that of the preceding figure. It will at once be seen that the lower the resistance the more sharply does the signal strength fall away on detuning, supposing that it is equal at resonance in the two cases.

There is, however, more than selectivity at stake, for the circuit of lower resistance gives, as one might expect, a higher current for the same applied voltage. Curves A and B of Fig. 12 are replotted in Fig. 13, showing the relative heights actually attained for the same signal voltage applied from an aerial coupling coil such as that shown at L_1 in Fig. 9. It will be seen that the curves are unchanged in shape by replotting, but that their peaks now indicate their respective efficiencies.

In the actual set the aerial tuning system is more complex than that shown in Fig. 10, since there are two tuned circuits coupled by the condenser C_3 and the coils L_4 and L_5. The resultant tuning curve will be of the general type shown at C in Fig. 12, which shows higher selectivity than either curve A or curve B. The advantages of the filter will be discussed next week.

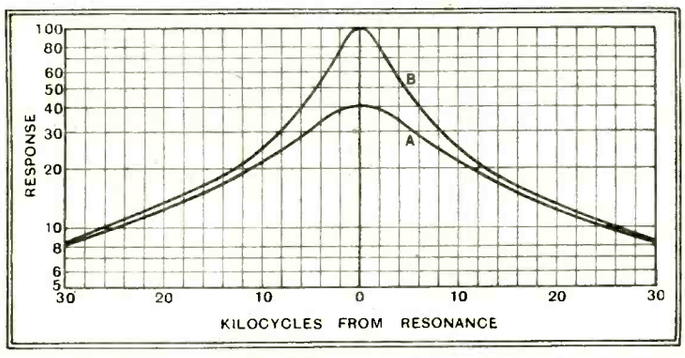


Fig. 13.—Curves A and B of Fig. 12 re-plotted to show the response of the two circuits to the same applied voltage. The higher efficiency of the more selective circuit is here clearly brought out.

Here is a list of stations in addition to those already mentioned from which reception has recently been good and which can generally be relied upon. *Long Waves:* Huizen, Radio-Paris, Zeesen, Motala, Moscow, and Kalundborg. The Eiffel Tower and Warsaw have suffered from heterodynes. Vienna Experimental is well heard on some evenings. *Medium Waves:* Nürnberg, Trieste, Gleiwitz, Turin, Heilsberg, Hilversum, Göteborg, Breslau, Poste Parisien, Brussels No. 2, Strasbourg, Toulouse, Frankfurt, Söttens.

D. EXER.

TRANSMITTERS' NOTES.

Amateurs in Jamaica.

Amateur transmitting licences are now issued in Jamaica and the stations officially recognised. These amateurs are anxious to work regularly with English stations. VP2DD has been in contact with Birmingham and VP NH, 2CC and 2MK, are anxious to get into touch with British amateurs; they transmit, in Morse, on the 20-metre waveband and the most convenient times for two-way working with Great Britain would be from 2200 G.M.T. on week-days, 2000 G.M.T. on Saturdays, and almost any time on Sundays.

Our correspondent states that Jamaicans are anxious to buy British goods suitable for local conditions, but find difficulty in getting them, as the market is swamped with American apparatus.

DISTANT RECEPTION NOTES.

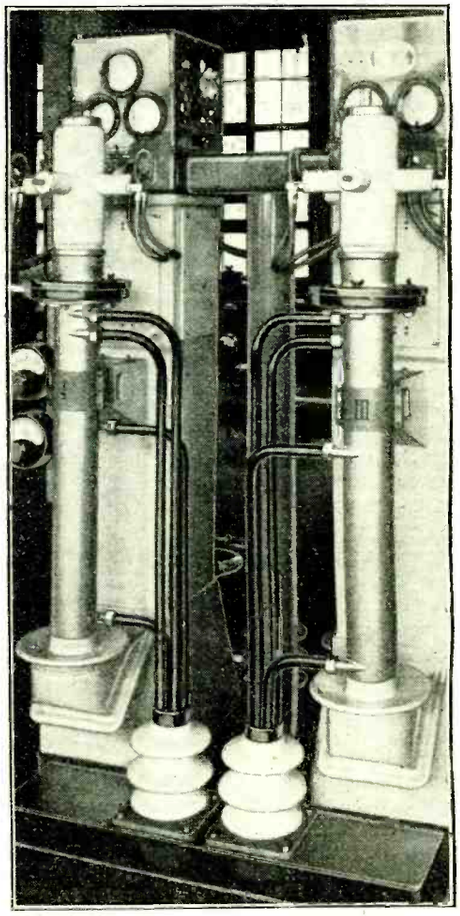
THE WIRELESS WORLD has always led the way in pointing out the advantages of calibrating receiving sets as accurately as possible and in showing its readers the simplest and most satisfactory ways of carrying out the process. When a set is properly calibrated it becomes a wavemeter or a frequency meter, as the case may be, in itself. Any station tuned in can thus be identified with something like certainty by reference to the wavelength and frequency tables. This is important enough, but far more important from the long-distance man's point of view is the fact that if his set is calibrated he can tune-in in a matter of moments any station whose field strength in this country is sufficient to bring it within the range of his apparatus, provided, of course, that the station concerned has not wandered badly from its allotted wavelength.

A Simple Business.

Calibration is neither a long nor a difficult business. Possession of one of *The Wireless World* Foreign Station Tuning Charts, issued free with last week's number, adds enormously to one's pleasure in using the receiving set, besides making an immense difference to the number of stations that can be "logged" on a given evening. The logarithmic condenser, which now forms part of most wireless receiving sets, enables calibration to be done in either wavelengths or frequencies. Which method is chosen is a matter of individual choice. Personally, I prefer kilocycles to metres, since the allocation of channels upon both the medium and the long wavebands is upon a frequency basis. As both the wavelength and the frequency are given in the table of stations in each issue of *The Wireless World*, identification is equally easy with either form of calibration.

The Season in Full Swing.

The change over from summer to standard time which has now taken place in all European countries means to the long-distance man a good deal more than might appear at first sight. The obvious advantage to him is that he can embark upon the quest for distant stations at least an hour earlier than before the change took place. And there is a second boon not always realised. Mid-European time is one hour ahead of ours; Eastern European time, two hours ahead. When "Summer Time" is in vogue many stations close down whilst it is still too light in this country for there to be much chance of their transmissions being well heard. That disadvantage has now entirely disappeared with the change over to G.M.T. Stations situated in Eastern Europe are now coming in extraordinarily well. Budapest, for example, though well heard only on occasional evenings a few weeks ago, is now quite reliable, and Vienna, though not quite so strong, is always to be found. Another station at the upper end of the medium waveband which is now providing amazing reception is Florence. The region between 436 and 550 metres has now, in fact, such a splendid selection to offer that there would be plenty of alternative programmes if the receiving set took in no wider band of wavelengths. This region contains Stockholm, Rome, Beromünster, Langenberg, Prague, Florence, Brussels No. 1, Vienna, and Budapest—nine stations situated in eight different countries.



THE BROKEN VALVES. Damage to these 150 k.W. porcelain-mounted valves while in transit to Leipzig has delayed the opening of Germany's most powerful broadcasting station. Tests are expected to begin within the next week or two on 259 metres.

www.americanradiohistory.com

BROADCAST BREVITIES

By Our Special Correspondent.

What's Best in "Birthday Week"?

TO most of us who read *The Wireless World*, the best feature of the B.B.C.'s forthcoming "Birthday Week" (November 13th to 20th) will be "Communications—1922-32"—a dramatic work by L. du Garde Peach—in which the "O.B." Department will collaborate for the provision of technical "effects." The play will tell the story of human transport and communication within the last decade, and I understand that realistic, and perhaps actual, wireless and telegraph effects will be employed.

Mr. H. G. Wells.

The programme will include a prophecy by Mr. H. G. Wells, who will dip into the future and give listeners a word-picture of the transport of men and messages in the days to come.

Music for the Microphone.

"The week" opens on Sunday, November 13th, with a special studio performance of "Romeo and Juliet," for which Leslie Woodgate is composing incidental music, specially suited to the microphone.

In the evening Mr. Stanley Baldwin will be heard in an appeal for the Papworth Village Settlement.

Round Broadcasting House.

"An Hour's Tour of Broadcasting House" will be the big feature on the Monday. This will take listeners in imagination through the twenty-two studios and into the Control Room. The trip should be quite enjoyable as well as instructive.

Anticipating Christmas.

A. J. Alan will make another meteoric appearance on Tuesday of Birthday Week, with a tale of mystery, not to say imagination. On the same evening we shall hear all about the preparation of a good Christmas dinner. A little premature, perhaps, but the B.B.C. has the stomachs of its listeners at heart.

An "all-star" vaudeville concert will complete the bill.

The Tzigane Again.

Wednesday will find us listening to a relay of Tzigane music from Budapest, with a symphony concert from the Queen's Hall thrown in.

Then, on Thursday, November 17th, the National transmitters will create a precedent by giving us Part I only of a broadcast play, "The Three Musketeers." For Part II we shall have to tune in the Regional transmitters on the following day.

Three "Stars."

Three great names in the musical world will also figure in the Thursday programme — Elena Gerhardt, Huberman, and Myra Hess. These artistes will combine in a concert of Chamber Music.

On Friday the B.B.C. Choir and Orchestra will be heard in Haydn's "Creation," conducted by Adrian Boult.

"Communications—1922-1932" will wind up a great week on Saturday, November 19th.

The Jazz King?

On the same evening, I hear, there is the possibility of a relay from America of the "King of Jazz"—Paul Whiteman, with his boys, band or orchestra—I forget which.

The B.B.C. Governors.

ALREADY some of the more important B.B.C. staff changes which I hinted at the other day have come to pass, including the elevation of Mr. Adrian Boult to a position on the Control Board. Even bigger things, however, are now being discussed. I should be surprised if it is mere idle rumour that declares that quite drastic changes will take place in the Board Room itself at the end of the year.

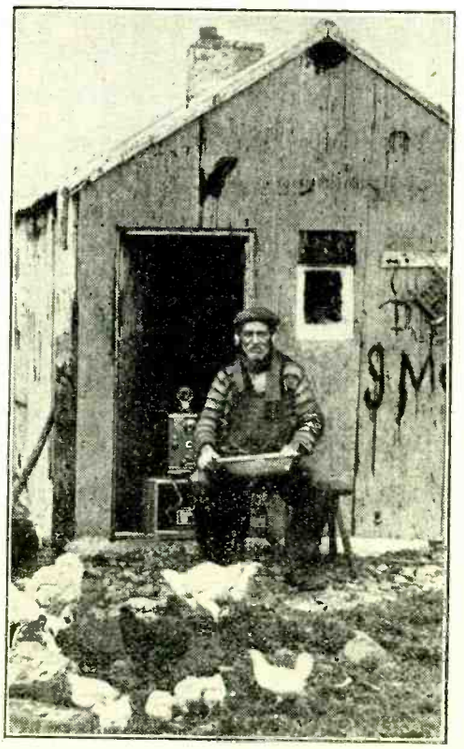
A Peerage?

I am led to understand that a peerage awaits a deserving recipient within the portals of Broadcasting House.

From a Wren Church.

I AM glad that the production of Whitaker-Wilson's chronicle play on Sir Christopher Wren, the tercentenary of whose birth is now being celebrated, will obtain a background of music from that little gem among City church organs—the instrument in St. Stephen's, Walbrook. Both acoustically and architecturally this church is Wren's real masterpiece—many judges prefer it to St. Paul's Cathedral—and, by a rare coincidence, the organ is perfectly adapted to the building.

The play is to be broadcast on October 18th (Regional) and 20th (National).



IS WIRELESS WASTED HERE? This 72-year-old hermit of Lough Beg, Co. Antrim, would probably find a ready retort to the writer quoted in the next column.

A Service in St. Paul's.

In the afternoon of October 20th, the Wren Tercentenary Service will be relayed to National programme listeners from St. Paul's Cathedral. An address will be given by Canon S. A. Alexander.

The B.B.C. and the Pirates.

ALL'S fair in love and pirate hunting, so I will not reprove the B.B.C. for stressing in their announcements the importance of the Post Office technical equipment for rooting out the licence dodgers. Indeed, I wish the B.B.C. would camouflage their own "O.B." vans to look like pirate hunters. "Every little helps," as Sir Henry Wood said to the second piccolo.

Readers' Problems.

WHAT happens to Harry Tate's famous moustache when he appears before the microphone? To forestall the many queries of this nature which would probably reach me following the appearance of Harry Tate before the microphone on Monday next, October 17th, I had better explain that he wears it. Apparently, without it, he does not feel at ease. Presumably, with it, he does.

Wireless Waste.

THE deplorable wastage of good music over the ether is the theme of an impassioned article by a writer in the *Journal de Geneve*. He finds that this "admirable invention" of broadcasting crams us with music until the attention is wearied, and we grow indifferent to it. "Housewives, with duster-enveloped heads and heel-less slippers," he writes, "do their chores to waltzes which made noble feet fly in the Court of Vienna. Your hostess thinks she renders sufficient homage to Bach or Beethoven if, during the broadcast, she merely whispers the request, 'Tea or whiskey?' Rural folk listen round beer casks, glass in hand and with moustaches wet, to sermons and prayers.

"Living in an atmosphere where fragments of masterpieces fly around unnoticed is like lighting pipes with bank notes!"

The Good Old Days.

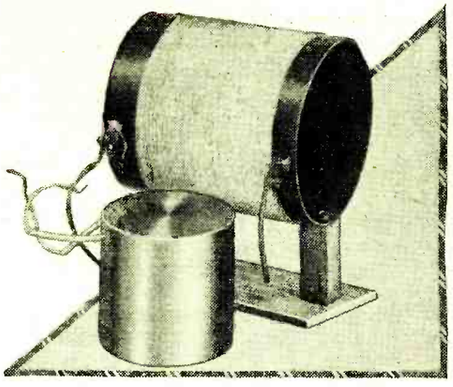
I cannot help liking a man who writes like that, though I am unable to work myself up to the same pitch of excitement. It is better, surely, that masterpieces should be available for all and sundry instead of remaining the preserve of the cultured and moneyed few, as in the days when noble feet flew at Vienna.

www.americanradiohistory.com

The New Tuning Coils.

Part 2.

Two-inch Ferrocart Coil Rivals Three-inch Litz Coil.



IN Part I of this article, which appeared in the issue dated September 30th, the apparatus for measuring the high-frequency resistance of the new tuning coils was described and preliminary measurements given. It now remains to explain the significance of the remarkably high magnification figures of the two Ferrocart inductances under examination.

When interpreting the figures given, it must not be forgotten that the series resistance r and the dynamic resistance R both depend quite largely upon the value of inductance that the individual coil happens to have, and they are, therefore, characteristics of the particular coil measured rather than a characteristic of all coils of the same style of construction. Their value, and especially the value of R, upon which depends very largely the amplification yielded by the high-frequency stage in which the coil is eventually incorporated, is far more an expression of the suitability of a coil for its purpose in a set than a commentary upon the excellence of its design.

THE accompanying article forms the second instalment dealing with practical measurements of efficiency of the new iron-cored tuning coils. It is shown that a closely screened coil of two inches overall diameter rivals in magnification the three-inch Litz (stranded wire) air-cored coil, and has the advantage of a much more constant dynamic resistance. The benefits of the latter characteristic in a set are constant amplification throughout the waveband.

The individual value of inductance possessed by a coil has much less effect, however, upon the magnification m or the decrement δ,[1] for all coils of the same style of construction turn out on examination to have about the same magnification. If, therefore, one happened to find that a coil of 150 μH had a magnification of 125 at, say, 300 metres, one might safely conclude that if turns were added to bring the inductance up to 200 μH the magnification would still not be far from 125 at that wavelength. On the other hand, the dynamic resistance would be brought up by the extra turns from 117,000 to about 156,000 ohms. The simplicity of this relationship (m is constant, R proportional to L) would not quite be maintained because of the altered incidence of the dielectric losses, which would tend to depress m as the inductance was raised, but for approximate comparisons one may safely assume that the magnification of a coil is a direct measure of the excellence of its design, no matter what its inductance may be.

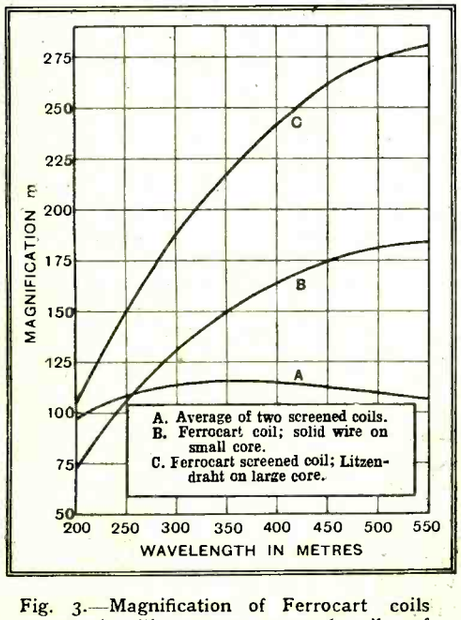


Fig. 3.—Magnification of Ferrocart coils compared with average screened coils of normal commercial design.

Comparisons.

Comparing first the screened coils A and B, it will be seen that their magnification is very much the same, though B is very slightly better (see Part I). They may, therefore, be taken as typical of the average modern coil, the more as they were made by two of the best-known manufacturers of coils of this class.

Turning to the smaller Ferrocart coil wound with solid wire, we see that while it is a little inferior to the ordinary screened coils at wavelengths up to about 260 metres, at higher wavelengths it is very considerably more efficient, until at 550 metres it shows a superiority of some 75 per cent. The larger Ferrocart coil, wound with multi-strand cable, is as good as the better ordinary coil at 200 metres, while at the highest wavelength it is $2\frac{1}{2}$ times as efficient. These results are shown graphically in Fig. 3, where the magnification of each of the Ferrocart coils is plotted against wavelength, the magnification of the two ordinary commercial coils being averaged and plotted as a single curve for comparison.

Competitor to Three-inch Litz.

Inspection of these curves makes it clear at once that over the bulk of the wave range the new coils, and especially those wound with Litz, are not in the same class as the standard screened coil that we use to-day. To find a worthy competitor for the Ferrocart coils it is necessary to go to the most efficient type of inductance that has ever enjoyed popularity, and to make comparisons with the large Litz-wound coils introduced by this journal in 1926 and used as standard in *Wireless World* sets for some years subsequently. The characteristics of two such coils were given in Tables 5 and 6 in the first instalment of this article, while their magnification is plotted with that of the two Ferrocart coils in Fig. 4.

It will at once be seen that the Litz-wound Ferrocart coil has a magnification

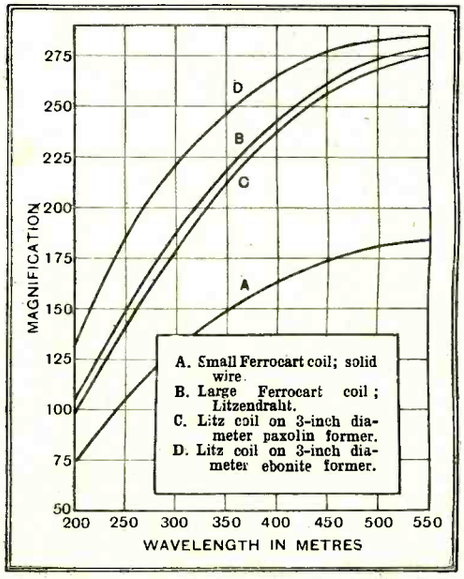


Fig. 4.—Ferrocart coils compared with 3-in. Litz-wound coils.

[1] These are practically interchangeable terms, for $\delta = \pi/m$.

www.americanradiohistory.com

The New Tuning Coils.—

a little inferior to Litz-on-ebonite (3in. diameter) and a little higher than Litz-on-paxolin. The comparison is, however, a little unfair in that the inductances of the Litz coils were nearly double that of the Ferrocart coil, with which they so closely compare. With more nearly equal inductances the curve for the Ferrocart coil would almost certainly fall below both Litz coils, and not between them. The movement would, however, be quite small, and the fact remains that for all practical purposes the Litz-wound version of the new coil may be regarded as equivalent to the highly efficient three-inch Litz-wound inductances.

These coils fell out of use for two reasons, the most important of which was that they could not be screened without losing their excellence unless an extravagantly large screening-box was used. Further, Litz wire is expensive. We have already seen that the first of these drawbacks does not apply to the Ferrocart coils; indeed, the one shown in curve B of Fig. 4 was wearing a skin-tight brass screen while the

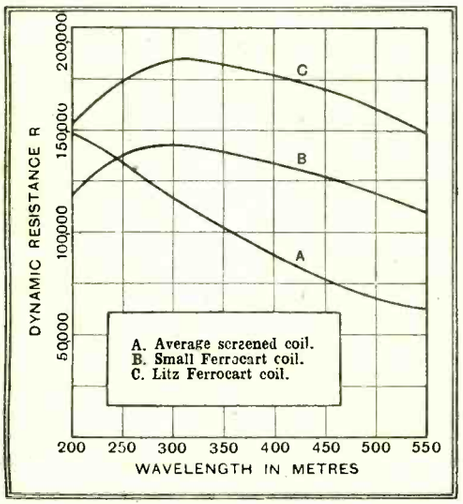


Fig. 5.—Change of dynamic resistance with wavelength. A comparison between Ferrocart and commercial screened coils.

measurements were being made. The second disadvantage remains, but is reduced in magnitude; a rough computation suggests that the length of wire on a Ferrocart coil will lie between a third and a half of that on an air-core coil of equal inductance.

Although the dynamic resistance of the tuned circuits measured is, for the reasons already given, no reliable guide to the relative excellences of the types of coil measured, considerable interest attaches to the *shape* of the curve for different styles of coil. Fig. 5 shows the variations in dynamic resistance over the waveband for the two Ferrocart coils, comparing them with the "standard" screened coil whose characteristics were obtained by averaging the results for two commercial samples.

It will be seen that whereas the ordinary screened coil falls off quite rapidly in dynamic resistance as the wavelength is raised, the Ferrocart coils remain much more nearly constant. In particular it is interesting to notice the shape of curve B, which refers to the Ferrocart coil

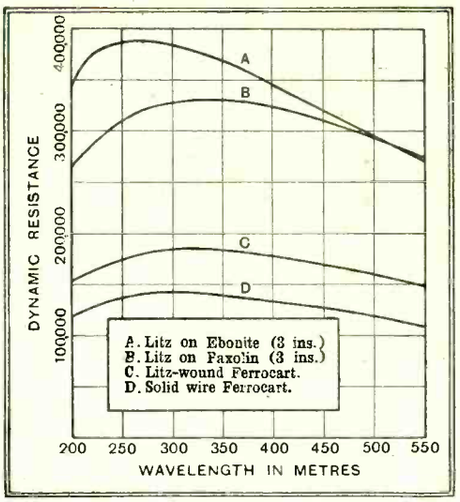


Fig. 6.—Change of dynamic resistance with wavelength for 3-in. Litz coils and Ferrocart coils. No correction has been made for disparity of inductance.

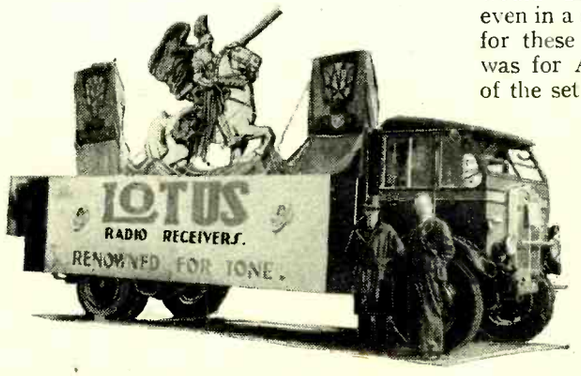
wound with solid wire, for the general run of this curve very strongly suggests a Litz coil. It would seem that it owes its shape largely to a reduction of copper losses combined with an increase in dielectric losses; or, more probably, a new loss introduced through eddy currents in the core. This loss would probably have the recognisable characteristic of dielectric loss, which is simply an increase of loss at the lower wavelengths.

However it arises, the shape of the curve is highly satisfactory, and use of the Ferrocart coil would probably prevent that unpleasant characteristic of many receivers, a certain deadness at the highest wavelengths due to the falling off in dynamic resistance that is so marked a feature of curve A.

Improved Selectivity.

Fig. 6 gives a comparison of the dynamic resistance curves of the Ferrocart coils with the two 3-in. Litz coils already mentioned. All four curves have much the same shape, with the possible exception of A, in which the use of an ebonite former has cut out the dielectric losses which bring curve B down at the lower wavelengths. This diagram shows very clearly indeed how the incidence of core losses in the new coils simulates the presence of dielectric loss, and tends, in conjunction with low copper resistance, to yield a dynamic resistance constant over the wave-band. The fact that the two Litz coils here have much higher dynamic resistance than the two Ferrocart coils is simply a result of their much higher inductance; a correction might have been made for this, but the curves have spaced themselves out so nicely for inspection that they have been presented in their natural, though rather misleading, form.

We have no information as to the possibility of matching Ferrocart coils; one would surmise that the most effective way would be to file away the core to make fine adjustments to inductance. In view of their high efficiency the matching would certainly have to be much more perfect than is usual at the present time if ganging were to hold sufficiently accurately over the tuning range of a set for their full advantages to be realised in practice, but we freely confess that we see no other obstacle to their immediate adoption to the benefit of our receivers, both as regards selectivity and sensitivity.



FIRST PRIZE. This Lotus display won the premier award in the famous radio convoy from London to Manchester for the Northern Radio Exhibition

A Four-range Superheterodyne.

Short Waves Plus Broadcast Bands.

ACCORDING to published reports, the B.B.C. is officially pained by the apparent neglect, on the part of the British wireless industry as a whole, of the short wavelengths. It is believed that the imminent completion of our new "World-sender" (as the Germans would call it) at Daventry will be responsible for a great increase of interest in this specialised branch of broadcasting.

Whether these strictures be generally deserved or not, they certainly cannot be applied to Faraday Allwave Wireless, Ltd., of 1, Salcott Road, London, S.W.11. This firm has just introduced a five-valve superheterodyne, externally of conventional appearance and with a built-in moving-coil loud speaker, which covers, in addition to the normal broadcast bands, short wavelengths between 15 and 60 metres.

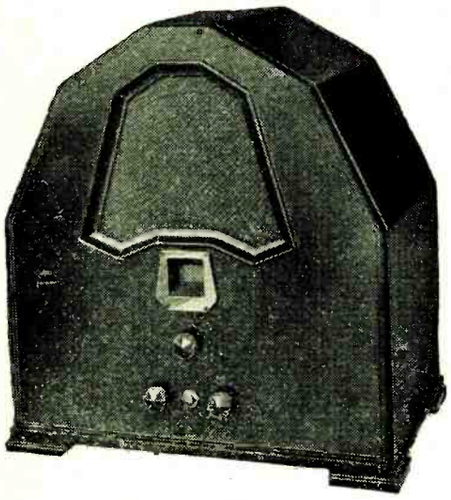
There are four bands in all, the change-over from one to another being effected by a conventional wave-range switch. There is no reaction, and, as the tuning system is fully ganged, the set is just as easy to operate as the most conventional of broadcast receivers.

A short preliminary test made by a member of *The Wireless World* staff gave the impression that the set behaves normally on the normal wavelengths, and that its performance on the short waves would be considered quite satisfactory even in a specialised receiver designed only for these frequencies. The model tested was for A.C. mains, but a D.C. version of the set is available.

www.americanradiohistory.com

Gecophone Four-valve D.C. Mains Receiver.

A Long-range Receiver with Two H.F. Stages.



NOMAD MODEL.

UP till now the D.C. mains user has been something of a "poor relation" in the family of all-electric set owners, subsisting on a much more limited choice of receivers than the fortunate people blessed with A.C. supply. This winter, however, the D.C. man is at last coming into his own. A much wider range of components and valves specially designed for his use are making their appearance, with the result that a D.C. set such as that now under review takes on solid reality.

The designer of a D.C. set is faced with many difficulties which are not encountered in A.C. receivers. To prevent the possibility of shock the more exposed metal parts must be isolated from the mains, and to avoid hum an ambitious smoothing circuit is necessary because it must always be assumed, in order to play for safety, that the receiver will be used where the positive supply lead is earthed. In every district roughly half the consumers will be connected in this way to balance the load on the three-wire system.

Screening Within Screening.

Pick-up leads must be isolated, and if mains noises are to be absent the detector circuit, including the gramo-radio switch, which can be a prolific source of hum, should be separately screened. Each of these problems, and a number of others common to D.C. sets, have been solved satisfactorily in the Nomad receiver. The whole of the metal chassis is at true earth potential, and is "safe." This applies also to the aerial and earth leads. Within the general screening another screen at cathode potential for the detector components is to be found, thus giving "screening within screening."

The current for the four D.C. valves, the heaters of which are wired in series, is passed through the field winding of the moving-coil loud speaker, and to maintain a hum-free background, however rough the mains, chokes are included in both positive and negative leads. An examination of the circuit reveals that there are many points of interest. A plate aerial is included for the reception of local stations without the use of an outside aerial, but its efficiency as a collector is very low, and it was found only to be of use when the local transmission was within about five miles. When the signal with an open aerial is so large that overloading of the valves occurs, a local-distance switch, causing the input circuit to be shunted with a 10-ohm resistance, can be brought into action.

The two H.F. valves are coupled by double-wound transformers which have been found to pass on less ripple voltage than other forms of coupling. As already referred to earlier, great care has been bestowed upon the pick-up connections which are isolated by condensers while the grid circuit is completed, when the switch is turned to gramophone, *via* a one-megohm resistance.

A screen-grid detector, which is finding quite a wide application in modern receivers, is embodied. Its advantages are greater sensitivity, considerably less damping of the preceding tuned circuit, and no change of capacity reflected back to the grid circuit as the tuning is altered. This assists in maintaining accurate ganging across both wavebands. To minimise as far as possible the higher-frequency heterodyne whistles between stations, a filter comprising a choke, shunted by a condenser (together with two 0.003 mfd. blocking condensers) is included in the output circuit of the pentode valve. The network also has the effect of attenuating the higher frequencies which are over-emphasised by the pentode.

FEATURES.

General.—*A table model all-mains D.C. receiver with built-in moving-coil loud speaker and provision for pick-up and external loud speaker. Illuminated dial indicator calibrated in wavelengths.*

Circuit.—*Four valves. Two screen-grid H.F. amplifiers with transformer coupling. Screen-grid detector parallel-fed transformer-coupled to power pentode. Provision for mains aerial reception.*

Controls.—*(1) Single dial tuning. (2) Volume control combining series aerial condenser and reaction, together with on-off switch. (3) Wave range and gramo-radio switch. (4) Local-distance switch.*

Price.—*23 guineas.*

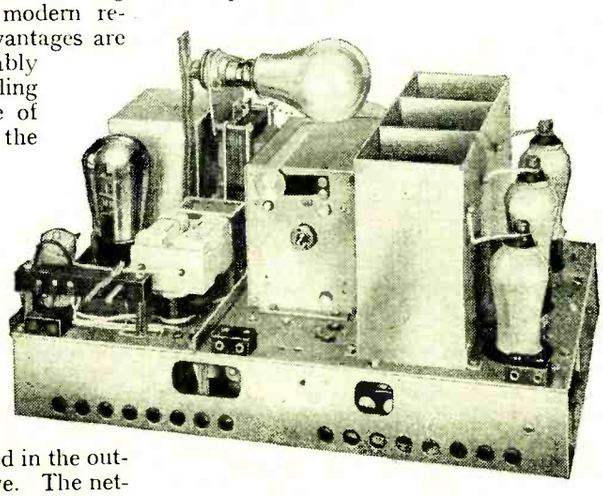
Makers.—*The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.*

Little need be said about the mains eliminator circuit save to congratulate the manufacturers on the use of really efficient smoothing chokes and condensers. The supply voltage is broken down for the heaters by means of a gas-filled lamp, which tends to maintain constant current.

An attractive volume control is used combining aerial and reaction condensers. Its progressive action is smooth and ensures, if used intelligently with the local-distance switch on nearby transmissions, that the signal strength can be adjusted from full volume to a level below entertainment value.

With regard to performance, the quality of reproduction is pleasing enough—the anode filter of the pentode effectively preventing undue high-frequency response. The moving-coil speaker is particularly free from bass resonance and speech is crisp and lifelike. The undistorted output is not the maximum possible for the output valve as volts must perforce be lost between the mains and the anode terminal of the D.P.T. valve. But the designers have managed to extract very nearly one watt (A.C.) from the output stage which is sufficient for all normal requirements. The selectivity was such as to enable a wide variety of programmes on the medium waves to be enjoyed without interference. On the long waveband nine stations were received, and it was just possible to obtain Königswusterhausen clear of its immediate neighbours.

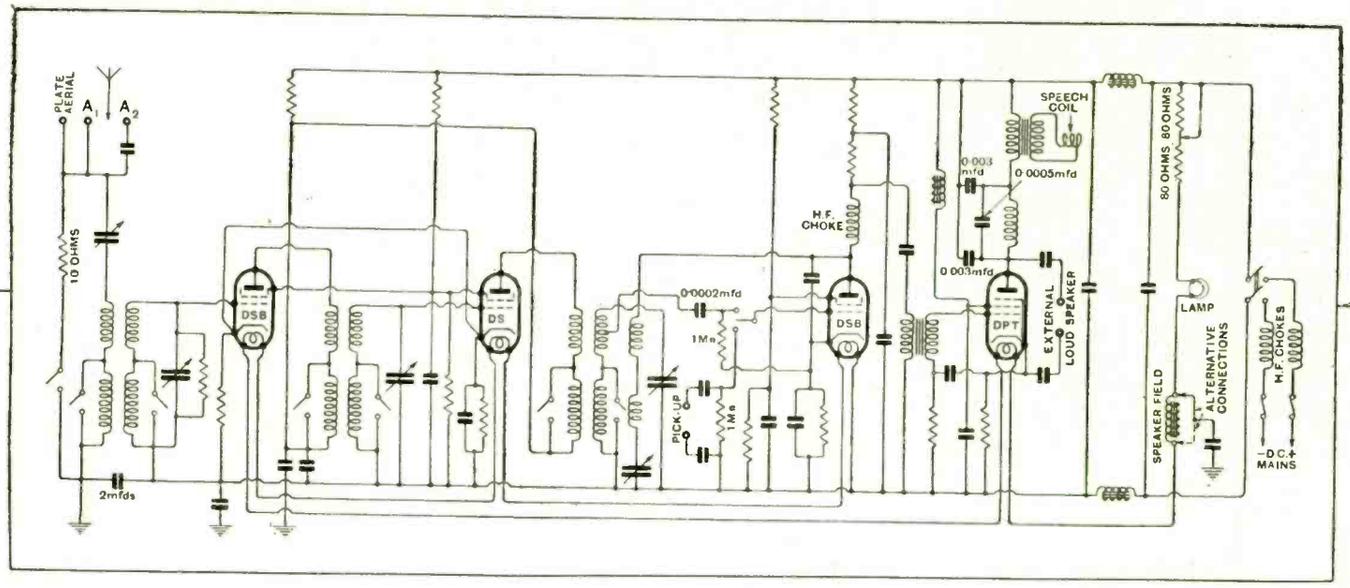
The Nomad receiver is exceptionally free from hum, and can be relied upon to give alternative entertainment from a large number of foreign stations even under poor conditions.

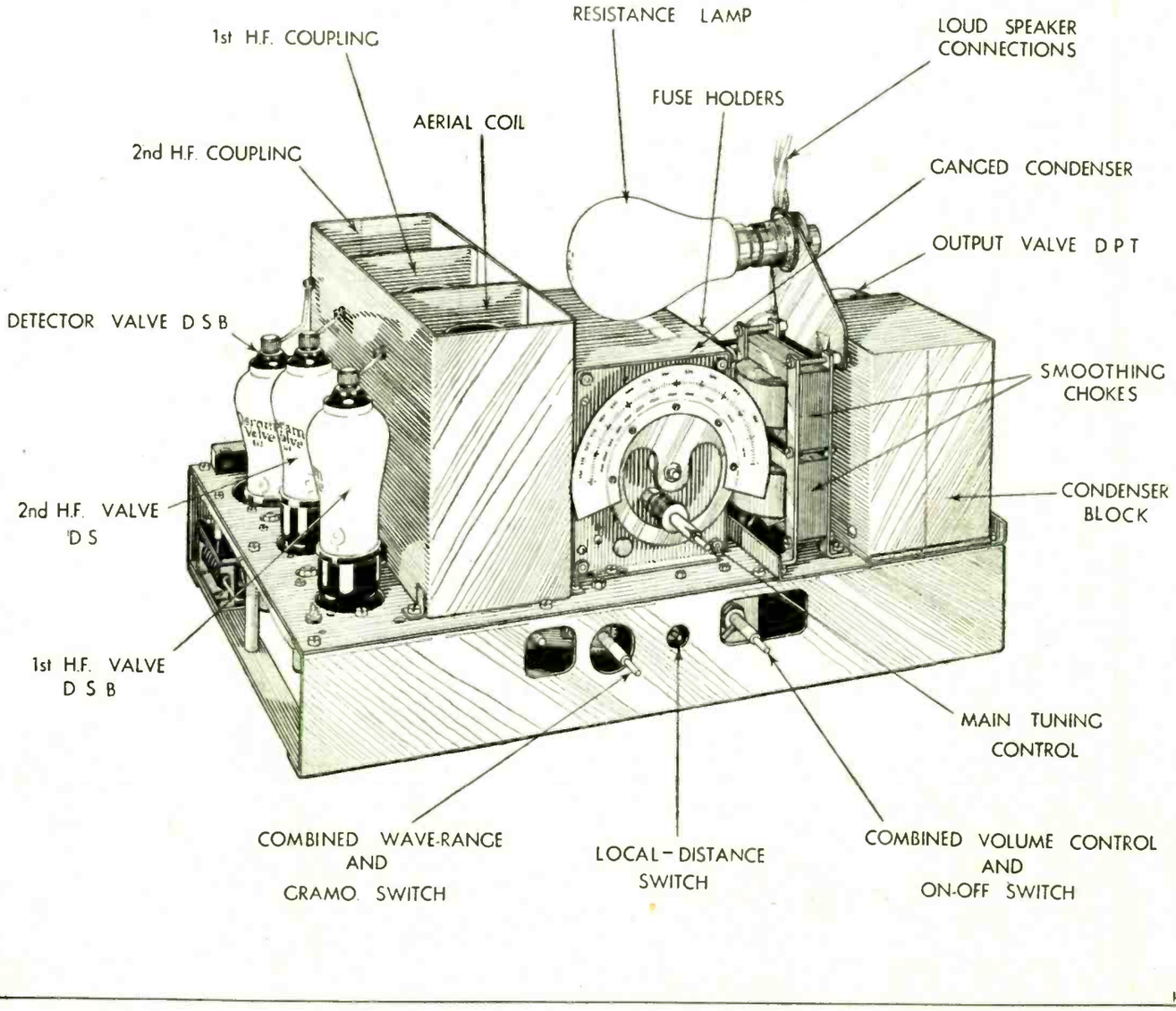


Rear view of the G.E.C. Nomad receiver showing the connectors for mains, aerial and pick-up.

www.americanradiohistory.com

SENSITIVE D.C. RECEIVER WITH MANY REFINEMENTS.





Circuit diagram and chassis details of the Nomad receiver. The metal frame is particularly robust and represents sound engineering.

www.americanradiohistory.com

READERS' PROBLEMS.

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers.

Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which particulars, with the fee charged, are to be found on this page.

The Secret Switch.

A SET which includes a battery-fed variable-mu H.F. valve consumes rather more current when it is operated in a most sensitive condition (with a small negative bias applied to the H.F. valve grid) than when it is desensitised for local station reception by increasing negative grid voltage. A reader who has a receiver of the type in question asks our help in devising an arrangement whereby members of the family may be prevented, as he puts it, from "wasting anode current" by indulging in unauthorised long-distance reception.

This state of affairs may most readily be brought about by the inclusion of an arrangement whereby the H.F. grid is maintained at such a negative voltage that sensitivity is sufficient for local station reception only. A mechanical arrangement to limit the travel of the slider of the potentiometer which controls bias would hardly be satisfactory, and so we suggest that the

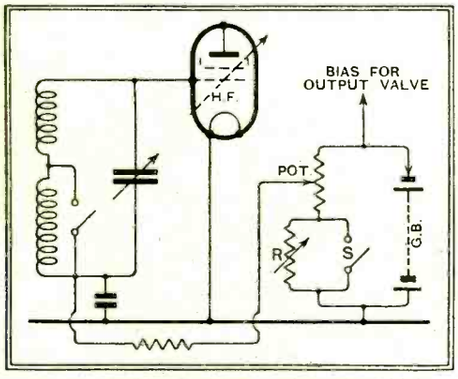


Fig. 1.—A bias-limiting resistance, which may be short-circuited by the switch S, so arranged that the anode current drawn by the H.F. valve shall not exceed a predetermined value.

best plan is to add in series with the potentiometer a fixed limiting resistance of suitable value; or, better, a variable or semi-variable resistance which may be adjusted by trial and error, so that the maximum sensitivity obtainable is just sufficient for short-range work. This resistance might be shunted with a switch—which for obvious reasons should not be in a conspicuous position—in order that it may be short-circuited when long-distance reception is required. The addition of this bias-limiting resistance to a conventional receiver is shown in Fig. 1.

Under-biased.

A READER who is using a four-valve battery-fed set with anode bend detection has noticed that when he withdraws from the H.T. battery the plug which feeds the detector with anode current, signals gradually increase in strength for two or three seconds until a well-defined maximum is reached, and then fade away to inaudibility. Naturally, he takes this as an indication that the normal sensitivity of the set might be improved, and asks if the effect described suggests anything to us.

When the H.T. battery circuit is interrupted it is evident that the detector is drawing anode current from the charge accumulated in a large by-pass condenser which will be found in the circuit. This source of voltage cannot be higher than that of the supply, and pressure will fall as the charge is drained away. The effect described indicates definitely that the bias applied is too high for the normal H.T. voltage. An adjustment of the operating conditions of either the grid or anode circuit would improve matters, but we suggest it will be best to make provision for close adjustment of negative bias.

Where Bass is Lost.

THE user of a high-power, high-quality amplifier, in which resistance-capacity coupling is used throughout, tells us that he has observed a sudden and well-defined falling-off in the reproduction of the lower register. His amplifier is used both for radio and gramophone reproduction, and the defect is noticeable on either.

A circuit diagram of the amplifier, which is sent for our consideration, shows that the arrangement is a conventional one, and, further, one that should be exceptionally "safe" and dependable. It is therefore logical to assume that a falling-off in bass reproduction must be due to a faulty coupling condenser or grid leak; in all probability the condenser has developed a more or less complete internal open circuit. A similar effect might conceivably be ascribed to a change in value of the grid leak, which now has a much lower resistance than formerly. But resistors of the type used in grid circuits do not usually change their values in a downward direction.

Monodial Resistances.

A CONSTRUCTOR of the "Monodial A.C. Super" seems to be mildly perturbed because the resistances R_{16}, R_{17}, and R_{18} are all "quite warm" to the touch after the set has been in operation for some time. We can reassure him by saying that this is quite a normal state of affairs; the receiver is distinctly of the high-power type, and requires a fair amount of energy for its operation. In the design this point was taken into account by specifying resistances of adequate, but not extravagant, current-carrying capacity.

Another reader has also noted the fact that these resistances become warm, but adds to his list R_{15}, which is the decoupling resistance for the output stage. Now there should be no current flow whatsoever through this resistance, and we cannot help thinking that he has confused this resistor with another in the receiver. If he has not, it may be assumed quite definitely that there is either a mistake in the wiring or else that a breakdown in insulation has occurred; it is rather difficult to see where this could take place.

Isolated Aerial-earth System.

IT is undeniable that D.C. receivers do not always function entirely according to plan, and that they are liable in certain circumstances to need minor adjustments and alterations which would be quite unnecessary in the case of their A.C. counterparts.

For instance, a reader whose set is connected to a D.C. system, of which the negative main is earthed, has found that the inclusion of the usual blocking condenser in the earth lead results in an annoying background of hum. He goes on to say that matters are greatly improved by the omission of this condenser, but when the set is directly earthed the fuse in the negative mains lead is liable to "blow." At present the set is being operated without any earth other than that provided through the mains,

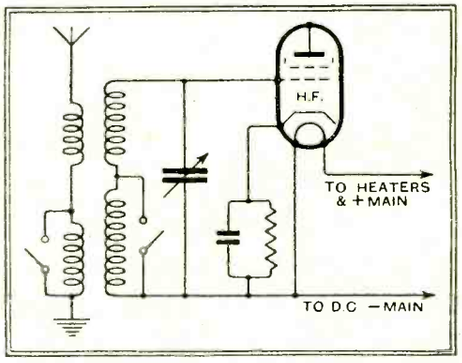


Fig. 2.—Magnetic coupling only: a D.C. receiver may sometimes be improved by using an aerial system without any metallic connection to the set.

and is working fairly satisfactorily. But our correspondent is not content; he feels that matters might be improved, and asks us to make a suggestion.

This is clearly a case where there is an appreciable difference of potential between the "earthed" negative mains and the true earth, and before going any further we should say that the practice of earthing the set directly through a conductive path is contrary to regulations, and should be avoided.

As the inclusion of the normal earth condenser results in hum, we suggest that matters could be greatly improved by using an aerial coupling device of the type shown diagrammatically in Fig. 2. Here there is no metallic connection between the aerial-earth circuit and the tuned secondary coils; insulation between the windings should be carefully checked.

The Wireless World

INFORMATION BUREAU.

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Tudor Street, E.C.4, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.

www.americanradiohistory.com

The Wireless World

A PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 686. FRIDAY, OCTOBER 21ST, 1932. VOL. XXXI. No. 16.

Editor:
HUGH S. POCOCK.

Proprietors: ILIFFE & SONS LTD.

Editorial Offices:
116-117, FLEET STREET, LONDON, E.C.4.
Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:
DORSET HOUSE, TUDOR STREET,
LONDON, E.C.4.
Telephone: City 2846 (15 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.
Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS.

EDITORIAL COMMENT.

Interference Crusade.

Where Help is Most Needed.

THE seriousness of interference with wireless reception, due to electrical disturbances, has been brought home very forcibly by the interest taken in our recent suggestions that listeners themselves should co-operate in endeavouring to trace the sources of local interference with a view to their elimination. Our proposals have resulted in letters from listeners all over the country, some giving specific instances of interference and others offering their services in connection with any scheme for interference hunting.

The first essential is, of course, that individual listeners should see to it that no electrical interference is originating on their own premises. If every listener would first undertake to make quite certain on this score, we believe that this alone would go quite a long way towards the elimination of a lot of the less severe but, nevertheless, irritating noises marring reception with sensitive receivers.

Since we first made the suggestion for listeners to participate in interference hunting, we have been in touch (unofficially at present) with the Post Office, and the B.B.C. has passed to us copies of the printed forms which they are at present sending out to listeners who complain to them of interference. These forms have been very carefully drawn up and, in our view, are ideally suitable for obtaining a fairly accurate guide to the nature of the interference, without expecting too much in the way of technical knowledge from the listener. These forms are available from the B.B.C., who, in turn, pass the information which the listener supplies on the form to the Post Office for their consideration and attention. The Post Office is, of course the proper authority to approach.

We believe that any new efforts to overcome interferences should be designed to work in with and not overlap those which already exist.

The Post Office, we understand, would welcome assistance from amateurs in identifying sources of interference, and it is in this direction especially that our readers can assist. Where, naturally, the Post Office finds it difficult to act is in cases of interference where no information is given as to its nature and location.

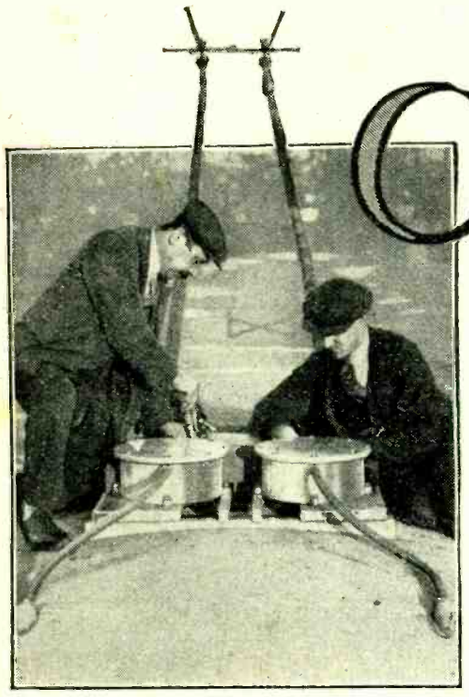
Receiving America.

Broadcast Band Stations Strong.

PAST experience tends to show that this time of the year is particularly favourable for the reception of American stations, and whilst the short-wave transmitters on the other side of the Atlantic can generally be depended upon to give fairly consistent results, the reception of ordinary American broadcasting can still be regarded as an achievement.

A letter published in this issue under Correspondence is, therefore, of special interest, as it gives the experiences of a listener in the heart of London who claims really good reception of a number of American broadcasting stations, so that they were equal in strength to many of the Continental transmitters which we are accustomed to receiving regularly. The receiver on which these results are obtained is one of special sensitivity; but, nevertheless, with reception as good as our correspondent indicates, many receivers far less efficient ought to give satisfactory reception on favourable nights, so that an hour spent in the early hours listening for American broadcasting is likely to be well rewarded.

www.americanradiohistory.com



This illustration shows stopper coils being fitted to trackless trams operated by London United Tramways.

Cutting out the Crackle

What the Listener Can Do to Minimise Interference.

By A. B. CALKIN, M.A.

(*Radio Technical Department, Philips Lamps, Ltd.*

THE ideal way of dealing with the problems of electrical interference is to remove, as far as possible, the cause of the trouble, and when this is impossible, to confine the interference within close limits to prevent it from spreading. This aspect of the subject with its many different applications to industrial and domestic machinery has received considerable attention during the past few years.

It is not generally realised, however, that the likelihood of obtaining substantially interference-free reception, at any rate from a number of stations, depends to a large extent upon the conditions obtaining actually in the place used for reception. The problem is, therefore, one that each listener can tackle for himself, at any rate in its earlier stages, rather than one, as is often thought, which immediately calls for expert advice from the B.B.C. or the Post Office.

Sparking Commutators.

The problems associated with the elimination of static interference to radio reception are not of the type inviting theoretical treatment, but essentially concerned with the grasping of one or two fundamental facts about the propagation of interference, to be followed by common-sense reasoning and the possible application of certain remedial devices which have proved satisfactory.

The following facts regarding the origin and propagation of electrical interference are of fundamental importance. All electrical machinery and equipment which, by virtue of its operation results in sudden changes of electrical current, whether sustained or intermittent, is liable to generate waves of electrical interference. In cases where the current changes are due to the mechanical make-and-break of a circuit as, for instance, a simple electric light switch, a spark will occur unless special means are provided to prevent it. In cases where a spark occurs a number of damped oscillations are generated, and for each spark a single "plop" will be heard in the loud speaker.

A DETERMINED effort is now being made to bring home to those responsible for the installation and maintenance of electrical apparatus that they are under an obligation to the community at large to take all practical steps to prevent interference with wireless reception.

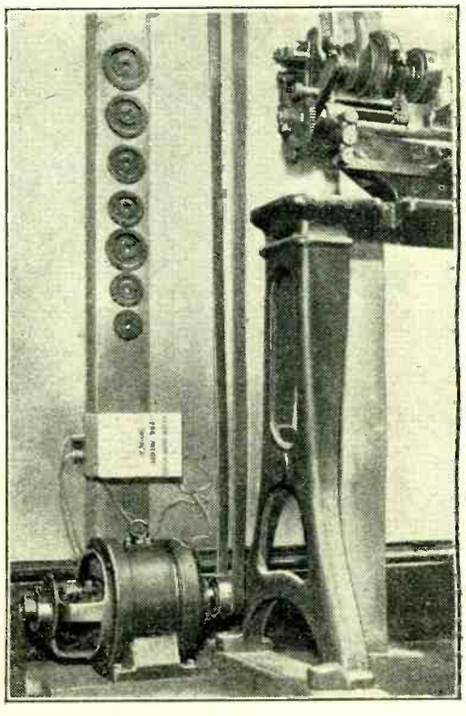
But, although these troubles can generally be most effectively tackled at their source, this article shows that the listener himself can do much to improve the average standard of reception.

Machinery and equipment in which sparking occurs will in general give rise to the worst interference. It must not be assumed, however, that simply because sparking does not occur that the equipment under consideration is necessarily non-interfering.

It will be realised from the foregoing that all manner of electrical gear, such as motors, generators, lifts, vacuum cleaners, switches, faulty contacts (whether due to a loose fuse or a corroded joint in the aerial system), all conspire together to upset our radio reception.

The question then arises: How is it that a single spark can cause interference to a number of radio receivers installed in several different houses? Here, at once, we come face to face with one of the fundamental facts about electrical interference. By far the greater portion of the energy responsible for this interference travels over the local mains net-work to which the sparking apparatus is connected, and by this means is introduced into the electric light systems of possibly hundreds of houses. The energy is not, as often supposed, absorbed in sending out just a train of damped waves into the ether.

One recognised authority in the Post Office Engineering Dept. estimates that as much as 90 per cent. of all H.F. interference reaches a listener's premises by conduction over the electric light mains, only the remaining 10 per cent. being transmitted by direct radiation. If reception suffers from serious electrical interference, the electric light and power mains, and to a lesser degree the gas and water



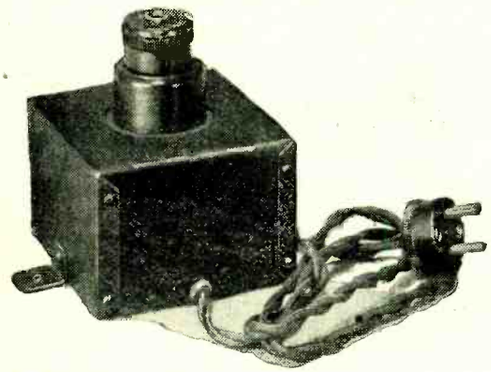
This photograph, showing an Austin anti-interference unit fitted to a lathe motor in "The Wireless World" experimental workshop, tends to disprove the old adage that the shoemaker is always the worst shod.

www.americanradiohistory.com

Cutting Out the Crackle.—

pipes (due to induction and earth currents), must be regarded with the gravest suspicion.

At this point the reader will probably conclude that an "all-electric" set will produce far more interference than a battery-operated set, for the very good reason that it is in direct connection with the source of the trouble. This is likely to be the case unless a certain amount of care is exercised. All-electric sets may give the impression of producing more interference than a battery-operated set, but not essentially for the reason suggested. As a rule, all-electric sets, particularly the more ex-



Built to the Post Office specification: a Trix "Interference Reducer" for interposing between set and mains supply.

pensive ones, are far more sensitive than their battery prototypes, and any interference that may be present in the mains and picked up by the aerial is obviously amplified to a greater extent by the more sensitive set. The reason for the interference not entering the all-electric set through the mains connection, as might at first be supposed, is the fact that a more or less effective barrier is offered to these currents by the smoothing equipment inside the set, whereby these currents flow inoffensively to earth.

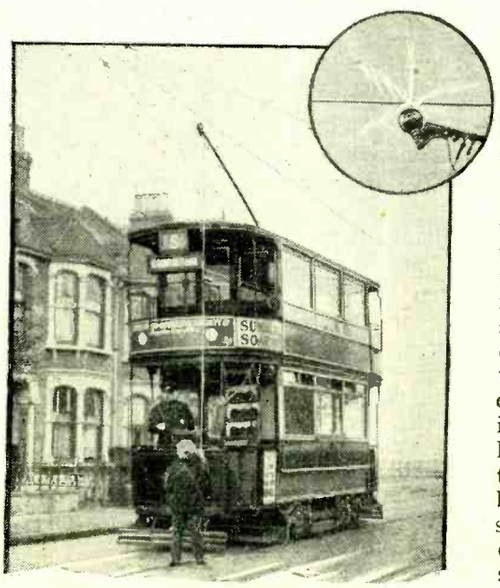
Under acute conditions, however, the interference may be so strong that the smoothing equipment in the set is inadequate to cope with it. Such cases require special treatment, which will be dealt with later on. The important fact to bear in mind is that the smoothing equipment in the set will not be effective in checking the interference unless a very low-resistance earth connection is used. Any impedance to high-frequency currents in the earthing system will seriously detract from the ability of the smoothing equipment to suppress the mains interference.

We have now arrived at our first conclusion, namely, this: In order to reduce the interference picked up by an all-electric receiving set, particularly in cases where such interference is suspected or known to be present in the mains, a low-resistance "earth" is indispensable.

From my own experience I have found that a separate earth connection, in the form of a copper tube, or, better, a large plate well embedded in the soil, gives superior results to any internal earth, such as water or gas pipes, and, where conditions permit, this type should always be used. But in certain instances I have found that a copper tube driven in the ground very close to the foundations of a house, so as to be in close proximity with drains, water, and gas pipes, etc., is almost useless as a means of leading off interference from an all-electric receiver. By the simple expedient of moving the earth tube a few yards away from the house to some undisturbed soil, free from any conductors likely to be propagating interference, a considerable reduction in interference could at once be obtained. While we are on this subject of earth connections, the need should be emphasised for a connecting wire of adequate section, at least 16 S.W.G. copper wire; a proper soldered joint should be made between this and the earth tube or plate. It should be remembered, too, that the earthing system must have a low-resistance path to H.F. currents; it should therefore be both as short and direct as possible.

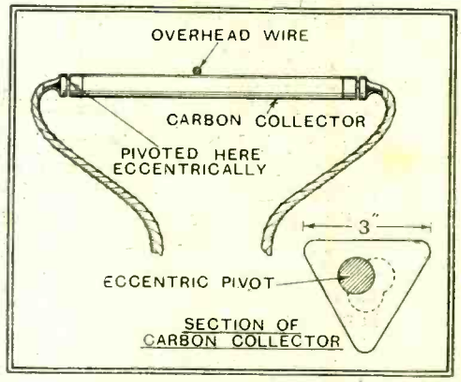
Convincing Proof.

I once had a particularly convincing proof of the effectiveness of a proper earth connection in reducing interference under reception conditions which seemed about as hopeless as they could be. A certain five-valve receiver was required for demonstration work in London. The local interference (very local in this case) was so strong that not even long-wave Daventry could be received without a background of mush. Other stations on the long-wave band were quite inaudible through the roar of interference, which became almost deafening as soon as one turned up the volume control of the receiver. The set was earthed to the water main, which at that time was the best available earth connection. As no soil was available near the premises I had a hole made in an area in the middle of the building for the purpose of sinking an earth tube. The area was covered in with concrete, which, after a whole day's hammering and drilling, proved to be 8ft. thick! However, the hole was made, and it only remained to fix a copper earth tube rigidly to the end of a piece of gas barrel 8ft. long, with the connecting wire taken up the centre of the barrel, and for the extended earth tube to be driven into the ground. This was done, and the hole was filled in with coke.



Heavy interference is often experienced in the vicinity of tramway lines.

The improvement in results, particularly on the long waveband, had to be heard to



It is claimed that the Conradty slipbow, a special form of collector for overhead tramway systems, confers immunity from interference when used with a choke coil.

be believed. Whereas with the original earth long-wave Daventry only could be received, and that accompanied by a faint background, with the new system four or five stations on the long wave could be regularly received, with less background than was originally heard with Daventry. Daventry itself was, of course, absolutely interference-free.

Interference *via* Aerial.

Having dealt with the importance of the earth connection, let us now turn our attention to the question of the best type of aerial. We have arrived at the conclusion that, provided we make use of an efficient earthing system, interference is unlikely to enter the set actually *via* the mains connection. If, after having provided the best possible earthing system, reception still suffers from interference, it is reasonable to assume that the interference enters the set *via* the aerial connection. As to whether the interference or the desired programme makes the most noise in the loud speaker depends upon the relative strengths of these two when they reach the grid of the first valve.

The amount of interference experienced when listening to a certain station is determined by the ratio of the signal level to interference level, and is not determined by the number of valves or the sensitivity of the set. This ratio, which is of fundamental importance when listening to distant stations, is determined by the quality of the aerial system. If the aerial is erected so that its coupling with the local sources of interference is small, then the ratio of signal to interference level will be high, and a large number of distant stations will be received without interference, always assuming, of course, the sensitivity of the set permits. If, on the other hand, the aerial is such that its effective height is small and its coupling

www.americanradiohistory.com

Cutting Out the Crackle.—
with the lighting circuits, and so on, is considerable, down goes the ratio of signal to interference level, and up comes the interference on distant stations.

When conditions permit, always use a well-insulated outdoor aerial erected as high as possible, taking care to space the down-lead well away from any conducting objects, such as gutters, drain-pipes, etc., and use the shortest possible length of lead-in wire inside the house. Without fear of contradiction, I say unreservedly: *There is no substitute for a good outdoor aerial.*

Bearing in mind the conclusions just arrived at regarding the importance of signal-to-interference ratio, it must be obvious that an indoor aerial, or worse still, a mains aerial, must necessarily introduce a far greater proportion of interference into radio reception than a properly erected outdoor one, if only for the reason that the indoors or mains aerial is so much more closely coupled to the electric mains.

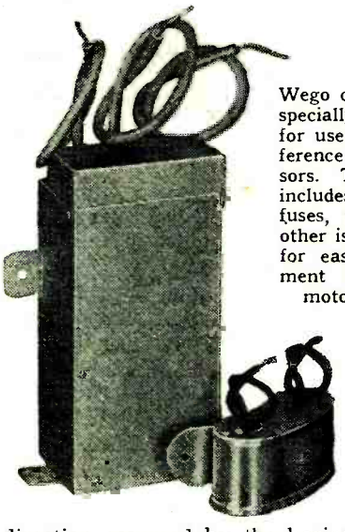
An outdoor aerial offers an additional advantage over the indoor or mains type in that its effective height can always be made greater. The benefits of the outdoor aerial are therefore two-fold, the amount of interference picked up is less, due to a shorter length of wire inside the house. Signal strength is greatly increased by the greater effective height of the aerial, and the result is a far bigger proportion of signal strength to interference.

Short Lead-in Wire.

In advocating as I do the use of an outdoor aerial-earth system, the fact has not been lost sight of that an outdoor aerial is an ideal which unfortunately cannot always be realised in practice. If a change from an indoor to an outdoor aerial is contemplated, the following practical points should be borne in mind: The interference pick-up of an aerial system will only be effectively reduced provided that proper care is taken to keep the down-lead well spaced from any metallic conductors, such as electric light conduits, telephone cables, water pipes, gutters, etc., and provided, too, that the receiver is placed close to the point of entry of the down lead into the house. A lead-in wire tacked neatly round the picture rail for a distance of 50 or 60 feet, because the aerial lead-in is in one room and the receiver in another, can only be pronounced as fatal in its effect on interference pick-up. Should the electric light installation be old-fashioned, with the wires not screened in metal conduit, any interference present in the mains will be far more difficult to eliminate, and the precaution of using a very short lead-in wire must be considered as essential.

Theoretically, it would be desirable to have the down lead and lead-in wires completely screened and earthed, leaving only the top part of the aerial free for pick-up. This, however, presents serious practical difficulties, and should not be attempted except in extreme cases where all other means have failed. The objection to using a screened wire for this purpose is that the capacity between the conductor and the screen is far too great in all standard types of wire, resulting in such a serious loss in signal strength, particularly with receivers with only small aerial coupling, that the advantage gained by using a high outdoor aerial may be completely nullified.

In any case, meanness with regard to insulators should not be tolerated. They are so cheap, and easy to fix. With bare copper wire at least three may be used at the end of the aerial remote from the receiver, and not less than two in other positions. Insulated wire may be a better proposition in big cities, where everything gets sooted up so quickly. Every additional foot of height above the ground or house-top is worth having. The actual

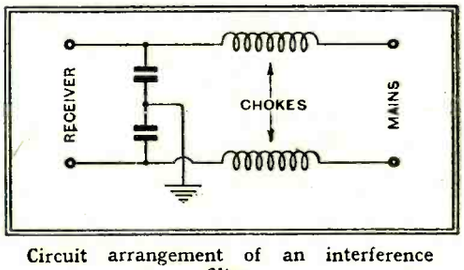


Wego condensers specially mounted for use as interference suppressors. The larger includes a pair of fuses, while the other is arranged for easy attachment to small motors, etc.

direction assumed by the horizontal portion of the aerial will best be determined by local conditions. From the aspect of picking up interference, should there be any power or telephone lines in the immediate vicinity, the aerial should cross them at right-angles rather than lie in a direction parallel to them. This remark applies, too, to overhead tram conductors.

Having now dealt with the subject from the aspect of the radio equipment, let us now briefly consider what steps can be taken to lessen the amount of interference actually radiated by the mains themselves inside the house. Provided there is good electrical continuity in the conduit which encases the electric light and power wires, and provided that this conduit is effectively earthed, it is unlikely that much direct radiation from the mains will take place.

Experience shows, however, that, at any rate from the point of view of high-frequency currents, electric light systems—particularly in old-fashioned houses—are often very poorly earthed, and a simple remedy may be found by making a good earth connection to the conduit near to the radio receiving set. It is not sufficient in itself that the mains be encased in conduit. The conduit must be electrically continuous and properly earthed.



Circuit arrangement of an interference filter.

I once came across a case where the predominant source of interference in a London restaurant was traced to a large D.C. ventilator motor mounted on the roof of the premises. The interference was sufficiently strong to spoil even local-station reception. By the simple expedient of establishing good electrical contact between the frame of the motor and the conduit encasing the power mains feeding the motor the interference was very greatly reduced, no condensers or other type of filter being necessary.

As pointed out earlier in this article, under acute conditions of mains interference the smoothing equipment in an all-electric set may be insufficient to prevent the interference entering the receiver *via* the mains connection. Under these conditions the use of a special high-frequency filter is recommended; this should be inserted between the receiving set and the mains. The filter consists of two air-cored choke coils and two condensers, the most suitable dimensions of these being found by trial. The method of connection is shown in the accompanying figure.

Mains Filters.

The choke coils should be wound with, say, 18 or 20 gauge enamelled copper wire on a 2½in. diameter Paxolin former. The number of turns, which can best be determined by trial, will lie between 50 and 200. The condensers must be of the non-inductive type and may have values between 0.001 and 4 mfds. It should be remembered that these condensers will absorb power if the filter is used with A.C. mains, and under such conditions they should have the smallest value practicable. Technically, it would be better to insert a filter of this sort actually between the company's meter and the rest of the house wiring, as the entire electric light system would then be isolated from the interference. The chokes, however, in this case would need to be wound with wire of sufficient section to carry the full load current supplied to the house.

It is hoped that the broad principles underlying the cause and propagation of electrical interference to radio reception have been dealt with sufficiently to enable the reader to tackle his own interference problems intelligently. It is not claimed that interference-free reception of all stations can be obtained simply by applying the methods described above, as undoubtedly the problem also needs tackling from the point of view of interfering machinery.

If, however, the principles involved be kept well in mind, and attention is paid to the practical points mentioned above, I am confident that radio reception, as found under average conditions, can be greatly improved.

www.americanradiohistory.com

SOUND RECORDING for the AMATEUR.

Some Alternative Methods Discussed.

By NORMAN P. SLADE.

Recording by aluminium disc.

WHICH is the most practical system of home recording for the amateur! Each existing method has its special advantages and disadvantages, but the author here shows that the amateur's choice is closely restricted by considerations of cost and the availability of the necessary apparatus.

The argument in favour of film recording will be studied with interest, and will, it is hoped, give rise to some useful discussion.

IT may be of interest to review briefly the possibilities of sound recording from the point of view of the amateur experimenter, and to try to arrive at some conclusion as to the method most suited to his special requirements.

There are four main lines of investigation open to him, all of which have been developed to a greater or lesser extent commercially. These are: (1) The disc, (2) the cylinder, (3) the magnetised steel tape, and (4) the sound film.

In considering these processes it is interesting to note one of the great differences between professional and amateur requirements. The commercial system must necessarily lend itself to the making of thousands of accurate copies of the original, whereas the amateur will as a rule have need of the original only, provided that its wearing properties are satisfactory. Again, the professional has been obliged to develop plant and processes of great complexity and costliness, while the amateur requires something much more simple and within the scope of his pocket.

Disadvantages of the Disc.

In employing the disc process, the professional is able to avail himself fully of what is, perhaps, its greatest advantage—the fact that it lends itself admirably to the making of many copies. But when we have added to this the comparative simplicity of the apparatus needed to reproduce from it (and perhaps the fact that it is convenient to store), it is difficult to see any further advantages of the system. As to its disadvantages, these are more easily discerned, and among them the following are recognised: Its limited playing time. Larger discs would ordinarily introduce additional tracking difficulties, while slower rates of revolution would interfere with upper register recording and reproducing under the present system. Such "long-playing" systems as have been devised require the addition of special fittings, and in any case do not outweigh the other disadvantages of the disc method in general.

Secondly, the speed of rotation of the disc being constant, and the fact that the spiral works steadily towards the centre, brings about a "crowding" of the upper register variations in the groove towards the end of the record, and at a time when the needle is becoming worn, and hence less able to follow the groove properly. Thirdly, the amplitude cannot be allowed to vary inversely as the frequency for notes below about 256 cycles with the present dimensions of the disc. Even if it were allowed to do so, the pick-ups at present available would probably have difficulty in following the very low-pitch recordings.

The fourth disadvantage is that the matrix as at present employed is by no means as durable as one could wish, and occasions more background noise than is desirable; and another disadvantage—the fifth—is that a group of "process" faults are always apt to develop, such as "swingers," pitting, flaws in the matrix, etc., in spite of the greatest care.

It is obvious, in any case, that the disc system, as employed by the manufacturers, is quite out of the amateur's sphere, and his only hope would appear to be to use the aluminium blank, which still has most of the disadvantages referred to above, to which must be added the great resistance offered to the cutting stylus, together with insufficient resistance to the reproducing needle, which therefore cannot be of the steel variety, while difficulty is often experienced in getting fibre needles to keep their point over long recordings or during heavy passages.

The aluminium disc, on the other hand, does offer two not inconsiderable advantages to the amateur—it is cheap, and can be used with a minimum of special apparatus, which itself is not costly, and it can be played on ordinary reproducers.

With regard to No. 2 on the list, the cylinder; it offers linearity of tracking, constant surface velocity, and consequently the crowding of the upper register referred to in the case of the disc can be avoided. Also by a suitable choice of diameter and length the playing time may be extended.

Its disadvantages arise in the choice of a suitable material and in the special nature of the apparatus which would be required to make and reproduce the record. With regard to material, the choice would appear to lie between a wax, which would not wear well, and a soft metal such as aluminium, whose drawbacks have been mentioned. Otherwise, results should be superior to those possible with the disc.

However, in view of the necessity of providing a special lathe to cut and reproduce the record, and the objections this would introduce, apart from the high degree of skill which would be required to produce a really successful record by this means, we can set aside the cylinder process for amateur use.

Magnetised Steel Tape.

This brings us to No. 3, the steel-tape process. The commercial development of this system in the "Blattnerphone" has shown its possibilities; and, judging from examples broadcast by the B.B.C., results appear to be very promising. Its advantages lie in the ease of making a record, once the apparatus is suitably adjusted, the increased playing time obtainable, the fact that the tape can be demagnetised and used over again, and the absence of anything corresponding to the damaging effect of a heavily weighted needle, with a consequent improvement of background, and also of wearing qualities. The writer

H.M.V. disc recording apparatus used in their studios at St. John's Wood.

www.americanradiohistory.com

Sound Recording for the Amateur.—

understands that the recordings are also remarkably permanent, and do not tend to deteriorate unduly with time.

Against all this, we are again confronted with the necessity of special apparatus. Nevertheless, compared with the disc and cylinder, the steel-tape process would appear to be well worth consideration with a view to its development to suit amateur requirements.

Finally, there is the "sound film." This would appear to be the method par excellence, and will probably supersede all methods of recording as time goes on. With it, it should be possible to obtain results superior to any system of recording yet devised. The playing time can be greatly extended, even at the "talking-film" speed of ninety feet a minute, and, no space for pictures being required, a narrow gauge of film would suffice, still permitting of a greater recording amplitude, and consequently requiring a lower gain in the amplifier. Another important advantage is the ease with which a large number of copies may be printed off from the original.

With regard to its technical disadvantages, these appear to be less than in the case of any other system of recording, but perhaps chief among them is the problem of film shrinkage. Obviously, this must give rise to undesirable fluctuations in pitch, and it is interesting to note that one of the most ingenious pieces of mechanism in the whole system is that which compensates for this shrinkage. A description of it may be found in *The Wireless World* of January 28th, 1931.

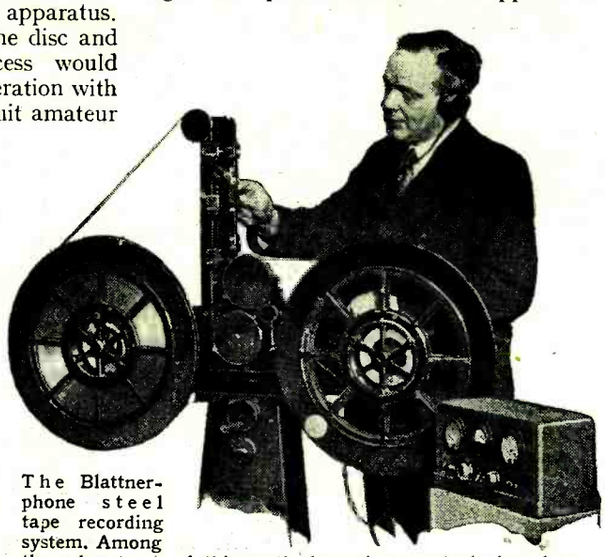
So far as the amateur is concerned, the developing and making of prints is hardly to be considered as a drawback, for if the system can be brought within his sphere this would be undertaken at a reasonable charge by the firm who supplied the unexposed film.

The outstanding obstacle, of course, is again the special nature of the apparatus, even though the amateur provided his own amplifying equipment, as he would probably prefer to do. In emphasising the virtues of film recording, the writer has not lost sight of this problem of the practical difficulties involved, but the provision of satisfactory apparatus at a reasonable price should not be a commercial impossibility. The whole thing depends, of course, upon the creation of a sufficient demand, and when this is assured we have ample evidence of what British manufacturers can do.

There is a danger of being dazzled by the magnitude to which the system has been developed to suit the needs of the talking-picture. No such complexities are necessary for effective amateur recording. Home-cinematographs—even "home-talkies"—are now an accomplished fact, and I gather that there are one or two systems commercially available for home use which employ the light-recording principle; but, judging from the little one hears of them, the system is in need of much more advertisement, and its advantages need much more exploitation, before the practice of amateur film-recording achieves the recognition and popularity which undoubtedly awaits it.

It is the system of recording for the future, but the length of time which must elapse before this can be fully realised must depend on the vision and keenness of amateur and professional alike.

It is hoped that these brief observations may help to foster this great interest, and perhaps induce some further comments from others.



The Blattnerphone steel tape recording system. Among the advantages of this method are increased playing time and the fact that the tape can be demagnetised and used over again.

RECENT "WIRELESS WORLD" CONSTRUCTIONAL RECEIVERS.

The Monodial A.C. Super.

(April 13th, 20th and 27th, 1932.)

A seven-valve ultra-selective superheterodyne set for the listener who wishes to have all the European stations at his command. One-dial control and eight tuned circuits are included, and there is a tone-correcting valve in the L.F. amplifier. The equipment comprises two separate units—receiver chassis and a power unit.

oooo

The Modern Straight Five.

(June 22nd and 29th, 1932.)

A long-range receiver for A.C. mains with two variable-mu H.F. stages. The undistorted power output is 5 watts A.C., being sufficient even for the largest room, and ensures that music will sound "alive" and natural, being rendered at about the original volume level. The selectivity is high, being adequate for all but the most exacting conditions.

oooo

The Battery Baby Superhet.

(October 7th, 1932.)

An economical and highly selective four-valve receiver for 2-volt battery valves comprising a single-valve pentode frequency changer, a variable-mu I.F. amplifier, a grid detector and pentode output to a permanent magnet moving-coil loud speaker. There are four tuned I.F. circuits, and automatic tone correction is embodied to restore attenuated side bands.

Full-size blue prints giving a complete layout and wiring diagram for each of these receivers are available from the Publishers at 1s. 6d. post free.

CORRESPONDENCE.

America on the Monodial Super.

AT the risk of being called a liar, a drunkard, Baron Munchausen, and various other epithets, I am writing to tell you of my experience last night (October 9th) with the Monodial A.C. Super* which I built several months ago. This set is standard in every respect except that I have incorporated visual tuning and also have redesigned the amplifier and power unit, which now consists of two PX25's in push-pull together with the necessary power equipment.

I am situated, as you will see by the address, not in the best of localities, being surrounded by high buildings, which contain lifts, and other "infernal machines."

Returning home late last night (2 a.m.) I thought it would be interesting to see if it were at all possible to get any of the American medium-wave stations so early in the year. Imagine my surprise when on switching on I found the ether simply bristling with them, and herewith I give a few of the best:—WJAS Pittsburg, WHAM Rochester, WPG Atlantic City, WBAL Baltimore, KDKA Schenectady, WENR Chicago, WABC New York City, Canadian Common Wave, WJZ New York, WOR Newark N.J. and WMAQ Chicago. There were many others besides these which were quite audible, but the ones I have mentioned were well up to the signal strength of Fécamp or Budapest.

WABC was broadcasting the Denndoil Motor Hour when I first switched on, and at one period came through quite as loud as Muhlacker.

Background noise, generally associated with American reception, was at an absolute minimum, and in no way interfered with the programme value.

I have been a regular reader of *The Wireless World* for the past ten years, and can assure you that this is no hot air talk, and if any of your readers would like me to send them the dial readings and wave lengths of the aforementioned stations, I should be only too pleased to do so. As a matter of interest the reading on my receiver for the London Regional programme is 43.5°.

G. C. MONKHOUSE.

Gordon Square,
London, W.C.2.

* *The Wireless World* Monodial A.C. Super described in the issues of April 13th and 20th, 1932.

www.americanradiohistory.com

Wireless in the Modern Hotel.

Solving the Multi-Aerial Problem.

By A. DINSDALE.

TIME was when the practice of connecting more than one wireless receiver to a single aerial was considered impossible. Then it became possible, but difficult. Now the practice has become relatively simple, and an almost unlimited number of receivers may be fed from a single aerial, without mutual interference or reduction in signal energy.

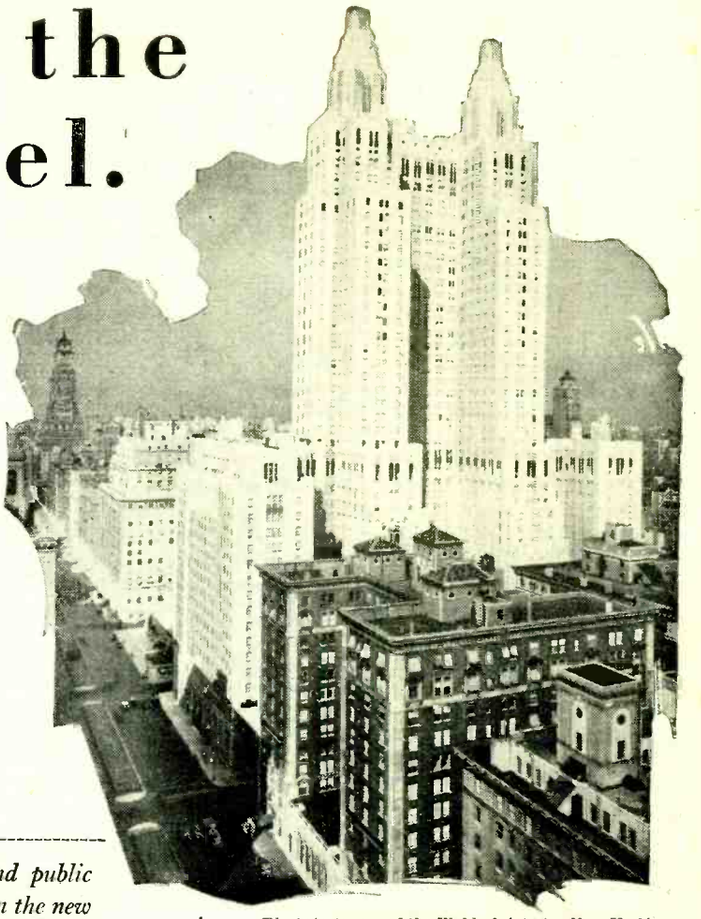
The problem, of course, is one which chiefly concerns the dwellers in mansions or flats. Not so many years ago the roof of any large apartment house was an unsightly death-trap of insecurely fixed aerials, stretching here and there in all directions. Even so, those who lived on the lower floors suffered from an inability to stretch an efficient aerial.

As a first step towards overcoming this difficulty the owners of some large American apartment houses installed a master receiver on the roof, with an operator in attendance, and forbade the erection of individual aerials. The output of the master receiver was piped at low frequency to loud speaker outlets in all apartments. This plan proved unsatisfactory, and the next development was the installation of various systems which had as their objective the bringing of an individual lead-in from a master aerial into each apartment. These systems suffered more or less from mutual interference between receivers, loss of signal strength, and particularly from local interference caused by lifts and other electrical machinery in the building, the said interference being picked up by the aerial lead-ins. This local interference has now been overcome by installing the master aerial as far above the roof as possible, and running screened H.F. feeder lines from a coupling system in the aerial lead.

Skyscraper City.

An example of a modern and highly comprehensive system is offered by the installation in the new Waldorf Astoria Hotel in New York, the equipment being designed and installed by Bell Telephone engineers.

In an overcrowded skyscraper city like New York the ideal living quarters for those who must live in the city, and can afford it, are on or near the roof of a skyscraper, such quarters being anything up to five or six hundred feet above street level, affording a magnificent view and as much fresh air as is available. Most of the large hotels cater for this tendency, providing apartment suites on their upper floors. In order to provide as much apartment space as possible, the Waldorf was built with two high towers instead of one, and it is between these towers that the aerials are strung.



The twin towers of the Waldorf Astoria, New York's latest hotel, dwarf all other buildings in Park Avenue.

THE wireless and public address system in the new Waldorf Astoria Hotel in New York provides, it is claimed, an unparalleled example of what can be done when architects and builders co-operate with communication engineers from the moment the first plans are laid. In the Waldorf Astoria wireless is "laid on" to 1,940 guest rooms.

There are three of them, one for the general programme distribution system, to be described later, and one each for the two lots of tower apartments. Each single-wire aerial is securely fastened to one tower and made fast to the other through a floating counterbalance weight, to keep the wire taut at all times.

One aerial supplies six receivers kept permanently tuned to six leading stations. The L.F. outputs of these receivers are piped to each of the 1,940 guest rooms in the hotel, terminating in a 12-conductor socket in the skirting board. Any guest who wants radio service 'phones an order to the reception desk, and a page boy arrives shortly thereafter with a loud speaker which he connects to the wall outlet. A simple six-position switch on the case of the loud speaker permits the guest to take his choice of any one of the six available programmes.

In each of the towers there are 69 apartments, and two H.F. transmission lines terminating within each apartment permit the tenant to connect up his own receiver and tune to any station he likes. It is claimed that even a badly operated single-valve receiver could not cause interference with other receivers on the system.

Elaborate arrangements are also made for the distribution of radio programmes to all public rooms. Conversely, any programme, banquet, or other event of importance originating within the hotel can be picked up, fed to a national network, and broadcast to the nation.

Naturally, a system so extensive and elaborate necessitates equipment and a control room worthy of the headquarters of a national network, and the long rows of amplifier racks visible in the accompanying illustration provide eloquent proof of the amount of equipment necessary.

Master Volume Control.

H.F. feeder lines from the main aerial are carried down to the control room on the sixth floor, and multiplied to six Western Electric 10-A receivers, one for each main channel. The control rack for each main channel is equipped with mixing apparatus so that the outputs of as many as three microphones, situated elsewhere in the hotel, may be blended, and a preliminary amplifier to raise the level of the microphone currents. The rack also contains a main channel amplifier whose input may be derived from the preliminary (microphone) amplifier, the radio receiver, a wire line, or a gramophone record reproducer. Any of these "non-air" programmes may be piped to guest rooms over one of the air programme lines, one

www.americanradiohistory.com

Wireless in the Modern Hotel.—

of the six receivers being disconnected for the purpose.

Final amplification is accomplished by power amplifiers, thirty-one of which are available. Twenty-four of these amplifiers are normally associated with guest room circuits, six with public room circuits, and one with the outgoing wire-line circuits leading to broadcasting stations. Thus, normally, each of the six main channels has four power amplifiers associated with it for guest room amplification, and one for each public room.

The master volume control in the control room is so set that no guest can raise the volume of his loud speaker to a point where it would annoy a guest in an adjoining room.

The public rooms are permanently equipped with large loud speakers concealed behind grilles artistically arranged so as to harmonise with the decorative scheme of the room.

Avoiding Man-made Static.

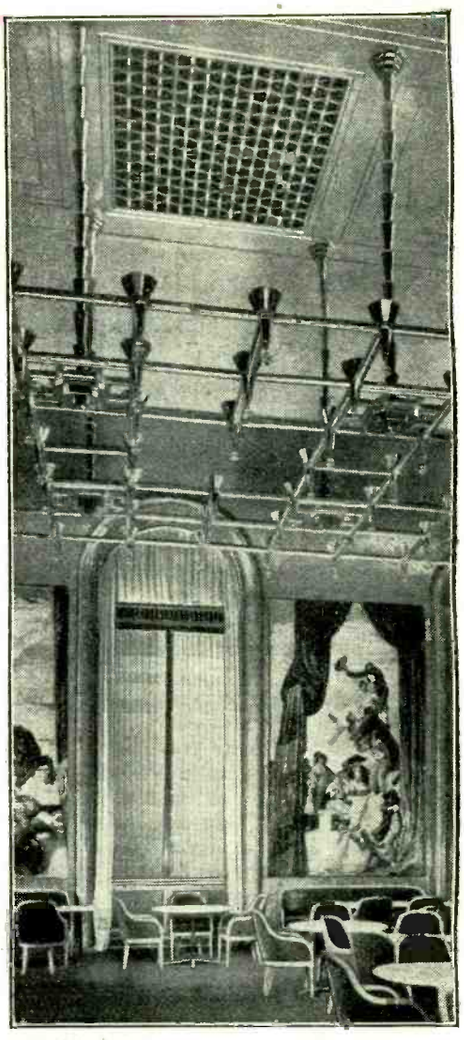
For the service of the apartment dwellers in the two towers, each of the two aerials (one for each tower) provided for that purpose is coupled to a radio-frequency transmission line of low impedance through a lightning protector, a wave trap for suppressing an unwanted local station which might overload the system, and a repeating coil. On reaching the highest floor on which apartments are situated the line is coupled to a loaded line of high impedance. To this line, in turn, are coupled low-impedance lines, sometimes as long as 250 feet, running down to lower floors to the individual apartments, where the impedance is again finally stepped up.

The coupling of the individual lines to the tenants' own receivers is accomplished through single-stage amplifiers, balanced and neutralised. These ensure against the feed-back of energy from improperly designed receivers, and against the modulation of one frequency in the signal by another, and give the signal a final boost before it reaches the tenant's receiver. The filament of each amplifier is lighted only when it is needed; its 110-volt supply is trunked through the outlet in its apartment, and current flows only when the set is operating. Noises originating within the hotel itself cannot cause man-made static because the double lines from aerial to single-stage amplifier supply the means by which any interfering impulse striking one wire is neutralised by the presence of the same impulse in the companion wire.

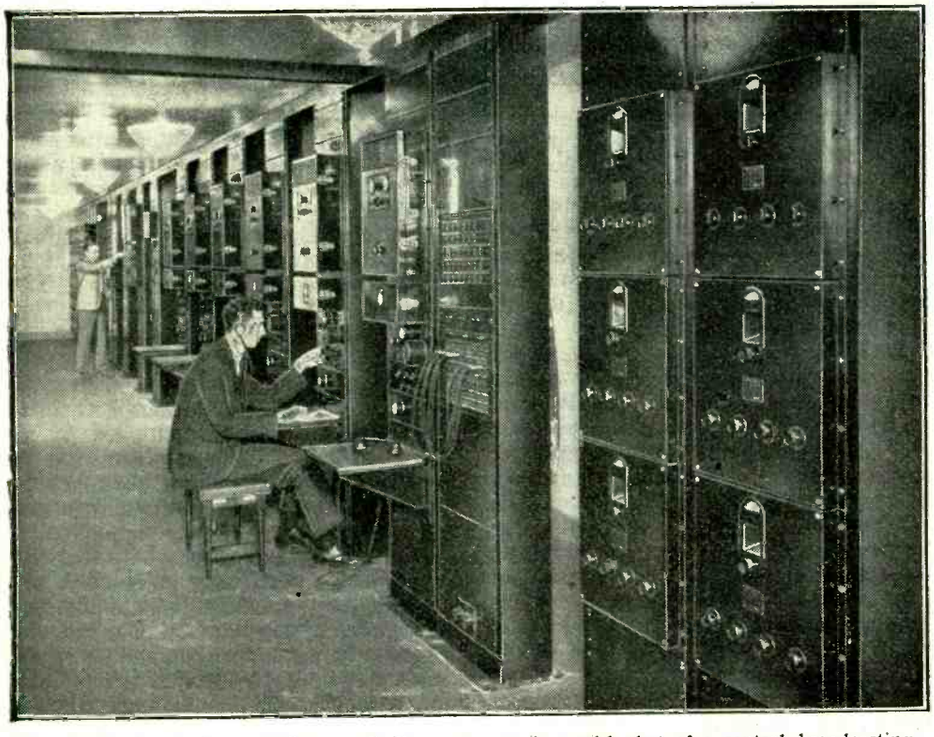
Programmes originating in one of the public rooms can be picked up by portable condenser microphones appropriately situated and connected through flexible, shielded leads to outlets in the skirting-board of the room.

Shielded cable connects the speech circuits from all the outlets to the control room. The filament and plate currents of the head amplifiers of the condenser microphones are also sent over this cable, which has a five-point outlet.

Since the hotel is supplied only with direct current, and all the radio equipment is designed to operate from alternating current, it was necessary to provide converter equipment. A power room is provided on the seventh floor, where a 240-volt. D.C. motor drives an alternator capable of delivering 15 kw. of power at 115 volts 60 cycles. Duplicate power equipment is also provided to guard against breakdown.



One of the dining rooms, showing the loud speaker grille in the roof.



The Waldorf Astoria control room challenges comparison with that of a central broadcasting station. The two panels on the right contain the six Western Electric receivers. The operator is seated before one of the six control racks, each of which contains preliminary and main amplifiers. In the background is the intercommunicating equipment.

It is claimed that this system provides an unparalleled example of what can be accomplished in designing and installing public address equipment when owners, architects, and builders co-operate with the communication engineers from the time the first plans are drawn. To adapt standard methods to particular needs, to provide many convenient microphone outlets, to fit loud speakers into decorative schemes and retain acoustic effectiveness, to bring cable for the required number of channels to each of several hundred rooms and suites, can only be done efficiently by carefully planning the electrical installation in advance of the actual construction of the building.

Possibilities in this Country.

Judging from "Free Grid's" remarks in a recent issue of *The Wireless World*, some British builders, and particularly those who build large apartment houses, would profit exceedingly if they gave some attention to the intricate potentialities of an adequate radio service for their future tenants. At the same time, there is an opportunity for those who specialise in public address equipment to devote some of their attention to the adaptation to British conditions of some of the features of the Waldorf Astoria installation.

www.americanradiohistory.com

UNBIASED

By
FREE GRID.

Interference.

IT is, I think, quite well known that interference from trolley buses is more difficult to eradicate than that from ordinary trams. It seems more difficult to cure even when the conscience-stricken tramway undertaking sets its engineers to apply remedial measures to the actual tramway or trolley bus system itself. For sheer ineradicable noise, however, commend me to a tramway system that exists in a district in the Liverpool neighbourhood.

Here the city fathers decided (quite wisely, in my opinion) that ordinary trams were archaic and cumbersome things cluttering up the King's highway. Moved, however, by the highest motives of economy, they opined that two overhead wires and a second trolley arm meant a sinful waste of money, so they hit upon the entirely novel method of providing an earth return by trailing a heavy metallic chain over the fairway. The chain dangled under and slightly behind the tram, thus literally providing an *earth* return. The display of pyrotechnics produced by this arrangement has to be seen to be believed, while the accompanying electrical disturbance drowns out everything on the loud speaker except the most hardened sopranos. I am not surprised to learn that, to quote the words of a local journal: "All efforts to combat the noise have so far proved unavailing."

This system rather reminds me of the method of picking up electrical energy which was used by the trams at Hastings (or St. Leonards, as the best people prefer to call it) during my last visit there (A.D. 1913). Studs were stuck between the rails at intervals, and, as the tram passed over, a magnet-system beneath the vehicle sucked up the connection to the stud, and the tram took a quick one which sufficed until it reached the next stud. The amusing part was that occasionally the stud didn't fall back after the tram had passed over it. Thus, any visitor to Hastings (sorry, I mean St. Leonards) who happened to tread on it was enabled to escape from the rapacious hands of the seaside landlady into the calmer atmosphere of the local hospital. If this system is still in existence (and if it is not I am sure some kind-hearted denizen of the place mentioned will furnish me with the date when it went out of commission), I can well imagine that its effect on local broadcasting will present a pretty problem for the local experts.

Now We Know.

EXTRACT from a local newspaper: "Insulators are cups of glass or porcelain which allow the electric currents to escape to earth."

This explanation will no doubt help the *W.W.* Information Bureau.

The Daily Drool.

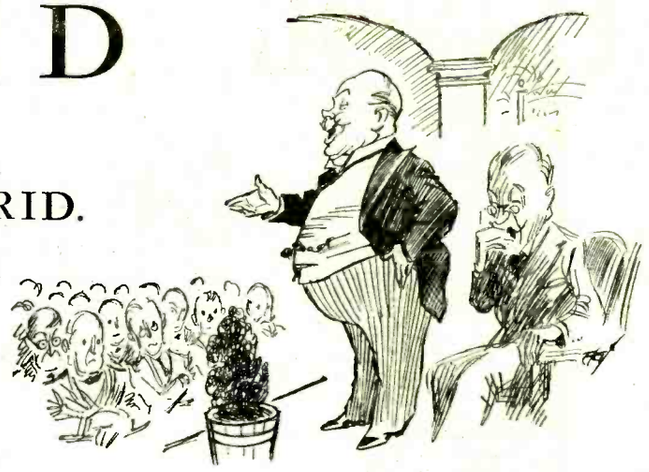
THE controversy still rages in the Press concerning the method we all ought to adopt in listening. Should we ration ourselves by choosing, at the beginning of the day, only those items to which we really want to listen, or should we just let the loud speaker drool on all day?

To those who somewhat fiercely denounce listeners who let the loud speaker do the diurnal drooling I would respectfully point out that the habit of permitting music to form an unobtrusive background to whatever we are doing was really established by restaurant orchestras many years before radio came to add to our grey hairs. At the same time I admit that the original purpose of the restaurant orchestra was, as reliable historians will confirm, to perform the same noise-drowning office as the band on the battlefields of olden days.

Speaking personally, I always like a soft background of music or a background of soft music, whichever way you like to put it, to all I do. I am, perhaps, peculiarly susceptible to its influence, thus proving the words of Cicero that it has power to soothe the savage breast. Unfortunately, however, the B.B.C. don't always provide the type of music to suit my mood, and, as even the radio-gramophone fitted with record-changing apparatus will only run for half an hour or so, without attention, I content myself with switching on when there's something on the air which I wish to hear.

Those Opening Speeches.

IF there is one thing that I am devoutly thankful for it is that the powers-that-be abolished the opening ceremony at the Olympia Radio Show several years ago. It would be well if the promoters of the smaller shows, usually organised by local trade associations, were to follow suit. Usually, they get hold of some local bigwig to do the opening, and, after he has got up on his hind legs and made the usual unctuous speech in which he once more informs us that radio is in its infancy, he is followed by one of the exhibition organisers who dishes out the customary guff about no home being complete without a wireless set.



"Radio is in its infancy."

Another Winner.

THE superhet has certainly returned with a vengeance this year, and thus time sees the ample fulfilment of my prophecy in these columns over two years ago (*W.W.*, September 17th, 1930). While I may say, with justifiable pride, that my prophecies turn out uncannily true, I do *not* adopt the method of certain race-course tipsters who give about a dozen different forecasts about everything concerning which they prophesy; I restrict myself to half a dozen only.

Lovers All?

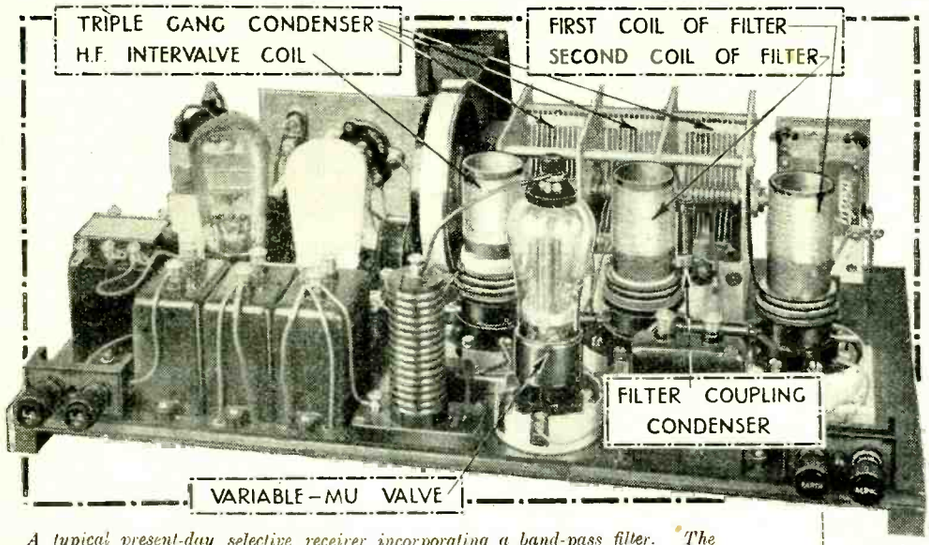
I HAVE received so many letters lately asking whether I am an amateur or a professional that I am beginning to wonder whether people are muddling up radio with football. The answer is that, *of course*, I am a radio amateur, and an enthusiastic one. Lest another mistake arise, let me warn people that when I use the word "amateur" I use it in its literal sense. I find it necessary to give this warning as so many people nowadays seem to regard the word as a synonym for beginners, as was the case with an acquaintance of mine the other day, who, exhibiting a sorry-looking specimen of hybrid receiver which was his first attempt at home construction, and strangely reminiscent of my own umpteen years ago, said, "I am only an amateur," in a hang-dog manner, when what he really meant to say was that he was only a beginner. I think that the Spanish word "aficionado" is perhaps more expressive than the French word, but why on earth don't we avoid all confusion by using the honest English word "lover"? I suggest that in future *W.W.* ought to lead the way in this matter.

www.americanradiohistory.com

The Signal Through the Receiver.

PART III.

High Selectivity Without Losing High Notes.



A typical present-day selective receiver incorporating a band-pass filter. The screening cans have been removed from the coils and H.F. valve.

TO obtain clear-cut reception of each desired station without annoying interference from those on adjacent wavelengths is undoubtedly one of the biggest problems in modern radio. High selectivity and good quality seemed to be mutually incompatible until the advent of the band-pass filter, the principles of which are here explained in simple language.

What happens to the signal as it passes through the variable-mu valve forms the subject of the next instalment.

IN the simple tuned circuit that was discussed in Part II we found that both from the point of view of selectivity and from that of signal strength it was definitely advantageous to arrange that the resistance associated with coil and condenser should be as low as possible. Low resistance, we saw, means a greater response to the desired signal, combined with its more abrupt disappearance on tuning away from it, both of which are very desirable in a set.

Comparison of Figs. 14 and 15 will show the improvement in selectivity occasioned by using tuned circuits of high efficiency. In each of these diagrams there are three curves, of which the outer one gives the response of one tuned circuit, the next that of two, and the inner one that of three in cascade. The term "in cascade" means that the signal passes through all the tuned circuits one after another, the process of selection thereby being heightened each time, and implies also that the two or three circuits concerned retain their individual characteristics when used in this way. That is to say, we assume, in drawing the curves, that when a second or third tuned circuit is added to the set the response curves of those previously present remain unaltered, and also that all the circuits involved are tuned exactly alike.

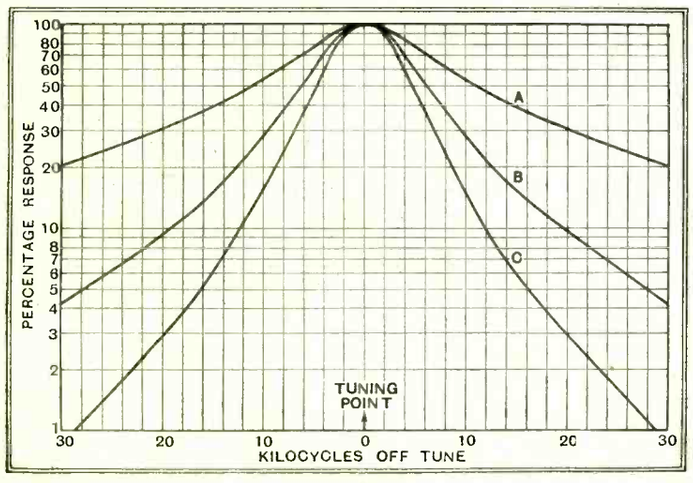


Fig. 14.—Resonance curves of high-loss tuned circuits (m = 80 at 1,000 kc.). Curve A is for one circuit; Curve B for 2 circuits, and curve C for 3 circuits made up of curve A circuits in cascade.

Of the six curves reproduced, the most attractive from the point of view of selectivity is Curve C of Fig. 15, corresponding to three low-loss circuits (m = 200 at 1,000 kc.) in cascade. At 12 kilocycles from resonance the response is only 1 per cent. of that given at exact tune. But there is another aspect to this selectivity, to appreciate which we shall have to revert to our picture of the modulated carrier-wave and its corresponding currents. In a circuit with low losses an oscillating current, once started, will die away comparatively slowly, as does the note emitted by a tuning-fork. A tuned circuit with higher losses might be likened to the same tuning-fork with a block of sponge rubber crammed between its prongs; when struck it would emit the same note, but owing to the frictional losses in the rubber the sound would die away almost at once.

Now, we have already seen that the modulated carrier sent out by the broadcasting station varies in amplitude at the frequency of modulation. For a high musical note of 5,000 cycles per second (some 4¼ octaves above Middle C) the amplitude of the carrier will rise to a maximum and drop down again to a minimum 5,000 times per second. The fall from highest to lowest value will therefore take only one-ten-thousandth part of a second. If the tuned circuits on which we are receiving this carrier have losses that are too low, the currents in them, sustained like the note of the undamped tuning-fork, will be unable to change in magnitude as fast as this. They will rise and fall, of course, and at the right frequency, but the rise will not be so high, nor the fall so low, as in the carrier wave whose antics they are vainly trying to follow. The result will be that the current in the tuned circuit will be a picture not of the carrier wave received, but of one like it in all respects, save that the high musical note is very much reduced in strength. Put in technical terms, the carrier will be partially demodulated.

The Low Notes.

Now let us consider a low note, of, say, 100 cycles per second (1¼ octaves below Middle C). In conveying this the amplitude of the carrier rises and falls, as

www.americanradiohistory.com

The Signal Through the Receiver.—

before, but at a much slower rate, the drop from maximum to minimum now taking only one-two-hundredth of a second. This slower change can be followed with almost complete perfection even by a very low-loss circuit, so that demodulation of the carrier does not occur for this note.

Taking these two effects together, it will be seen that a low-loss circuit will have no result on the proportion of low notes conveyed by the carrier, but will seriously reduce the high notes, the reduction increasing progressively as the pitch of the note is raised. In a set using such circuits to excess, musical reproduction

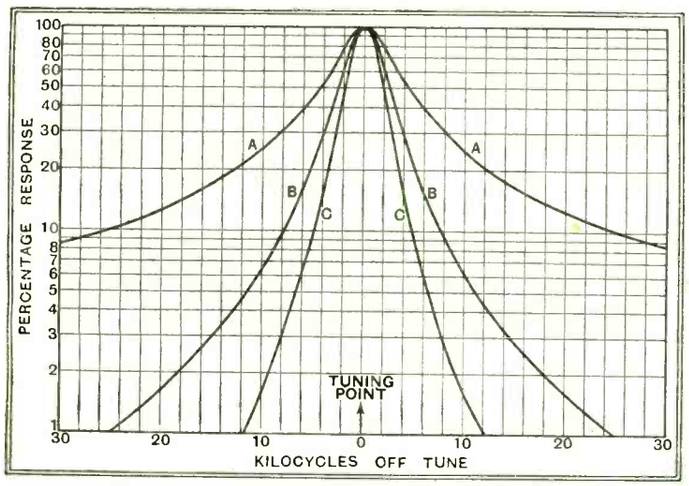


Fig. 15.—Resonance curves of low-loss tuned circuits ($m = 200$ at 1,000 kc.). Curve A is one circuit and curves B and C for 2 and 3 circuits in cascade, respectively.

will be seriously marred by a strong tendency to "boominess," and there will be a lack of clarity and precision. To set against this, the low-loss circuits will confer on the set the undoubted advantages of high amplification and high selectivity.

Loss of High Notes.

In trying to escape from the dilemma thus confronting him, the designer of a receiver needs to have accurate information as to the exact extent of the loss of high notes that accompanies any given

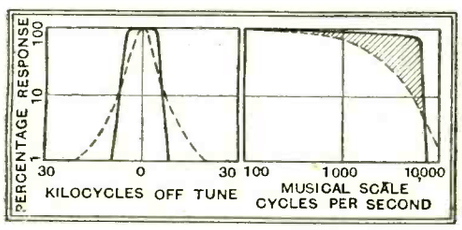


Fig. 16.—The ideal square-topped tuning curve compared with a real curve (shown dotted). In the right-hand figure the lost high notes due to over-sharp tuning are shown as a shaded area.

degree of selectivity. At this stage the mathematician makes himself useful by showing, on grounds of pure theory, that the slowness of response of a low-loss tuned circuit to variations in the amplitude of a current is numerically the same as its reduced response to slight detuning. Reference to Fig. 15 may help to make this rather involved statement clearer.

Practical Figures.

If a tuned circuit has the characteristics shown by curve A of that figure, its selectivity is such that when detuned by 5 kc. (5,000 cycles) its response is only 45 per cent. of that at resonance. A mathematician can show that its failure to follow a carrier varying in amplitude at the rate of 5,000 cycles per second results in the current which actually flows having variations in amplitude which are also only 45 per cent. of the variations of the carrier. Thus, from the response curve of a tuned circuit to a range of high frequencies round that to which it is tuned, such as those of Figs. 14 and 15, we can also read off the extent to which it cuts high notes when receiving broadcast music.

Looking at curve C of Fig. 15, we find that, though the selectivity is attractively high with these three circuits, the response to a 5,000-cycle musical note is miserably low—only 9.1 per cent. Curve C of Fig. 14, which represents circuits of higher losses ($m = 80$ at 1,000 kc.), shows us that with this combination we get 45 per cent. of a 5,000-cycle note, but selectivity is much lower. Still better musical quality, and still worse selectivity, can be had from curve A of this diagram, which gives 77 per cent. of a 5,000-cycle note, but allows a station 30 kc. away from that to which the circuit is tuned to come through at 20 per cent. of its volume at resonance, which represents serious interference.

Band-pass Theory.

It is clear from these considerations that what is wanted is an arrangement which will depart radically from the peaky curves we have so far been considering. It should yield in their place a tuning-curve which stays as near the maximum height as possible over whatever we decide to regard as the necessary musical range, thereby assuring us of good high-note reproduction. Outside this range it should drop down as fast and as suddenly as possible, so that selectivity may be kept high. Fig. 16 gives a general idea of the type of tuning curve wanted, together with the results from a musical point of view.

Although the attainment of such a curve as this is, in practice, quite impossible, yet it can be approached a good deal more closely than in any of the curves we have so far seen by employing a band-pass filter.

In the diagram of the receiver (see Fig. 9 in last week's instalment) we see that the first two tuned circuits are both

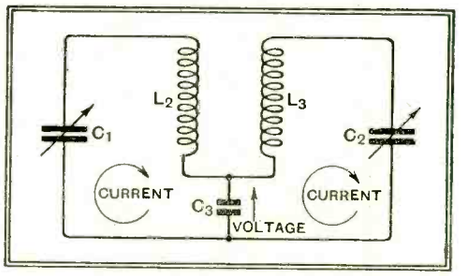
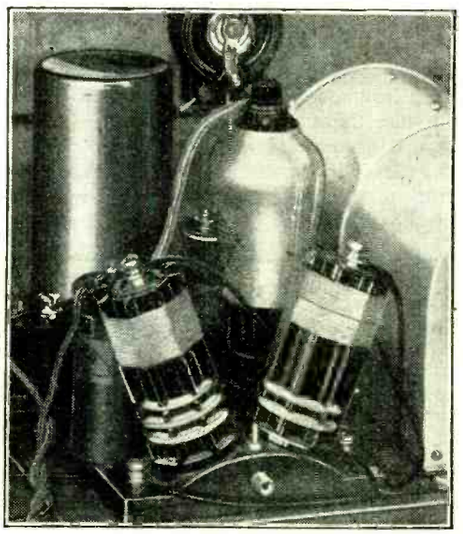


Fig. 17.—Simple scheme showing how the condenser C_3 acts as a coupling between the two tuned circuits of the filter.

completed through the coupling condenser C_3, which has therefore to carry the current that flows round both of them. This has the result, as Fig. 17 shows, of causing the current in the first tuned circuit to develop a voltage across C_3, and this voltage then acts to drive a current round the second circuit. Simultaneously, this current sets up its own voltage across the coupling condenser, so modifying the original voltage and altering the current in the first circuit.

The theory of the action and interaction of these two circuits is rather complex,



A commercial band-pass filter in which the two coils are magnetically coupled together.

but the final result is the emergence of a new type of resonance curve. This new curve expresses the response of the two circuits taken together. In Fig. 18 the heavy line curve is typical of a filter, the effect of the interaction between the two circuits being to replace the single peak at the resonance frequency by two humps, separated from one another by a few kilocycles, and having a shallow trough at the frequency to which they are actually tuned. This curve is not an imaginary one, but has been calculated for the low-loss coils we have already discussed, the tuning-curves for which are

www.americanradiohistory.com

The Signal Through the Receiver.—repeated from Fig. 15, and appear in dotted lines on the new diagram for comparison with the filter into which they are built.

It will be seen that the filter is rather less selective than the two coils which make it up would be if used in cascade (inmost curve), but that the reproduction of the high notes in the music is incomparably better. A 5,000-cycle note, reproduced by the filter shown at 83 per cent. of correct strength, would be reduced to only 20 per cent. if the same two coils were used in cascade.

The curve shown is not the only one that can be had by connecting these two coils to form a filter, for by lessening the "tightness" of coupling curve A will slowly drift into curve B. The designer of a set may, therefore, make a compromise between quality and selectivity to suit his own ideas.

Filters, however, are rather more difficult to handle than the last sentence implies, because the separation between the humps given by the simple filter circuit of Fig. 17 does not remain constant as the tuning is varied. The reason for this is that the impedance offered by the condenser C_3 at 200 metres is only one-third of that which it offers at 600 metres, with the result that, for the same current in L_2, the voltage introduced in the second tuned circuit $L_3C_3C_2$ is three times greater at the higher wavelength. Since "tight" coupling (high voltage on C_3) results in widely spaced humps, and "loose" coupling tends to drift the curve inwards to the form of curve B, the characteristics of a simple filter can only be strictly correct at one wavelength within its range.

This difficulty can be got over in several ways, all of which depend on the use of two couplings acting simultaneously, one getting tighter and the other looser as the wavelength is increased. In the receiver which is the basis of our discussions the capacitative coupling due to C_3 is augmented by the inductive coupling due to the auxiliary coils L_4 and L_5, each of which is coupled to one of the main tuning coils, together making an inductive link between them. The result of this dual means of coupling the two tuned circuits is to keep the two humps on the resonance curve at approximately the same distance apart at all points on the tuning range. The variations in quality of reproduction, sensitivity, and selectivity with wavelength that will inevitably arise in using any less complex system of coils and condensers to tune to the required signal are reduced in this way as far as present knowledge of the science of wireless will permit. We may agree, then, that our receiver as regards the input tuning has at least made a good start.

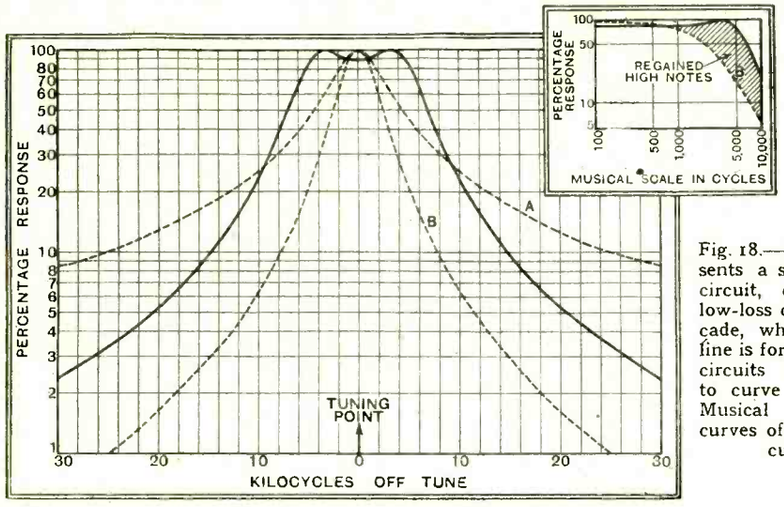
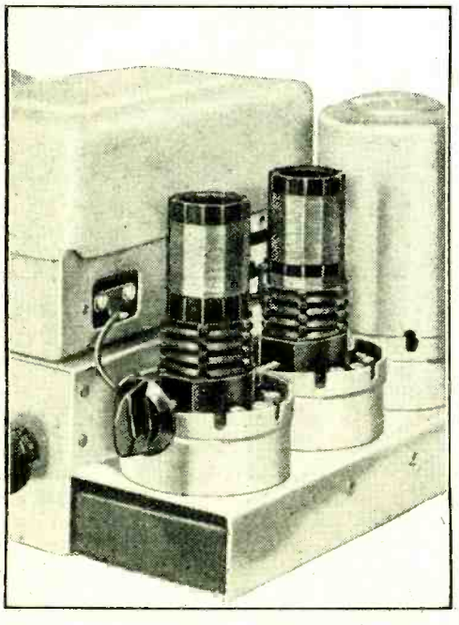


Fig. 18.—Curve A represents a single low-loss circuit, curve B two low-loss circuits in cascade, while the heavy line is for a filter of two circuits corresponding to curve B. (Inset) Musical response curves of the filter and curve B.



Metal-shrouded coils (with screens removed) forming the two members of a filter. The coupling contains both inductance and capacity.

DISTANT RECEPTION NOTES.

NUMBERS of those interested in long-distance reception will no doubt have made use already of the excellent calibration chart published recently in *The Wireless World*. For their own sakes I hope that those who have not yet undertaken it will not delay the calibration of their receiving sets. There is nothing complicated or difficult, even for the beginner, about calibrating a set, and once this interesting task has been done it is no exaggeration to say that one's pleasure in using the apparatus for the reception of foreign stations is doubled. Perhaps the most surprising of the improvements that follow in reception is to be found in the increased number of stations that can be tuned in. With an uncalibrated set you may, for instance, have a gap between the settings required for Dublin and Stockholm in which nothing is ordinarily heard. Once the set is calibrated you will have little difficulty in finding Berlin Witzleben, Madrid Union Radio, and Belgrade, provided, of course, that you conduct your search upon an evening when conditions are favourable.

I mentioned last week that the identification of stations which do not give their call-signs is rendered easier when the set is calibrated. Here is an instance. You tuned in one night some distance below Hilversum a station which is coming in fairly strongly. The language is quite unfamiliar and you cannot hear the call-sign. By comparing the setting of the calibrated condenser dial with your chart you find that the wavelength is just under 280 metres. You can then record Bratislava in your log with a feeling of certainty.

There is a wonderful selection of good transmissions available on the long waves just now, and the majority of them are to be heard at any time when they are working, either in daylight or in darkness. Oslo, though its signals are very strong, is apt to suffer from heterodyne interference, for it has Russian neighbours on either side. Frequently, though, this station may be received clearly and well. Kalundborg is uniformly excellent, and the Vienna Experimental station, working on 1,237 metres, is often to be heard. The Moscow Trades Union station comes in with enormous strength, and is often worth listening to when musical programmes are being given. Motala, though still somewhat unreliable, is improving. It is a pity that Warsaw and the Eiffel Tower are separated by only 5 kilocycles, for when both are working at once neither can be properly received. When one is silent the other is always good.

Medium-wave Stations.

On the medium waveband the pick of the stations at the present moment are Turin, Heilsberg, Hilversum, the Poste Parisien, Brussels No. 2, Strasbourg, Toulouse, Rome, Beromunster, Langenberg, Prague, Florence, Brussels No. 1, and Vienna. These are all so good that on any evening reception at full loud speaker volume can be guaranteed from them. Other stations that are very good at times, though subject to a certain amount of variation in strength, are Belgrade, Lyons Doua, Sottens, Frankfurt, Milan, Breslau, Gothenburg, Bordeaux, Gleiwitz, Trieste, and Nürnberg. Readers should note that the Spanish stations, which have not been too good for a considerable time, are coming back once more. Madrid Union Radio is handicapped by sharing a wavelength with Moscow Stalin, but it is well heard when the Russian is not working. Barcelona EAJ1 and Valencia (on 267.6 metres) are both worth attention. The last-named station is now 8 kilowatts. D. EXER.

www.americanradiohistory.com

NEWS of the WEEK.

A Bit Mixed.

DILATING on the menace of high power broadcasting stations, and of Luxembourg in particular, a Brussels "daily" declares that the new station's power of 1,250 metres is only exceeded by that of Moscow, with its output of 1,304 metres.

Floating Pulpit.

THE Rev. Father Lhande, a celebrated religious broadcaster in France, is about to start for Africa. It is announced that he will preach several sermons *en route* to be picked up by wireless and relayed to French listeners.

New German Call.

THE definite centralisation of German broadcasting is now apparent on the ether when all the German stations are taking the same programme. Instead of the lengthy and involved announcement hitherto employed, the call is "Hier ist der deutsche Rundfunk."

For Emergencies.

AMATEURS need not twiddle their thumbs in New Zealand. An enthusiastic Radio Emergency Corps has been formed with 270 qualified amateurs covering fifteen districts, their object being to maintain national communication in the event of storms, earthquakes, and other emergencies.

Berlin's Ultra Short Waves.

AN ultra-short wave broadcasting service became a regular institution in Berlin on October 10th. The transmissions are made on a wavelength of 6-7 metres and a power of 4 kW in the aerial. The schedule is as follows: Wednesdays and Saturdays, 19.00 to 20.00; Mondays and Thursdays, 22.00 to 23.00 (G.M.T.). Although it is exceedingly unlikely that the ultra-short waves would be picked up in this country, "one never knows."

A Tenth Birthday.

CONGRATULATIONS to Denmark! Ten years ago to-day (October 21st) the first broadcast transmission was made from Lyngby. To celebrate the event a radio exhibition is being opened to-day in Copenhagen and special programmes will be broadcast, including a talk by Graf von Arco, the German radio pioneer, on the work of Poulsen. Valdemar Poulsen, who is now 62 years of age, will be remembered as the inventor of the light-arc which made possible the first practical wireless telephony.

Licence Fees by Instalments?

THERE will be many sympathisers with the plea, renewed last week, for a scheme permitting the purchase of wireless licences by instalments of, say, one shilling, payable at any Post Office. The difficulty appears to lie in the amount of additional clerical work which such a scheme would entail.

If, however, a really strong demand arose the Post Office could probably make some kind of concession to persons who cannot easily afford a lump payment.

Current Events in Brief Review.

The Opportunist.

BUDAPEST No. 2 broadcasting station is changing its wavelength from 210 metres to 840 metres subject to the approval of the Madrid Conference.

The Hungarians evidently believe that it is wise to apply to the highest authority, and are taking advantage of the sitting of the world Conference. It is to be hoped that other broadcasting concerns do not bombard the Conference with similar requests; the delegates at Madrid seem busy enough on general problems without descending to the particular.

All Except the Cash.

POOR country folk flocked to Vienna for the wireless show which opened on October 8th, but according to our local correspondent little business was done, owing to the shortage of cash. Yet the show offered all the latest developments in radio—an overwhelming predominance of superheterodyne receivers, moving-coil loud speakers, station name dials, radio gramophones, anti-fading devices, photo-cell burglar alarms, and kit sets.

BRESLAU. Until the opening of the 120 kW. Leipzig transmitter next month Breslau is Germany's most up-to-date station in service. The picture shows the buildings and peculiar aerial for strengthening the ground wave.

"News by Television."

IN our issue of September 9th, in commenting on a method of transmission of news by television, we quoted from a letter received from the Marconi Company stating that their apparatus was "covered by British Patent No. 373,288."

Messrs. Baird Television, Limited, who are also interested in the transmission of news by television, have notified us that no patent bearing this number exists but that a patent application of the same number is being opposed by the Baird Company.

Enquiry of the Marconi Company at Marconi House elicited the reply that the company had no further comment to make.

"H. & C., Aerial in Loft."

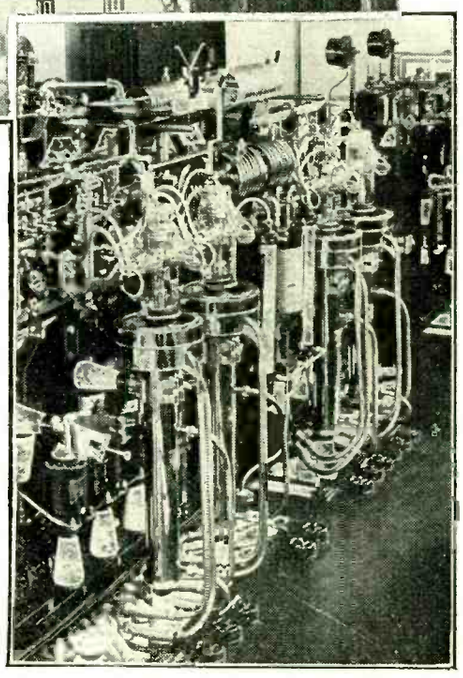
DOUBTLESS inspired by the recent opening nearby of a very modernistic Underground railway station, a firm of house builders at Bounds Green (North London) are making a novel claim for the up-to-date and modern character of their residences. They are displaying a large "For Sale" board on which appears in prominent letters the legend, "Wireless Aerial in Every Roof," side by side with "Main Drainage, H. & C., Electric Light," and other tempting adjuncts.

It is believed that some of the estate-development companies now building houses in the vicinity of the B.B.C. transmitters at Brookmans Park are contemplating the offer to prospective purchasers of free wave traps—"and Kirke diode detectors if required!"

An Anti-static Company.

THE abolition of man-made static is the object of a new company, formed in France, bearing the title Société Industrielle des Appareils Anti-Parasites." According to the Articles of Association, it will engage in "the creation, construction and sale of efficacious devices for counteracting the different sorts of artificial-parasites."

It's an ill wind, etc., and we hope the new concern prospers.

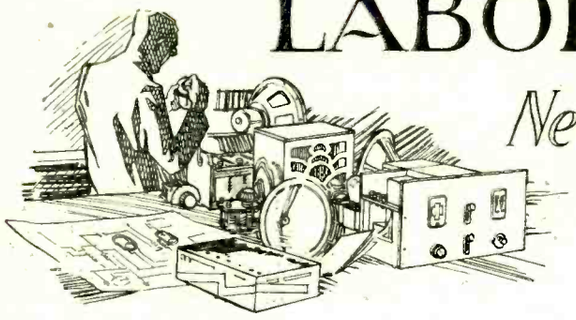


Although 60 kW. is the normal output, Breslau can work to a maximum of 120 kW. In the photograph are the first and final power stages. Telefunken are the manufacturers.

www.americanradiohistory.com

LABORATORY TESTS

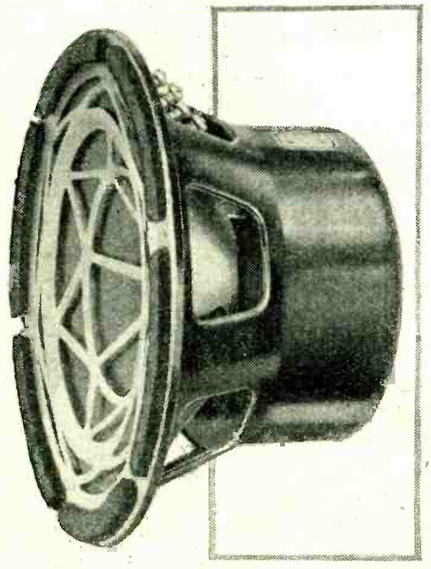
New Radio Products Reviewed



R & A "VICTOR" LOUD SPEAKER.

THE fact that a loud speaker is sold in chassis form implies that it will receive a good deal of handling before it is finally installed in a baffle or cabinet. It is not surprising, therefore, that cases of damage to the diaphragm are of common occurrence. In designing the R & A "Victor" permanent magnet moving-coil loud speaker considerable thought has been given to this problem, with the result that it is practically impossible accidentally to damage the diaphragm. The front is protected by a metal grille of pleasing design, and the back is enclosed by two concentric shells with holes staggered to give full protection without introducing box resonance. The outer shell encloses the output transformer as well as the permanent magnet, and the six ratios provide an unusually wide range of working impedances from 850 to 15,000 ohms.

The outstanding feature of the performance of this unit is the uniform distribution of the output energy over the frequency range. This is especially noticeable in the bass, where the majority of permanent magnet units rely on a resonance in the vicinity of 100 cycles to give a false impression of sensitivity. In the R & A "Victor" the principal diaphragm resonance is



R and A "Victor" permanent magnet moving-coil loud speaker.

at about 60 cycles, and the important range of frequencies between 75 and 400 cycles is free from objectionable resonances. The benefits of this arrangement are at once obvious when the loud speaker is tested either on speech or music, while the 60-cycle resonance is helpful in correcting the loss of amplification below 100 cycles which occurs even in some of the best amplifiers.

In the upper register there is no sharp cut-off, and the output tails off gradually above 5,000 cycles. There is still an appreciable output at 12,000 cycles when the general level is about 1 watt.

The makers are Reproducers and Amplifiers, Ltd., Frederick Street, Wolverhampton.

FILT EARTHING DEVICE.

SINCE the earth connection is sensibly a part of the aerial system, it behoves all who desire to obtain the best from their receivers to give as much attention to this as to the elevated wire. Whereas in the one case good insulation is of paramount importance, in the other anything that tends

Filt earthing device containing a special moisture attracting chemical.

to insulate the earthing device from the surrounding soil should be avoided. Dry earth is a poor conductor, but if maintained moist it shows good conducting properties.

With the view to maintaining the soil in the immediate vicinity of the earth connection in a moist state, Graham Farish, Ltd., Mason's Hill, Bromley, Kent, has introduced a novel earthing device. Known as Filt, this consists of a copper cup which acts as a container for a special chemical possessing the properties of attracting and retaining moisture even in the dryest of seasons. Furthermore, it slowly percolates into the surrounding soil and forms an area of moist earth, so making a very satisfactory earth connection.

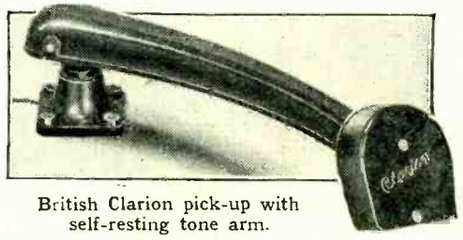
That the claims made for this device can be substantiated we have no doubt, for tests made with a specimen Filt show that the chemical is highly deliquescent, attracting to itself moisture even when exposed to the air, and remaining in a liquid state for a long period.

A good earth connection will be assured, and very little attention is required to maintain this condition over a period of years. The price is 2s. 6d.

BRITISH CLARION PICK-UP.

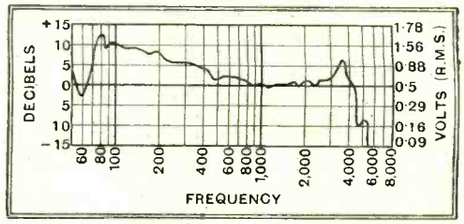
THE movement of this pick-up is of the half-rocker type and is equipped with laminated copper-plated pole pieces arranged in echelon. The armature is lightly damped and the pick-up follows the constant frequency records without difficulty down to 50 cycles.

The output is commendably free from irregularities, and its principal features are a tone arm resonance at 80 cycles, which provides a useful rise in the lower register, and an armature resonance at the commendably high frequency of 4,200 cycles, followed



British Clarion pick-up with self-resting tone arm.

by a sharp cut-off above 5,000 cycles. The tone arm and head are produced as a one-piece bakelite moulding, the arm being hinged vertically to facilitate needle replacement. The hinge is provided with a stop which prevents the needle from coming into contact with the motor board when the pick-up is lifted off the record.

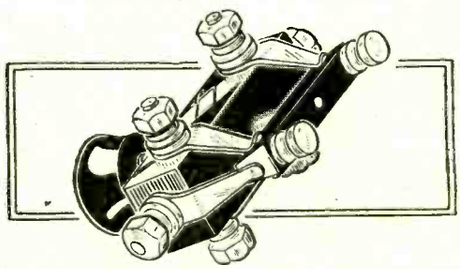


Open-circuit output characteristic of British Clarion pick-up with H.M.V. loud needle.

The price is 21s., and the makers are the British Clarion Co., Ltd., Miller Street, Camden Town, London, N.W.1.

RED DIAMOND TWIN SWITCH.

KNOWN as the Model R.D.34, this component consists of a pair of three-point switches operated by a single plunger carrying two fully insulated contact studs. It should find a useful application as a two-circuit wave-change switch, the complete isolation of all contact points from the single



Red Diamond two-circuit three-point wave-change switch.

hole fixing bush being a feature which particularly favours its use for this purpose. The makers are the Jewel Pen Co., Ltd., 21-22, Great Sutton Street, London, E.C.1, and the price is 3s. 3d.

www.americanradiohistory.com

BROADCAST BREVITIES.

By Our Special Correspondent.

No Welcome.

NO official welcome from the B.B.C. station will greet the new 100 kW. transmitter of the Irish Free State at Athlone when it takes the air in the next few days. Such a friendly gesture had not occurred to anyone at Broadcasting House when I raised the question last week; nor did it then commend itself.

Our Human B.B.C.

In a word, the B.B.C. is very human. Would anyone possessed of a loud speaker with 2 watts output extend the hand of brotherhood to a neighbour who was shaking the party walls with 12 watts?

The two cases are analogous. Athlone has a power of 100 kW. in the aerial, while its wavelength (413 metres) will be uncomfortably near that of Midland Regional.

The First Rival.

Athlone's programmes, good or bad, will distract the attention of British listeners; for the first time in its history the B.B.C. is confronted with a serious rival covering its own service areas.

The B.B.C. is not amused.

Not Yet Testing.

RUMOURS that the Empire Station at Daventry has already started testing are quite untrue. As stated in *The Wireless World* last week, the first signals will go out at the end of next month. The first "official" programme will be given on Christmas Day.

Balance and Control.

THE Balance and Control Department of the B.B.C. must undergo some reorganisation consequent upon the untimely death of Mr. H. Davidson, who had been responsible for handling many musical broadcasts during the last three years.

There are actually ten members of this very important department at Broadcasting House and one representative at each of the provincial stations.

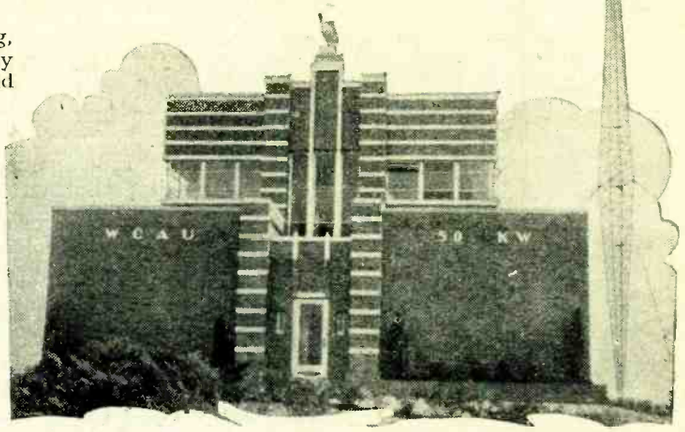
The Autocrat.

Each man has to combine a technical knowledge of wireless with sound musicianship and a great deal of tact, the last being as important as the others. Performers, and especially conductors, are apt to be suspicious of the man who controls the output; nor are they to be blamed on this account, for there is no denying that the knob twiddler, sitting at his little window overlooking the studio, has autocratic powers, and can mar the most artistic efforts with a turn of the hand.

Making Records for the Empire.

An even more exacting job has come the way of the Balance and Control Department during the last week or two. This is the control of the special vaudeville and other performances at Broadcasting House which are being recorded at the H.M.V. studios, Abbey Road, for Empire consumption. "Not only have we to see that, musically speaking, everything is absolutely O.K.," an engineer told me, "but we have to contend with landline troubles. A few days ago a perfect record was ruined in the last few moments by the crackle of a lightning flash."

The trouble is that a landline crackle on an ordinary "O.B." is forgotten in a moment. On a record it remains as a permanent blot.



WCAU.—Not the zebra shed at Whipsnade Zoo, but America's newest broadcasting station—the 50 kW. R.C.A.-Victor transmitter at Newton Square, Pennsylvania. The single mast is a striking feature.

Supplementing the Daventry Service.

These records, by the way, should very usefully supplement the efforts of the new Empire Broadcasting Station, though I feel that they indicate a certain lack of confidence in the success of the transmissions.

Anyway, on top of the programmes from Daventry, the world is to be offered recorded versions for local diffusion. Mr. Malcolm Frost, the B.B.C.'s world emissary, will try to dispose of the records in Cape Town, East Africa, India, Ceylon, Malay States, China, New Zealand, Fiji, Vancouver, Canada, and . . . yes, it's true . . . New York!

Better Than a Peace Conference?

Thus shall nation speak peace unto nation, through the lips of Leonard Henry and Harry Tate.

"Grand Hotel," Portland Place.

THE new Cafeteria in Broadcasting House is doing a roaring trade, especially since the Director-General and the Controller set the fashion by queuing up for sausages and mashed.

I am told that some American tourists, attracted by the odour of the cafeteria, walked up to the enquiry desk in the entrance hall a few days ago and asked for the cocktail bar.

Lance Sieveking's Vaudeville.

I SHALL make a point of listening to Lance Sieveking's first effort in the vaudeville line on Monday next, October 24th. Since Bertram Fryer's recent departure, broadcast vaudeville has revealed nothing very original, and I think Sieveking, who is to take a large share in its future direction, is a good choice: in fact, to my mind, he carries originality to a fault. Anyhow, we shall see.

"The Other Room"—a Thriller.

A HALF-HOUR thrill will be broadcast Regionally on November 4th, and Nationally on November 3rd. Entitled "The Other Room," it is taken from a short story by Don Marquis, and in it a nerve specialist and a general practitioner play the leading parts. The production is by Howard Rose, who has also adapted the play for the microphone.

A Compliment from Holland.

MY felicitations to Val Gielgud, the B.B.C.'s Dramatic Director, on the decision of "AVRO," Holland, to broadcast his play "Red Tabs" during the coming winter.

AVRO is Holland's biggest broadcasting organisation, and is at present using the Hilversum station.

One Man, One Studio.

ONE of the features of the "Tour of Broadcasting House" programme, which is to be given in birthday week, on November 14th, to be exact, will be a revue specially written by Henrik Ege. In this will be a cast of twenty-two people, one in each of the twenty-two studios of Broadcasting House. The revue will call for amazing dexterity on the part of the producers at the Dramatic Control panel in manipulating cue-lights and potentiometers to "fade in" and "fade out" one studio after another in proper sequence.

An Announcer Returns.

HON. DAVID TENNANT, former B.B.C. announcer, will broadcast a reading of seventeenth century religious poetry in the National programme on October 30th. Mr. Tennant's voice was heard anonymously in the closing item of the "Good-bye, Savoy Hill" programme recently, being wrongly assumed by a number of people to be the voice of the Director-General, Sir John Reith, or, alternatively, that of the Controller of the B.B.C., Vice-Admiral Sir Charles D. Carpendale. One perplexed journalist, indeed, mistook it for the voice of Sir Philip Cunliffe-Lister, M.P.

The Poor Lady Announcer.

GALLANTRY is not stronger among German listeners than elsewhere, according to a Berlin friend. A well-known broadcasting "aunt" was recently asked to undertake a few announcements at Berlin to see how listeners would react to a woman's voice. Apparently the reaction was violent, for Berlin has definitely abandoned the idea of employing women announcers.

www.americanradiohistory.com

Lotus BAND-PASS THREE.

An Economical Three-valve General-purpose Set.

A.C. MODEL.

THE unquestionable popularity of the modern three-valve receiver is by no means an accident of fashion. It is by virtue of its merit that it has attained the eminence as the most serviceable type for general-purpose use. In its very latest form, as exemplified by the Lotus Band-Pass Three receiver, the A.C. model of which forms the subject of this review, it provides an adequate selection of foreign programmes, is quite simple to operate, and, as a consequence, satisfies the needs of a very large section of the listening public.

As befits a modern set, the Lotus model embodies a moving-coil loud speaker and is sensibly self-contained, even to the extent of including a small aerial which is quite satisfactory for reception within a reasonable distance of the local station. Normally, however, the set will be used with an outdoor aerial and an earth connection.

Briefly, the circuit employed consists of an H.F. stage in which is fitted a variable-mu valve, a tuned anode H.F. coupling, and a power-grid detector coupled by means of an L.F. intervalve transformer to a pentode valve giving a power output of approximately two watts. Preceding the H.F. stage is a band-pass input filter, the first tuned member of which is loosely coupled to the aerial by means of two aperiodic, or untuned, windings. When receiving on the medium wave-band one section of this winding is short-circuited by the wave-change switch.

Silent Background

The high-tension supply is derived from a Westinghouse metal rectifier, and the output is smoothed by the loud speaker field and an electrolytic condenser. This arrangement very effectively removes all trace of mains hum. Indeed, the receiver is singularly free from background noises, and with the aerial disconnected the illuminated scale provides the only indication that the set is live.

The controls, which number four in all, are arranged neatly below the loud speaker fret. They consist of a single tuning control, a four-position switch which combines the functions of wave-change, on-off, and radio-gramophone switching, a volume adjustment, and a reaction control. The condenser dial is calibrated in wavelengths and carries two scales, but only the range actually in use at the time is illuminated.

Not the least attractive feature of the set is its simplicity of operation. The wavelength calibration is most helpful, while the sensitivity is well maintained over the whole range without constant use of reaction. When first installed an adjustment must be made to compensate for the aerial capacity, for which purpose a small trimming condenser is provided on the terminal panel at the back of the set. This carries also the aerial and earth connections, two sockets for the attachment of a gramophone pick-up, and a mains fuse.

FEATURES.

General.—*A three-valve A.C. mains receiver embodying moving-coil loud speaker. Provision for gramophone reproduction and extra loud speaker. Dual illuminated scales, wavelength calibrated.*

Circuit.—*Band-pass input filter capacity coupled, one H.F. stage linked by a tuned anode circuit to a power-grid detector. Transformer L.F. coupling followed by a pentode. H.T. from a Westinghouse metal rectifier.*

Controls.—*(1) Single tuning control, (2) Combined wave-change on-off and radio-gramo switch. (3) Reaction. (4) Volume control.*

Price.—*16 guineas. Royalty, £1.*

Makers.—*Lotus Radio, Ltd., Lotus Works, Mill Lane, Liverpool.*

As a whole the performance of the set is decidedly good. Its selectivity is adequate to cope with all receiving conditions, although in very close proximity to a powerful station use may have to be made of the alternative aerial socket, which places a small condenser in series with the aerial windings. A reduction in the normal sensitivity will follow, but much can be done by careful handling of the reaction control partially to off-set this effect so that foreign stations will still be receivable although at a lower volume level.

Elsewhere few occasions will arise to make use of the alternative aerial connection, and under these conditions a good selection of Continental programmes will be receivable at a volume quite adequate for domestic needs. When heterodyne does not mar reception the quality of reproduction will be found well above the average for this class of set.

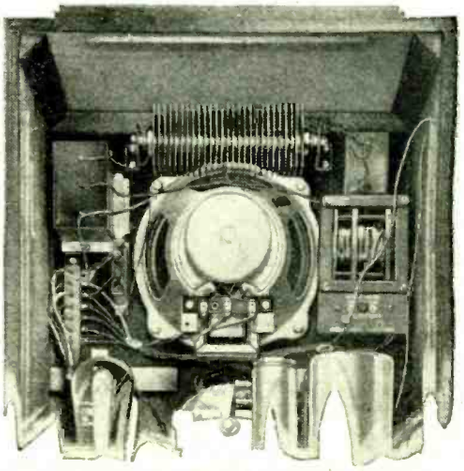
On the long wave-band the performance is particularly good at all times, and during a brief daylight session no difficulty was experienced in receiving Daventry National and Radio Paris C.F.R. on a very indifferent aerial and in a notoriously bad locality.

Quality of reproduction is most pleasing, speech in particular being clear and perfectly natural. The bass and the treble are present in ample measure to support the middle register, which is well reproduced but does not obtrude. As a whole, the output is well balanced, for although the pentode is only slightly corrected, the upper register does not predominate. This can be accounted for by a happy choice of the L.F. coupling system and the careful matching of the Magnavox speaker to the output valve.

Servicing of the set when necessary will be a comparatively simple matter, for the assembly is so arranged that the two units comprising the receiver can be separated in a few minutes. There is no need to unsolder a single wire, for a neat seven-way cable terminating in a contact strip links together the two units electrically so that removing the screw connectors, also the fixing screws holding the chassis in position, enables the latter to be withdrawn from the cabinet.

The workmanship throughout attains a very high standard, having regard to the reasonable price of the set, and this is reflected in the cabinet work, which is exceptionally well executed. Unnecessary ornamentation has been avoided, and although quite plain in design the cabinet possesses the distinct advantage that it fits in well with practically all furnishing schemes.

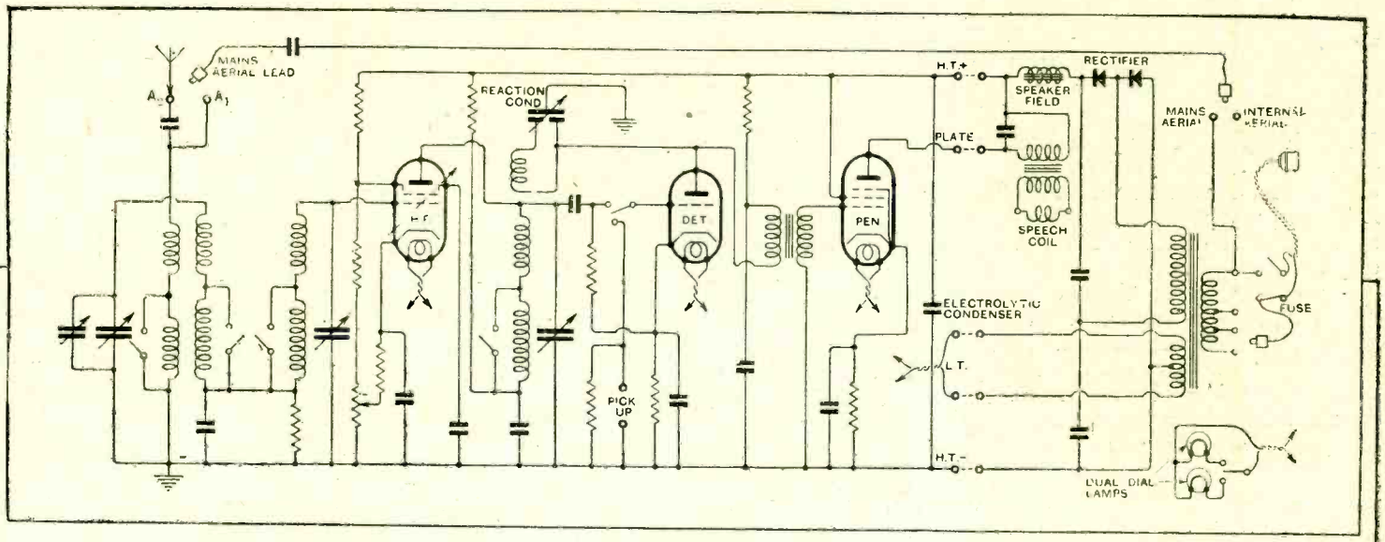
To sum up, the Lotus Band-Pass Three is an eminently satisfactory general-purpose receiver, economical to operate, simple to handle, and capable of providing an ample selection of alternative programmes at good quality.

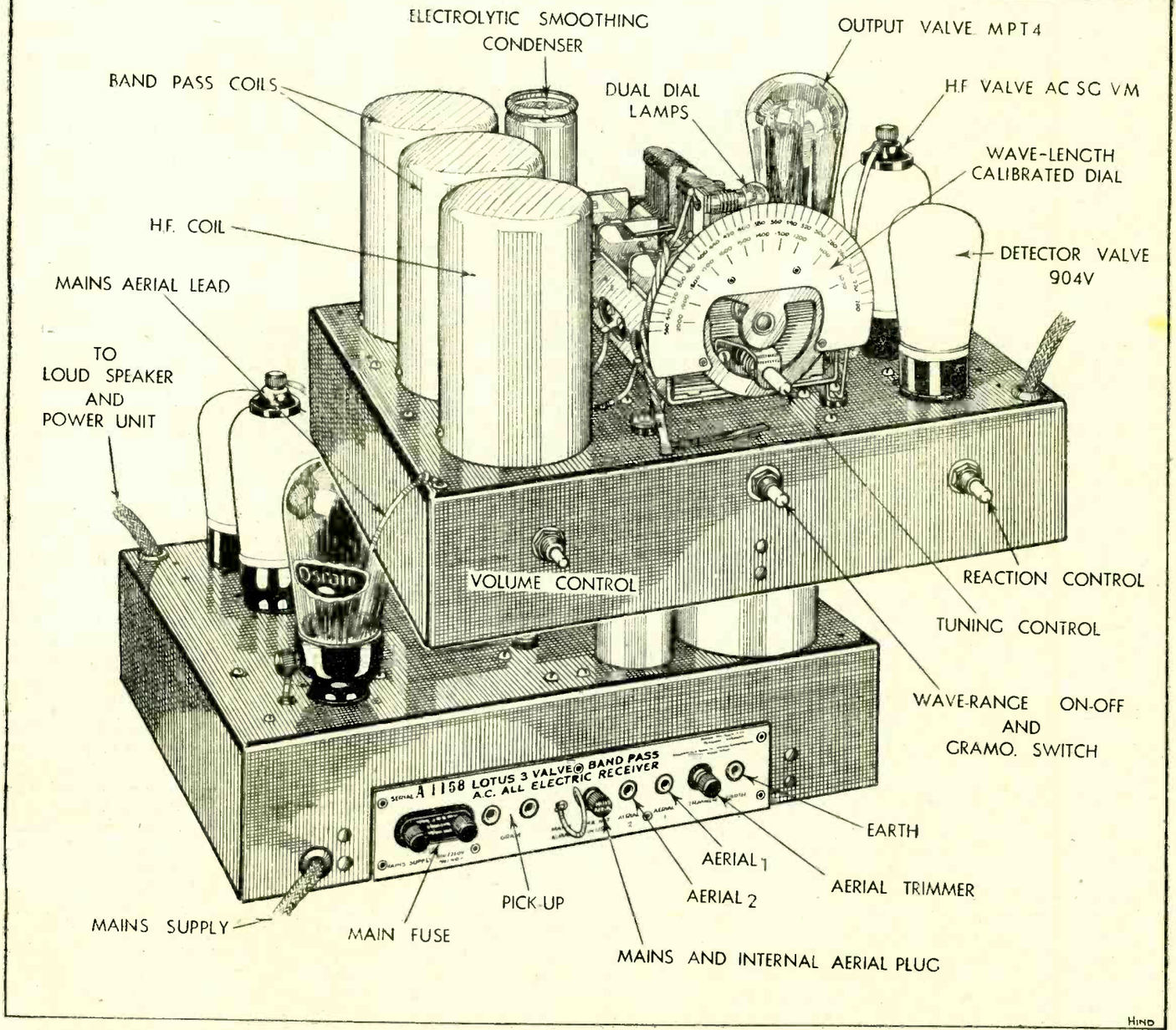


Rear view, showing the eliminator equipment. The metal rectifier can be seen above the moving-coil speaker.

www.americanradiohistory.com

A WAVELENGTH-CALIBRATED A.C. MAINS RECEIVER.





Theoretical circuit diagram together with chassis showing the front and rear of the Lotus Band-Pass Three receiver, A.C. model.

www.americanradiohistory.com

Practical HINTS AND TIPS.

AIDS TO BETTER RECEPTION.

INTERMITTENT faults are always the hardest to trace, and one of the most elusive of all is that occasionally—but fortunately not very often—brought about by an internal defect in a valve. This may take the form of misplacement of one or other of the electrodes, or of a loose connection.

Valve Tests.

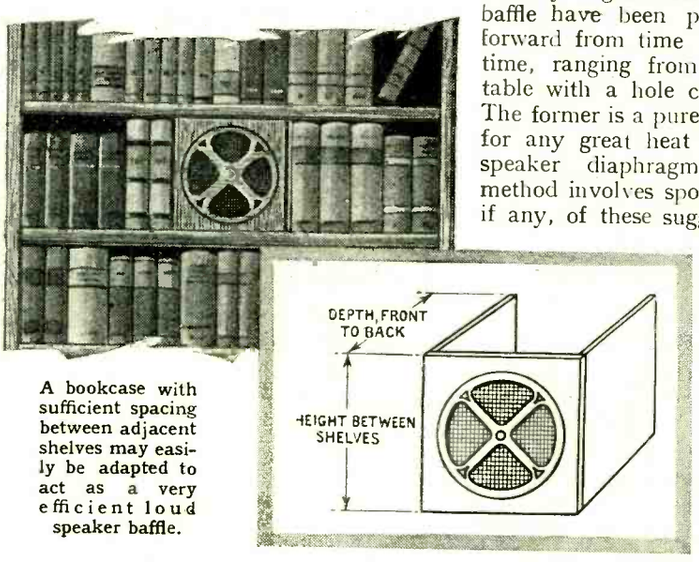
As the internal parts of valves are, of course, totally inaccessible and generally invisible as well, there will be no obvious indication as to the actual valve at fault, and it is a good plan to try the effect of tapping the glass bulb. This treatment will almost invariably accentuate the fault, and thus localise the source.

IN the great majority of receivers the normal position for a pick-up is in the grid circuit of the detector, which, for purposes of gramophone amplification, is converted to act as an L.F. amplifier. Readers need hardly be reminded that this method of connection is totally unsuited to a set employing diode detection; the two-electrode valve, or rather the modern three-electrode valve with its plate "idling," does not amplify.

Diodes and Pick-ups.

As far as the use of diode sets for gramophone reproduction is concerned, this is not a handicap, as all these receivers must of necessity provide more post-detection amplification than those with more conventional circuit arrangements. The usual plan, when it comes to the question of fitting a pick-up, is to make provision for inserting it at will, by the operation of a switch, in the grid circuit of the first L.F. valve. The scheme applicable to the "Diode Quality Four," described in *The Wireless World* of September 30th, is shown diagrammatically in Fig. 1 (*a*).

A still simpler method, also applicable to the receiver in question, is shown in diagram (*b*). Here the pick-up is merely joined across the volume-control potentiometer, R_3, in series with the grid-bias battery and an on-off switch. In sets without manual tone correction a difficulty might arise with regard to the high resistance of R_3; in a modern diode set this has a value of at least $\frac{1}{4}$ megohm, which is considerably higher than that specified by the makers of most pick-ups. But, in the case of the receiver in question, this does not greatly matter, as any imperfection in the pick-up, due to operating it under wrong conditions, may be corrected. It would, however, be in order to shunt it with a resistance of the value recommended if it is found that loading applied in this way helps to avoid over-emphasis of certain narrow bands of frequencies.



A bookcase with sufficient spacing between adjacent shelves may easily be adapted to act as a very efficient loud speaker baffle.

With regard to grid bias, it should be realised that the full voltage of the bias battery will not be applied to the grid of the valve at low volume settings—that is, when the potentiometer slider is towards the lower end of its travel. This difficulty may be overcome by making the voltage of the battery rather higher than would otherwise be necessary.

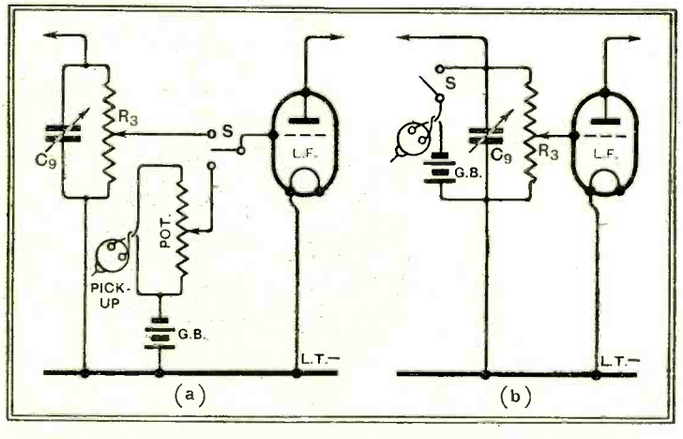


Fig. 1.—Two methods of adapting a battery-fed set with diode detector for operation with a pick-up.

If only in the interest of battery economy, it is well to make provision for switching off the filaments of all valves preceding the first L.F. amplifier when the gramophone pick-up is to be put into use.

REFERENCE to data recently published in this journal will show that a baffle must be of large area if low notes are to be properly reproduced—it must be so large, in fact, that it can hardly have a place in a tastefully furnished room, unless it be disguised in some way or other.

A Bookcase as a Baffle.

Many disguises for a baffle have been put forward from time to time, ranging from a fire-screen to a table with a hole cut out of the centre. The former is a purely ornamental device for any great heat would ruin the loud speaker diaphragm, while the latter method involves spoiling the table. Few, if any, of these suggested disguises have possessed both the desirable qualities of large area and rigidity. But a bookcase may easily be adapted to act as a baffle without being spoilt either in appearance or utility. Furthermore, when filled with books it is acoustically "dead," and many people possess one which is amply large enough to fulfil the requirements as regards size and spacing between shelves. This form of baffle has an outstanding advantage over other types in that no alterations, beyond the removal of half a dozen or so books, have to be made to the existing scheme of furnishing and decoration; nothing new has to be given a place in the room.

The scheme is simplicity itself, and a glance at the accompanying sketches should make it perfectly clear. By means of a U-shaped framework, a small chamber is made between two shelves, and in this chamber the loud speaker is mounted, exactly as in a larger cabinet. The front of the chamber is, of course, in the form of a grille to permit the egress of sound-waves, and for a similar reason the back of the bookcase must be cut away behind the loud speaker chamber. Beyond this the bookcase will not need any permanent alteration, and, indeed, the piece cut away may be replaced at any time should it be desired to do so, although its absence will not be noticeable behind a row of books.

The joints between the chamber and

www.americanradiohistory.com

Practical Hints and Tips.—

the shelves and back must naturally be made sound-proof, and it is essential that the bookcase should stand an inch or so clear of the wall. In the majority of cases the wainscot ensures adequate spacing.

It will hardly be necessary to add that the scheme works at its best with an open bookcase; where glass doors are fitted, these must be opened for listening.

The small amount of carpentry involved in carrying out the necessary additions and alterations should present no difficulties. Naturally, no definite dimensions can be given for the framework, as bookcases do not run to standard sizes.

Pick-up Tone Correction.

IN the design of the "Baby Superhet," an economy was effected by arranging for the normal characteristics of the pentode output valve to compensate automatically for a certain amount of high-note loss which takes place in the tuned circuits. With this object, no deliberate correction is introduced into the pentode - loud speaker coupling. It therefore follows that when the set is used in conjunction with the pick-up, the reproduction of the gramophone records may be a trifle high-pitched. But the inclusion of the usual fixed corrector in the output anode circuit would definitely impair quality of reproduction on the radio side, and the fitting of a switch to cut it out of circuit at will might be considered an undesirable complication.

Fortunately, there is a very simple solution of the problem of obtaining suitable overall characteristic for both types of reproduction. The simplest and generally most satisfactory way of introducing correction on the "gramophone" side is to shunt the pick-up with a resistance, of which the value will be fairly low, and can, in any case, be best determined by trial; it is unlikely to be lower than 10,000 ohms.

As an alternative to the use of a separate resistance, the potentiometer which will almost invariably be used as a gramophone volume control may have a lower resistance than that customarily recommended by the pick-up makers.

Rules of Thumb.

IN almost every art or science there exists a vast collection of empirical formulæ or rules of thumb which are in constant use—unashamedly by amateurs and dabblers, and surreptitiously by high-brow professionals. It is unfortunate that our own art is somewhat deficient in these easily remembered rules, and such as exist are open to criticism on scientific grounds. Nevertheless, there are a few that are worth while remembering, and which will be accurate enough for most practical purposes. For the benefit of readers, three of the best-known ones are enumerated below.

(1) *Wavelength is directly proportional to turns* (in a tuning coil).—This is a very useful rule. If, for example, a simple short-wave receiver can be tuned to a wavelength of 30 metres with a four-turn coil, there is little doubt that a wavelength of 15 metres will be receivable with a coil of similar diameter having two turns.

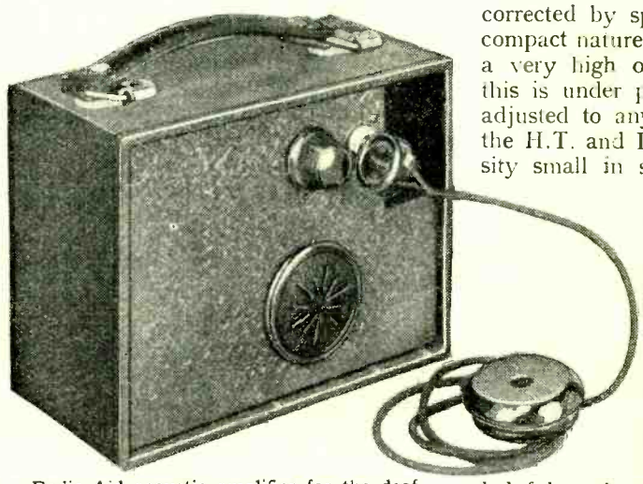
(2) *Frame-aerial windings.*—For a frame aerial wound in a more or less conventional manner, and of roughly the usual size, a total length of 75 feet of wire will provide suitable inductance value for tuning to the medium broadcast band with a 0.0005-mfd. condenser. For a long-wave frame a total of about 250 feet of wire would be necessary.

(3) The correct value of negative grid bias to apply to a three-electrode amplifying valve is ascertained by dividing "H.T. voltage applied" by "twice amplification factor" (of the valve concerned).

This rule tends to become inaccurate when it is applied to modern valves of exceptionally high efficiency.

RADIO-AID ACOUSTIC AMPLIFIER.

A Small Portable Amplifier for the Deaf.



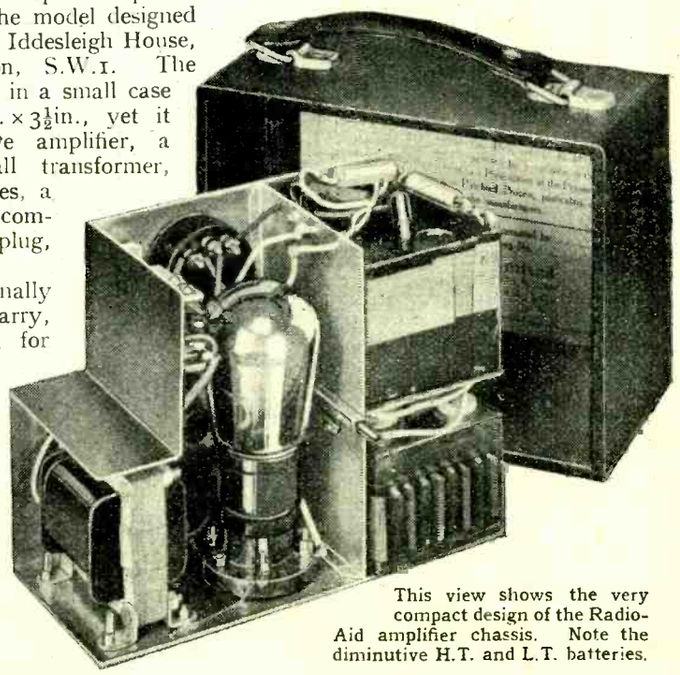
Radio-Aid acoustic amplifier for the deaf.

ALTHOUGH many attempts have been made from time to time to produce small deaf aid amplifying equipment, it is doubtful if anything quite so compact and simple to operate has yet been seen as the model designed by Radio-Aid, Ltd., 4, Iddesleigh House, Caxton Street, London, S.W.1. The apparatus is contained in a small case measuring 7¼in. × 5½in. × 3½in., yet it includes a single-valve amplifier, a microphone and small transformer, H.T. and L.T. batteries, a telephone ear-piece complete with cord and plug, and a volume control.

The unit is exceptionally light, convenient to carry, and quite unobtrusive, for when not in use the telephone is housed in a small pigeon-hole. Removing the telephone jack automatically disconnects both H.T. and L.T. batteries.

The design of the instrument is such that it allows for correction in the response characteristic to be made so as to suit individual requirements in much the same way as optical defects can be corrected by special lenses. Despite the compact nature of the apparatus, it affords a very high order of amplification, but this is under perfect control and can be adjusted to any level desired. Although the H.T. and L.T. batteries are of necessity small in size, very little current is taken from either, so that maintenance will consist of occasional removal of the 2-volt accumulator, which, incidentally, is of the unspillable type, for charging, and replacement of the small H.T. battery when the need arises.

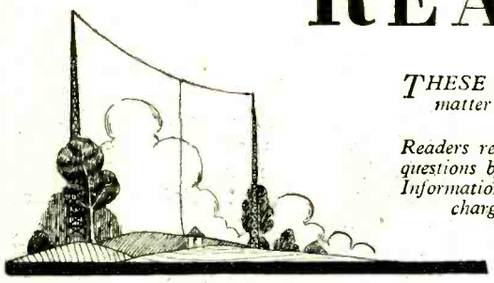
There can be no doubt that this acoustic amplifier will prove exceedingly helpful to those experiencing difficulty in identifying sounds of normal intensity, for it may be that the defect applies only to certain parts of the audible spectrum. A scientifically corrected amplifier will compensate for this aural astigmatism and render the reproduction more natural. The price is £15.



This view shows the very compact design of the Radio-Aid amplifier chassis. Note the diminutive H.T. and L.T. batteries.

www.americanradiohistory.com

READERS' PROBLEMS.



THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers.

Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

Bias for Battery Valves.

AFTER having read a note recently published in these pages on the subject of fitting automatic grid bias to a battery-fed receiver, a reader asks whether the fact that in his receiver the negative pole of the H.T. battery is joined to L.T. positive will necessitate any change of the standard arrangement. He sends a circuit diagram of his set, and asks us to indicate where the bias resistance should be inserted.

We are almost tempted to say that H.T. – should not be joined to L.T. +, and to recommend our reader to change over to the more correct system of interconnection before converting his set for automatic bias. But consideration of his circuit diagram shows that, from the point of view of safety, the system of interconnection he has adopted is much better than the average, mainly because a three-point on-off switch is used. In these circumstances it is suggested that the bias resistor should be connected as in Fig. 1. Due to

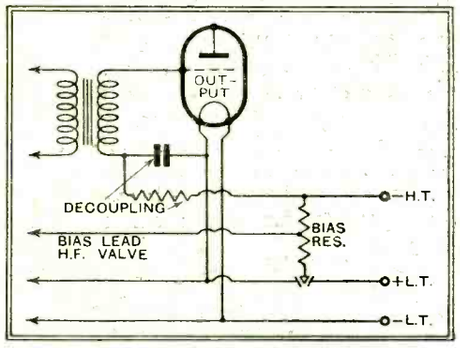


Fig. 1.—Automatic bias system, applicable to a battery-fed set in which H.T. – is connected to L.T. +. In estimating the value of the bias resistor, the voltage of the L.T. battery must be added to the rated bias voltage of the output valve.

the method of battery interconnection it will be necessary, however, to take into account the voltage of the L.T. battery when calculating the value of the bias resistor. As bias voltage is always estimated in respect to the negative end of the filament it will in this case be necessary to add the voltage of the L.T. battery to that normally required for the purpose of bias.

This complication, though of a minor nature, provides another argument in favour of the "standard" system of interconnection—H.T. negative to L.T. negative.

Using the Tuning Chart.

A READER, who has a set with two tuning condensers, asks our advice as to how he should calibrate it with the help of the tuning chart which appeared with *The Wireless World* for October 7th. He seems to imagine that the only alternatives open to him are to obtain two charts, and to use one of them for each dial, or else to draw both sets of tuning curves on a single chart.

Experience shows that there is practically no advantage in preparing individual calibrations for both condensers of a two-control set. We suggest that only one of the circuits should be calibrated; when it is desired to receive a given station, the calibrated circuit should be tuned as indicated by the chart, and then the other condenser dial should be rotated to the point at which resonance is indicated, either by the signals of the wanted station, or, if for any reason they are unreceivable, by a general feeling of "liveliness."

As to which circuit is chosen for calibration is often a matter of indifference, but, strictly speaking, it should be the one that is least liable to be affected by extraneous influences.

Altering Commercial Sets.

AN ever-increasing number of queries regarding factory-built receivers are being addressed to the Information Department, and particularly to the Information Bureau. Many of these questions relate to internal modifications or alterations.

Although we are willing, and, indeed, anxious, to be of service to readers by giving them the information they ask for, it is right to point out that many manufacturers make it a rule that the introduction of any modification whatsoever is sufficient to invalidate the guarantee. Accordingly, it should be made quite clear that a reader who applies the information given by us does so at his own risk during the period of validity of the guarantee.

Until compromise disappears entirely from set design it follows that every receiver, however good, is susceptible to modification, more especially if it is to be operated in exceptional receiving conditions, or if the needs of the owner are unusual. For instance, a very elementary problem is set us by a new reader, who is using a commercial set fitted with alternative aerial sockets. For long-distance reception the aerial is connected to the socket marked A_1, while the other socket, A_2, providing more selectivity and less sensitivity, is intended for use while receiving nearby stations, or when interference is encountered.

So far as reception of the local station is concerned, it is found that even the use of the "insensitive" socket provides excessively loud signals, with which the volume control can hardly cope. This difficulty may easily be overcome by fitting an external semi-variable condenser in the aerial circuit, as shown in Fig. 2 (a). A maximum capacity of 0.0001 mfd., or even 0.00005 mfd., would be sufficient. The handiness of the aerial change-over is enhanced by fitting a switch, as in Fig. 2 (b).

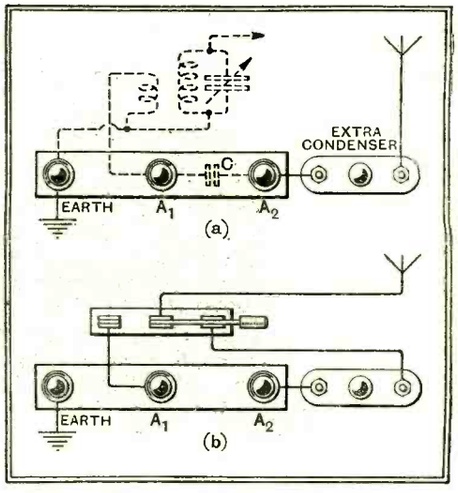


Fig. 2.—When a built-in aerial series condenser is too large, a small condenser may be added externally, as in diagram (a). Internal connections are in dotted lines. The use of a switch for changing connections is shown in diagram (b).

D.C. Loud Speaker Fields.

WHEN energising current for the field winding of a moving-coil loud speaker is obtained by connecting it in series, or even in parallel, with the source of rectified H.T. current in an A.C. receiver, the resistance of the winding is a matter of considerable importance; in following a published design it is, practically speaking, essential that any instrument used should have precisely the resistance specified. With regard to similar loud speakers intended for connection to D.C. mains, on the other hand, the precise resistance of the field coil has no direct bearing on the behaviour of the receiver; indeed, it does not usually form a part of it, being connected directly across the mains. All that one has to see is that the winding is rated by the manufacturers to work at the voltage of the supply system.

A request by a reader for information on this subject is probably due to his having confused the essential difference between the normal methods of connection. In a D.C. set the field winding could admittedly be used as a voltage-absorbing resistance in the heater circuit; if this were done, its D.C. resistance would then be critical, but this plan has not been generally adopted.

The Wireless World

INFORMATION BUREAU.

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Tudor Street, E.C.4, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.

www.americanradiohistory.com

The Wireless World

A PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 687. FRIDAY, OCTOBER 28TH, 1932. VOL. XXXI. No. 17.

Editor:
HUGH S. POCOCK.

Proprietors: ILIFFE & SONS LTD.

Editorial Offices:
116-117, FLEET STREET, LONDON, E.C.4.
Editorial Telephone: City 9472 (5 lines).

Advertising and Publishing Offices:
DORSET HOUSE, TUDOR STREET,
LONDON, E.C.4.
Telephone: City 2846 (17 lines).
Telegrams: "Ethaworld, Fleet, London."

COVENTRY: Hertford Street.
Telegrams: "Cyclist, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 268, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates:
Home, £1 1s. 8d.; Canada, £1 1s. 8d.; other countries abroad, £1 3s. 10d. per annum.

As many of the circuits and apparatus described in these pages are covered by patents, readers are advised, before making use of them, to satisfy themselves that they would not be infringing patents.

CONTENTS.

EDITORIAL COMMENT.

Service After Purchase.

Value of Co-operation.

PERHAPS one of the most difficult problems in the wireless industry to-day is the question of service of receivers after purchase. A wireless set, even in these days of robust construction, is a comparatively fragile piece of mechanism, and, however perfect the set may be at the time it leaves the hands of the manufacturer, little faults may develop unexpectedly after the set has been installed at home.

Most manufacturers give some sort of a guarantee with their receivers, but often this document is of little value in practice to the set user whose instrument may suffer from a breakdown. It is unreasonable for the purchaser to expect service, free of charge, for the period of the guarantee, and most manufacturers have themselves given up the attempt to give it. Many instances were continually arising where a service man travelled many miles to inspect a customer's set, only to find that the reason the set was not working was that it had not been switched on, that the slot-meter was short of a shilling, or that the aerial was disconnected. These, of course, are extreme cases, but they are by no means rare. On the other hand, we have receivers sold with no intention on the part of the manufacturer to service them at all.

It is a very difficult matter to say just where a manufacturer's responsibility should stop, and to decide, too, when the expectations of the purchaser in regard to service exceed the bounds of reason. It is most desirable that both parties should study to be fair.

We have often stated in the past that we believe one of the surest ways of reducing service calls upon the manufacturer is for every set sold to be accompanied by as detailed a description of the receiver as the technical staff of the manufacturer is capable of producing; not only should this information describe the set itself in detail, but it should also give extensive hints on connecting up, operating, and the correction of possible faults which may occur.

The purchaser, on the other hand, should recognise that in a wireless set he has a delicate and intricate piece of apparatus which must be treated with consideration if proper service is to be expected from it. Even with so robust a piece of mechanism as a car, few motorists would feel satisfied to drive without at least a working knowledge of the mechanism. It is just as important for the owner of a wireless set, however non-technical he may desire to remain, to acquire a certain amount of wireless knowledge.

Ferrocart Coils.

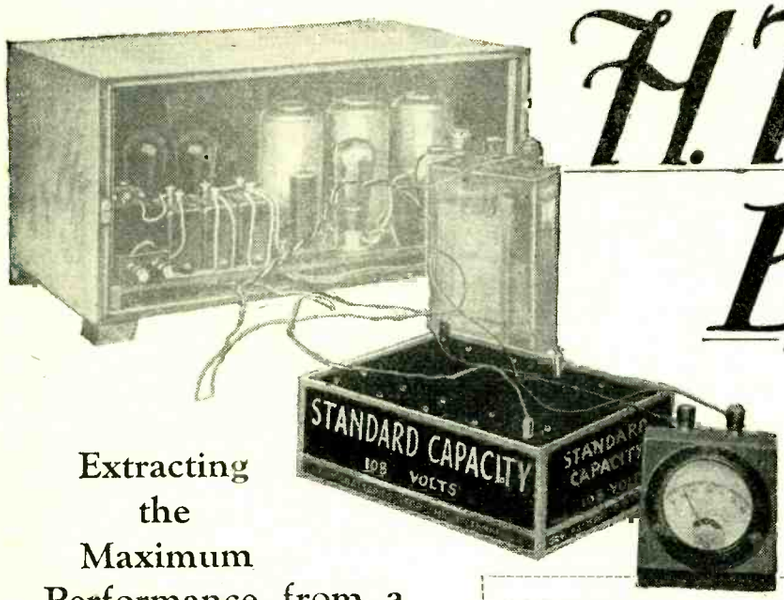
To be Available Here.

READERS will be glad to know that coils employing Ferrocart material, as described in recent articles in *The Wireless World*, are to be made available in this country through Messrs. Colvern, who, we learn, have acquired rights in respect of these coils from the originator in Germany.

The efficiency of these coils is so high that we can anticipate an important step forward in receiver design, and we congratulate Messrs. Colvern on their enterprise in appreciating so promptly the importance of this new development.

It may well be that the new coils will not be available for some little while yet, as considerable development work will, no doubt, have to be undertaken before they can be marketed.

www.americanradiohistory.com



H.T. Battery Economy

Extracting the Maximum Performance from a Given H.T. Current.

THROUGH neglect of a few simple precautions, many users of battery-operated receivers fail to obtain an adequate return for the money invested in H.T. units. The present article shows some of the points at which current may be running to waste, and describes circuits designed to regulate the consumption of the output valve in accordance with variations in the volume of reproduction.

THE past few years have seen a very marked improvement in the efficiency and reliability of dry-cell H.T. batteries, and the hundreds of thousands of users of battery sets in those parts of the country unserved by supply mains have little cause for complaint in the service they derive from the popular 99- or 108-volt battery of standard capacity. Yet the cost of H.T. power from dry batteries works out at about £5 per B.O.T. unit as compared with one penny or, at the most, 6d. per unit from the public supply mains, so that the battery user cannot afford to tolerate the smallest waste of H.T. current.

In securing the best possible performance from a battery of given capacity there are two factors to be borne in mind. First, the total current drawn by the set must be kept within the limits specified by the makers; and, secondly, every milliampere of that current must be made to do useful work in providing the maximum range and quality of which the set is capable. In a mains receiver, assuming three hours' use per day, an unproductive milliamp. of current will cost the consumer one farthing per annum, but in a battery receiver he may be as much as 10s. out of pocket at the end of the year. As it is quite easy to use unprofitably as many as 4 or 5 mA. out of a total of 10, little further incentive should be required to check over the set stage by stage to see that the valves are working efficiently. A milliammeter is invaluable, but much can be done merely by altering the H.T. battery tappings in accordance with the following suggestions and noting the effect on the performance.

Although the output valve is responsible for the greater part of the drain on the H.T. battery, we will leave the consideration of this stage until later and turn our attention first to the H.F. valve. It will be safe to assume that this is of the screen-grid type, and as there are separate H.T. feeds for the anode and screen-grid in this valve it is easy to see that H.T. current may easily be squandered unless the relative voltages applied to these electrodes are carefully chosen. Experience shows that the anode voltage may with advantage be fixed at the battery maximum, and that the efficiency of the valve depends primarily on the choice of a suitable screen-grid voltage relative to the anode voltage employed.

Excessive Screen Voltage.

With the anode voltage fixed, the current drawn by the screen-grid as well as the anode rises with the screen-grid voltage, and, up to a certain point, the amplifying properties of the valve are also increased. Above this optimum screen voltage the amplification falls off, but the drain on the H.T. battery goes on increasing. Thus it is quite easy to run the H.F. valve inefficiently by using too high a screen-grid potential.

This point is illustrated in the curve on the right of Fig. 1, which represents the results of actual measurements with a type VS2 valve in a typical H.F. stage. The vertical scale represents the stage

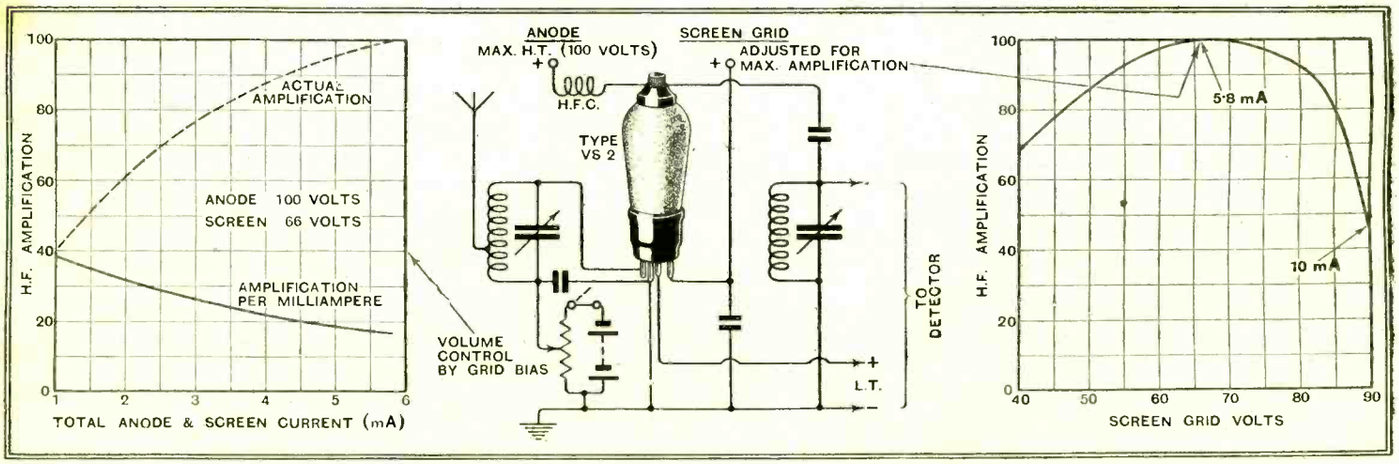


Fig. 1—Typical screen-grid H.F. stage showing (right) wastage of H.T. current through excessive screen voltage, and (left) that reduction of volume by increasing negative bias results in a higher amplification per milliampere.

www.americanradiohistory.com

H.T. Battery Economy.—

amplification, and for convenience the maximum amplification has been adjusted to 100. Screen-grid volts are marked along the horizontal scale, and it will be seen that, starting at 40, the amplification rises from 70 to the maximum of 100 when the screen-grid volts reach 66. Above this point the amplification falls off rapidly until, with 90 volts on the screen, the amplification is less than 50. The total currents taken by the valve with 66 and 90 volts on the screen are 5.8 and 10 milliamperes respectively, so that with the excessive screen voltage the "amplification per milliamp. of H.T. current" is only 5 as compared with 17 for the optimum voltage of 66.

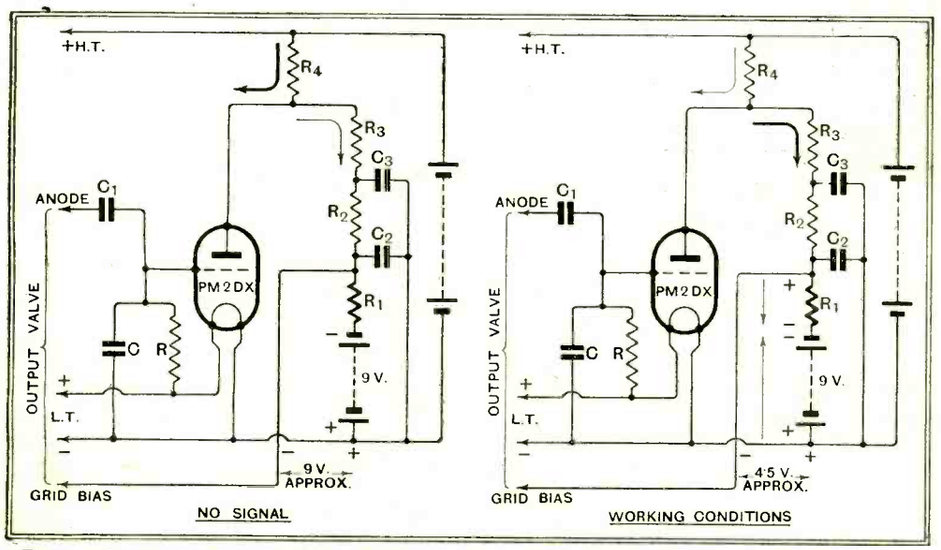


Fig. 2.—Schematic diagram of the bias control valve circuit in the Philips type 830 B battery receiver, showing the distribution of current for no signal and under working conditions.

It will be noticed that the curve falls off less steeply below 66 volts, and the screen can therefore be worked at a slightly lower voltage to save still more current without an appreciable loss of amplification.

The total consumption of the screen-grid valve, as well as the amplification, is also controlled by the grid bias. With the anode and screen voltage fixed, variable grid bias in this stage is therefore a profitable method of volume control for the set as a whole, and the latest "variable-mu" valves have been specially designed for this purpose. The graph on the left of Fig. 1 shows a very interesting point in connection with this method of volume control. As the negative bias is increased, the current consumption falls more rapidly than the amplification, so that at low volume levels we are actually getting a higher "amplification per milliamp." than at maximum volume.

In the detector stage there is not so much scope for adjustment. Nowadays leaky-grid detection is almost universal in battery receivers, and the anode current with modern detector valves need not exceed 1 milliamp. The H.T. voltage can generally be reduced to 45 or 50 volts without undue loss of signal strength, and further economy can be effected by attention to the grid bias. It is customary to return the grid leak to positive L.T., but a better scheme is to use a filament potentiometer and to connect the grid-return lead to the slider in order that the best compromise between detector efficiency and current consumption may be obtained. The rule is to work as near the negative end of the potentiometer as possible.

It is in the final power-output stage that the greatest care must be exercised to avoid wastage of current, for in the majority of cases this stage takes more H.T. current than the sum of the preceding stages. The criterion here is the power output available per milliamp. of standing H.T. current. In general, pentode valves show to best advantage from this standpoint, and they also require a smaller voltage input for a given power output, which may permit further economies in the earlier stages of the set.

Apart from the choice of a suitable valve, the most important factor from the point of view of economy is again the grid bias. Neglect of this factor is probably responsible for more prematurely exhausted H.T. batteries than any other cause. The grid bias is the sluice gate which holds in check the reservoir of the H.T. battery, so that it is sound economy to buy a fresh bias battery with every new H.T. unit. The higher the negative bias the less will be the drain on the battery, and the experiment should be tried of increasing the bias until it is obvious that the quality of reproduction is impaired. Many sets are worked with an unnecessarily high H.T. current through neglect of this simple precaution.

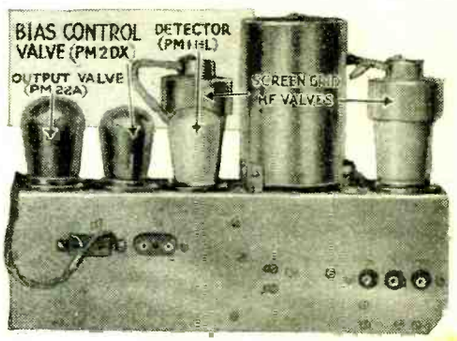
In conclusion, it may be interesting to record the possible future trend of battery-receiver design from the point of current economy. With the usual arrangement of a single output valve the average H.T. current is always standing at a value sufficiently high to cope with the loudest passage of music. A circuit is required which will automatically adjust the operating conditions of the valve in accordance with the signal applied to its grid.

This has been accomplished in the Philips type 830 B receiver by an ingenious circuit employing a separate valve to control the bias to the PM22A pentode output valve. During intervals in the programme the output valve is over-biased by a 9-volt battery, thus reducing its H.T. consumption to a fraction of the normal value. As soon as the modulation is resumed the bias-control valve comes into action and develops a voltage in opposition to the bias battery in accordance with the strength of the incoming signal. At the loudest volume level the effective bias is reduced to $-4\frac{1}{2}$ volts.

Bias Control Mechanism.

For those who may be further interested in the mechanism of this circuit a schematic diagram of the control-valve connections is given in Fig. 2.

Connected across the H.T. battery, in series with the 9-volt bias battery for the output valve, is a group of resistances R_1 to R_4. The resistance across which the voltage opposing the bias battery is developed is R_1. To reduce the current taken by the circuit to a conveniently low value R_4 is introduced, while the values of resistances and condensers R_2, R_3, C_2, C_3 are adjusted to give a time constant which will smooth over minor irregularities in the fluctuating grid bias. The control valve is connected in parallel with part of the resistance circuit across the H.T. battery, and functions as a leaky-grid detector. The grid is connected through a small condenser C_1 to the anode of the output valve. When an alternating voltage is applied to a leaky-grid detector the mean current falls; in other words, the effective resistance of the valve is increased. Thus current from the H.T. battery, which, under static conditions, was flowing principally through the control valve, is deflected on the arrival of a signal through the resistance branch containing R_1. As a result, a voltage is developed across this resistance in opposition to the bias battery, and the effective value of the bias transferred to the grid of the power valve is reduced. It will be readily understood that the design of a circuit of this nature is far from simple, and considerable research is involved in finding a correct relationship between the constants of the circuit to ensure uniformity over the range of control.



Chassis of the Philips 830 B battery receiver, showing auxiliary bias control valve.

www.americanradiohistory.com

Whistle Suppressor

A Simple Tuned Filter for Eliminating Interference.

By W. T. COCKING.

THE steady heterodyne whistle which often mars reception of a foreign transmitter is the penalty we pay for attempting to accommodate too many stations in a given waveband. Fortunately such interference can be suppressed with negligible effect on quality by the introduction of a series tuned circuit into the L.F. amplifier.

The simple and inexpensive filter here described will ensure good quality from more stations.

THE proposals put forward for the elimination of the steady heterodyne whistle caused by the beats between the carrier waves of adjacent stations have been many and various, but none is effective without in some degree affecting the quality of reproduction. Since the whistle is of the same nature as the desired speech and music, it cannot be eliminated without removing also at least a portion of the wanted modulation.

The usual procedure is to employ a filter having a cut-off frequency somewhat lower than that of the whistle, so that the heterodyne note, and all higher frequencies, are removed from the output of the loud speaker. This filtering action may be obtained in the high-frequency tuning circuits or in the L.F. amplifier. In the case of the common 9,000 cycles whistle between stations spaced by the standard frequency, the cut-off provided by the tuning circuits is usually quite sufficient and little trouble is experienced, except with unselective types of receiver.

Tuned Filters.

Lower frequency whistles, due to stations working with only a small separation, cannot normally be eliminated by the tuning circuits alone, and it is then the common practice to use a filter in the L.F. stages which cuts off all frequencies higher than about 3,500-4,000 cycles. This satisfactorily prevents whistles, but unfortunately the quality suffers severely, owing to the practically complete elimination of the higher harmonics of speech and music.

It would obviously be an improvement if we could arrange to eliminate only frequencies in the immediate neighbourhood of the whistle, and to reproduce higher frequencies unimpaired. The quality would then be affected to the least possible extent, for it would only suffer at all when those particular notes were broadcast, the higher harmonics of which correspond to the whistle frequency. Since these occur comparatively rarely, and are of a transient nature, the reproduction would not be greatly affected.

Such a means of preventing heterodyne whistles does exist, and at various times it has been recommended for this purpose. It is all too little known, however, for it is very effective and affects the quality of reproduction to an extraordinarily small degree. It consists simply of shunting a tuned acceptor circuit, resonating at the whistle frequency, across one of the L.F. circuits.

A unit may be constructed embodying all the necessary apparatus, and it may be connected directly to any existing set in which suitable points are accessible in the L.F. portion. The best results are usually obtained when the acceptor is connected in parallel with one of the L.F. couplings, such as an L.F. transformer primary, or an anode coupling resistance, but in many cases it is sufficient to connect it across the loud speaker terminals. The higher the impedance of the circuit across which it is connected, the better will be the whistle elimination, but the more the quality will suffer. With a circuit of some 10,000 ohms to 50,000 ohms impedance, the loss of quality is very small and most whistles are satisfactorily removed.

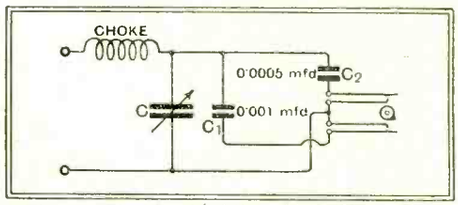


Fig. 1.—The circuit of the whistle filter. The frequency range from 4,000 cycles to over 9,000 cycles can be covered with the variable condenser in conjunction with the two fixed condensers C_1 and C_2.

The heart of the unit is the inductance, and it is essential for this to have the correct characteristics if the results are to be satisfactory. An inductance of about one henry is needed, but it is of the first importance that its effective resistance at frequencies of some 4,000-10,000 cycles should be very low. This rules out the use of any iron-cored choke, and it is necessary to use an air core component with many turns.

Details of the Choke.

The constructional details of a suitable choke are given in an accompanying sketch; a former is built to the dimensions given by assembling discs of plywood and winding 1,825 turns of No. 32 enamelled wire into each of the three slots so formed, or a total of 5,475 turns. Winding is carried out continuously, and in the same direction in each slot. The inductance of a component built to this specification has been measured and was found to be one henry with a D.C. resistance of 257 ohms.

When used with a capacity of about 0.0003 mfd., the resonance frequency is a little over 9,000 cycles, and it is, therefore, suitable for eliminating the very high-pitched whistle, between normally spaced stations. These, however, are usually the least troublesome, and it is the lower frequency whistles, down to about 5,000 cycles, which are the most unpleasant. With a higher capacity these may be effectively eliminated, and with some 0.0015 mfd. whistles of about 4,000 cycles can be removed. Obviously, therefore, we require an available capacity range of from a little under 0.0003 mfd. to 0.0015 mfd., and this is most conveniently obtained by using fixed condensers in conjunction with an ordinary 0.0005 mfd. variable condenser.

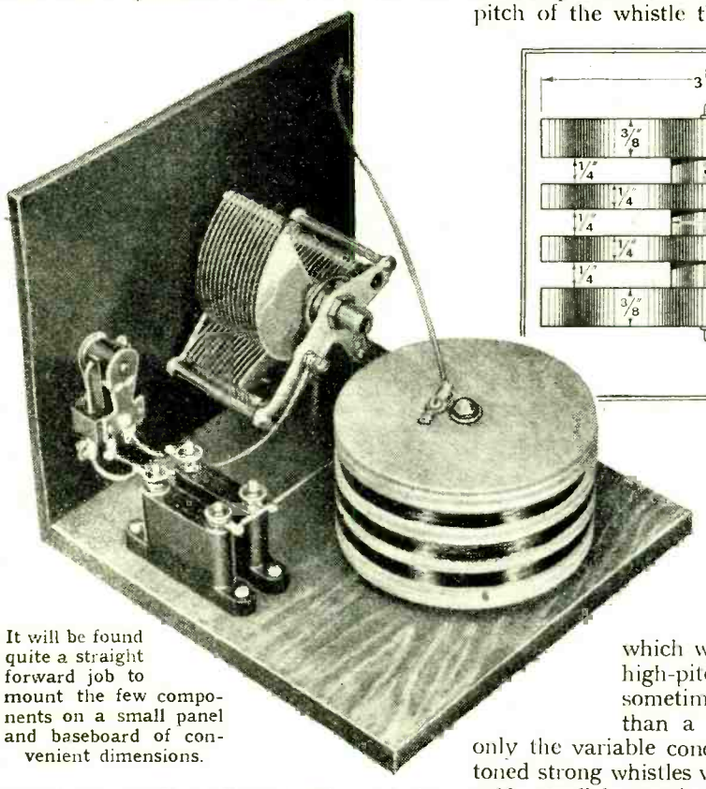
The circuit diagram of the complete unit is shown in Fig. 1, in which Ch is the choke and C the variable condenser of 0.0005 mfd. A three-position switch

www.americanradiohistory.com

Whistle Suppressor.—

allows of this capacity being used alone, or of either a 0.0005 mfd. C_2, or a 0.001 mfd. condenser, C_1, being placed in parallel with it. The unit is so simple that it needs little in the way of constructional detail, and the general arrangement of the components can be followed from the photographs; the layout is not at all critical, and can be modified to suit individual requirements.

In use, the two terminals are connected to the two ends of an L.F. transformer primary, a coupling resistance, or to the loud speaker terminals. If the unit be left permanently connected, in the absence of a whistle the switch should be in the centre position and the condenser vanes unmeshed, so that the quality is not affected at all. When a whistle is heard the condenser should be slowly rotated until a point is found at which it disappears. If no such point can be found with the switch in the middle position, it should be set to throw the 0.0005 mfd. condenser in circuit, and the procedure repeated. If still no elimination point be found, the third switch position should be tried. It



It will be found quite a straight forward job to mount the few components on a small panel and baseboard of convenient dimensions.

should be noted that the setting of the variable condenser is quite critical, and it should be turned slowly or the elimination point may be passed over. A slow-motion dial is not strictly necessary, but it might prove convenient to those unaccustomed to critical tuning.

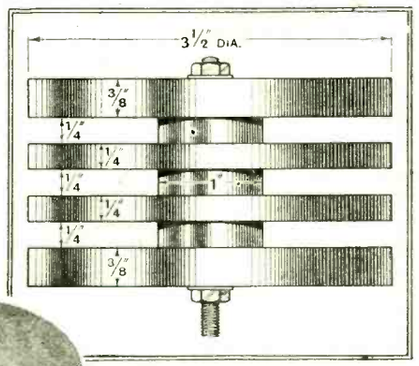
Whistles of Low Frequency.

Those whistles which are of lower frequency than 4,000 cycles cannot satisfactorily be eliminated, since they are not within the tuning range of the unit. They are comparatively rare, however, and when they occur they are accompanied by other forms of interference, so that their elimination would not make listening of much greater pleasure. The chief purpose of the unit is to remove the steady heterodyne whistle where this is due to stations being spaced by 5 kc. and upwards, and in this it is remarkably effective.

In many cases it will prove almost impossible to detect the effect of the acceptor circuit upon the quality of reproduction, even although a certain small band of frequencies must be missing from the loud speaker output. It forms, therefore, a useful adjunct to a receiver of any type, and will extend the number of those stations which can provide programme matter of entertainment value.

Adjustment for every Whistle.

It must be realised that the unit cannot be just connected in circuit and expected to give freedom from whistles. It requires adjustment for every different whistle, just as the tuning of the set must be altered for different stations. Each whistle may require a different setting of the acceptor condenser, and the higher the pitch of the whistle the less the capacity



Constructional details of a one-henry choke. The former is built up from plywood discs, and 1,825 turns of No. 32 enamelled wire are wound in each slot.

which will be needed. Very high-pitched whistles, which sometimes sound little more than a thin hiss, will need only the variable condenser. Fairly low-toned strong whistles will require the 0.001 mfd. parallel capacity, while those falling between these limits will probably need the 0.0005 mfd. parallel condenser. A little experience will soon show the particular switch setting and approximate dial reading for any given heterodyne note.

One word of warning should be given. If the receiver is not fitted with effective H.F. stoppers, so that H.F. currents can wander into the L.F. circuits, oscillation may be found when the unit is connected. Care should be taken, therefore, to keep the wires leading to the unit away from the H.F. portion of the set and from the aerial, and in some cases the use of screened wire for the connections may be advisable. Little difficulty has been experienced from this source, however, when employing modern types of set, but it is a point to be borne in mind when using it with older receivers.

LIST OF PARTS.

The parts shown below were actually used by the designer, but alternative components can be employed in most cases.

1 *Variable Condenser*, 0.0005 *mfd. and dial* (Wavemaster type "Colonial log," Catalogue No. 14/A).
1 *Fixed Condenser*, 0.001 *mfd.* (T.C.C. type 34).
1 *Fixed Condenser*, 0.0005 *mfd.* (T.C.C. type 34).
1 *1-pole three position Switch* (Wearite I.31).
1 *Choke* (See Text for particulars).
2 *Terminals* (Clix).

This unit is available for inspection by readers at the Editorial Offices, 116, Fleet Street, London, E.C.4.

STANDARD FREQUENCY TRANSMISSIONS.

FULL particulars are now available of the standard frequency transmissions of 1,000 cycles per second which are being conducted on the second Tuesday in each month from station G5HW of the National Physical Laboratory at Teddington. The transmissions last from 10.40 to 12 G.M.T. on a nominal carrier wave frequency of 360 k.c. (wavelength 830 metres). The schedule is as follows:—

G.M.T.

1040. Announcement in Morse code. "CQ de G5HW (3 times). Standard Frequency Transmission at 1,000 cycles per second."
1045 Transmission of modulation frequency uninterrupted.
1145 Modulation frequency changed by minus 2.5 parts in a million.
1155 Announcement in Morse code. "CQ de G5HW. Correction to Standard Frequency $\frac{\text{plus}}{\text{minus}}$ × parts in ten million" (3 times).
1200 Programme terminates.

The modulation is derived from a continuously running frequency standard maintained at the National Physical Laboratory and having a nominal frequency of 1,000 cycles per second, the accuracy of which is within two parts in 10 million, but during the transmission the exact frequency is measured and a correction to the nominal frequency in terms of parts in 10 million is made at the end of the programme. The object of changing the frequency by −2.5 parts in a million, as shown in the schedule, is to enable receivers to decide whether their own frequency of 1,000 cycles is above or below that of the N.P.L. standard.

A Recent "Wireless World" Constructional Set.

The Diode Quality Four.

(September 30th, 1932.)

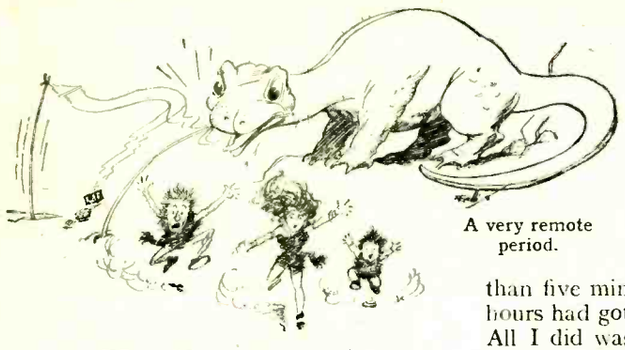
A general-purpose battery-operated set with a distortionless diode detector. Designed for high-quality reproduction, simple operation, and economy in battery current. Selectivity is exceptionally good, and the receiver includes a variable-mu H.F. stage, automatic bias, and a constant-width band-pass filter.

www.americanradiohistory.com

UNBIASED

By

FREE GRID.



A very remote period.

No Resistance?

"TIME was when the only resistance in a wireless receiver was the grid leak," says the radio correspondent of a Brummagem newspaper, somewhat sententiously. I am afraid that his "Time was" must refer to a very remote period before myself or Marconi had been heard of, for I seem to recollect that I used to use a pretty hefty resistance in my crystal set, to wit the tuning coil, which in its worst form must have put up a resistance running into tens of thousands of ohms in order to develop across itself the potential differences to actuate the crystal.

Rejecting in Comfort.

HAVING settled the automatic-stop controversy there is another matter which I wish to bring up concerning radio-gramophones, but this time it concerns itself with a simple invention which I trust that people who make automatic record-changers will trample each other to death in a wide scramble to obtain from me.

It so happened that I received an invitation to spend a week-end recently with a repulsively rich aunt, and I was compelled to accept it, as I have expectations from her. Upon my arrival I found that the ordeal was to be mitigated by the fact that she had acquired a plutocratic-looking radio-gramophone complete with record-changing mechanism.

After loading her up with a full supply of records—I mean the radio-gramophone and not my aunt—I quickly made myself comfortable with pipe and carpet slippers in an easy chair on the other side of the room. It was soon evident that I had not chosen my records as carefully as I might have done, as I found that I had to make several journeys across the room to press the rejector button. This necessity for constantly rising from my armchair speedily shortened my temper, and at last it dawned upon me that the manufacturer of the wretched thing expected me to place my chair right up against the instrument with the loud speaker blaring away in my ear. True, there was a volume control, but, if adjusted, it is naturally insufficient for a person sitting at the other side of the room. At any rate, in the interests of musical realism, the volume control should be used very sparingly.

What on earth is the use of an automatic record-changer if someone has to sit on top of it to work the rejector button? I cast about in my mind for a solution of the trouble, and had it in less than five minutes, and within a couple of hours had got my idea into working order. All I did was to sally forth and obtain a simple solenoid arrangement, a small metal rectifier, an inexpensive mains transformer, a bell-push, and a length of flex. I speedily fixed them up so that, instead of my having to work the rejector button whenever a record failed to please, the solenoid did the needful *inside* the cabinet—the metal rectifier and transformer being used to supply energy from the mains. This having been done, I simply sat back in my armchair at the other end of the room, with the bell-push on my lap, and rejected the whole batch.

How Pirates Can Help.

ACCORDING to an official announcement published in two Northern newspapers, Lancashire still requires another 11,800 sets and Yorkshire 28,000 to achieve the ideal of a radio set in every other home. I don't know why the standard aimed at is every *other* home instead of in *every* home, but surely the official licence figures issued by the P.M.G., from which the computations mentioned above are made, form no reliable basis, since the pirate has been completely left in the cold, and it is not impossible that the ideal which is aimed at was achieved a considerable time ago.

Does Kindness Pay?

I SEE that according to a report in a well-known journal a flash of lightning affects a long-wave receiver a quarter of a million times as strongly as the spoken voice. This is the first time I have heard that the spoken voice affects a radio receiver at all, except via the transmitting aerial; at any rate, my radio receiver pays no attention to me at all when I speak to it, although since reading the statement quoted, I have tried all methods to induce it to do so, including kindness.

I have tried kindness.

Question and Answer.

CERTAIN readers who appear to exhibit an unusual degree of interest, bordering on rudeness, in my personal affairs have written to me asking whether or no my features are really like those portrayed from time to time in the pages of this journal. The reply to this is both yes and no, that is to say, the sketches bear the same resemblance to myself as do the cartoonists' best efforts in the case of Messrs. Baldwin, Ramsay and Co.

Impersonations.

TWO years ago when visiting a provincial wireless show I chanced to call at a certain stand in a vain quest for technical information, and in the course of conversation I was surprised to learn from the lady who presented me with a bag of literature that not long previously the stand had been visited by "Free Grid," of *The Wireless World*. Upon my expressing surprise she took the wind completely out of my sails by explaining that

Impersonated.

he had been pleased to give her an autographed photo of himself, which she produced for my inspection. It was the portrait of an unkempt-looking individual dressed in plus-fours and a boater.

From information received, it appears that similar scurvy tricks have been played recently at other provincial exhibitions, and in the one case the impersonator accidentally betrayed himself.

It appears that on announcing his identity he was politely asked to prove it by leaving a thumb-print impression. He agreed with alacrity. Unfortunately for him, however, he boggled his attempted sleight-of-hand, and the rubber stamp fell from his fingers.

I regret to say that these occurrences point to a more serious state of affairs than may appear at first sight. Can it be that an unscrupulous rubber stamp manufacturer is supplying the implements for the perpetration of these nefarious acts? As matters stand at present, it is obviously impossible for me to continue to use my thumb-print as a signature, and I hereby give notice of its discontinuance.

www.americanradiohistory.com

NEWS of the WEEK.

Another Giant Station.

BAMBERG is the latest name to conjure with in European radio circles. Bamberg is the village near Vienna which is to become famous on account of the 120 kW. broadcasting station now being erected at that spot. It is stated that tests may be started before the end of the year.

Sealed Orders.

SEALED letters each with a request that the recipient will not open it until requested to do so during a special transmission on October 29th have been received by listeners to the programmes of the Dutch Radio Association, VARA.

We understand that each letter contains a new badge, the cost of which will be collected after the special programme.

In Honour of Ferrié.

AVENUE DU GENERAL FERRIÉ is now an accomplished fact in Paris. At the impressive inaugural ceremony a few days ago M. Paul Painlevé, the Air Minister, and General Perrier, representing the French Academy of Sciences, gave memorial speeches recalling the deceased General's great work in the service of European wireless.

Comedy at Almelo.

THE townsfolk of Almelo, Holland, are laughing over the recent police "captures" of the illicit transmitter which has been broadcasting light programmes every evening. Despite two successive captures of the offending station, the transmissions continue. The police and postal authorities are advancing the theory that there must be a chain of clandestine transmitters, each station ready to enter into action immediately a colleague is caught.

Fewer Listeners in Germany.

THE German broadcasting authorities publish the sad news of a drop in the broadcast licence figures. The present quarterly total is 4,077,347, which is 42,184 less than on July 1st. This is the first time in German radio history that the October figures have shown a decrease against the figures for midsummer. The drop is attributed to the world economic crisis, and not to the reorganisation of German broadcasting.

Dutch Programmes from Luxembourg?

AIR service operators on the Continent are complaining that they are being seriously interfered with by the Luxembourg 200-kW. tests on a wavelength in the neighbourhood of 1,200 metres. Whether this will be the official wavelength of Luxembourg is doubtful, opinion at the Madrid Conference being definitely against the station's occupying the long-wave band.

According to a correspondent, the new directors of the station are determined that Luxembourg shall reflect French policy. It is likely that AVRO, the Dutch "neutral" broadcasting association, may make extensive use of Luxembourg on Saturdays and Sundays

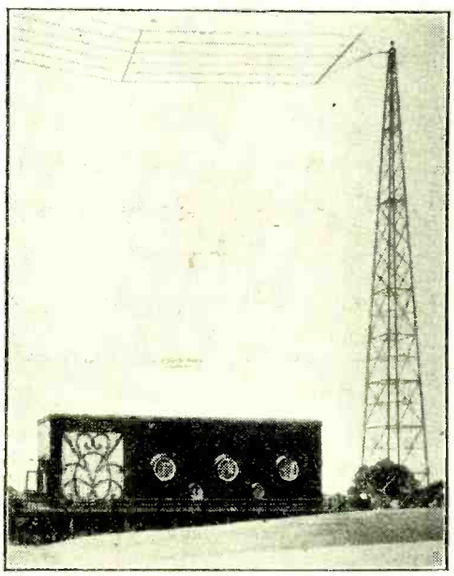
Current Events in Brief Review.

New Wavelengths.

THE 20.64-metre wavelength originally adopted by *Radio Nations*, the short-wave station of the League of Nations at Prangins, has been found unsuitable. The Sunday evening transmissions between 10 and 10.45 G.M.T. are now given on 31.3 and 38.7 metres.

D.C. to A.C.: A Dispute.

AS we go to press a first-class dispute is raging between the Fleetwood Council and 3,000 owners of mains-operated wireless sets on the subject of the change-over from D.C. to A.C. supply. The Council contends



A TRANSMITTING "RECEIVER." This odd-looking erection is the new Freshman broadcasting station at Palisades, New Jersey, built to resemble a "Freshman" radio receiver.

that it is not legally bound to bear the cost of adapting wireless sets to the new supply, but the set owners, fortified by a message from the Electricity Commissioners, are raising a shilling fund to enable the Council's decision to be contested in the Courts.

Modesty?

THE *Cortes* or Spanish Parliament has banned the broadcast microphone from the Parliamentary precincts.

New Terror for Motorists.

AN interesting legal point arises in connection with the growing popularity of the car radio receiver as exemplified in the new H.M.V. six-valve "superhet." designed for use in cars with metal bodies. Several boroughs prohibit the use of loud speakers in a public place, and thus the radio motorist may find that when he is passing through a particular district he is breaking the law if the windows of his car are open.

German Giants Testing.

LEIPZIG is already testing on 120 kW. with a wavelength of 389.6 metres, which is that at present allocated to Frankfurt. It is hoped that the station will be working regularly by the first week in November.

Munich is also beginning tests on 533 metres.

Canada's Pirate Hunt.

GOOD hunting to the Canadian Department of Marine at Ottawa! The department has decided to undertake a house-to-house canvass to determine just how many set owners are failing to pay the annual radio licence fee of two dollars.

Another object of the scheme, it is whispered, is to learn the attitude of Canadians to the possibility of an increased tax. In other words, when will the worm turn?

Electrical Music.

THE new vogue of electrical music is advancing rapidly in Germany. Last week a society for the furtherance of electrically produced music was founded in Berlin, its aims being the organisation of public concerts with electrical instruments such as the Trautonium and the Neo-Bechstein reproducing piano. Composers are to be encouraged to write specially for the new type of instrument.

A Radio Family.

THE world's champion radio family lives in New Zealand, according to the American Radio Relay League. Not only are three sisters of the family qualified and active amateur radio operators, but there is also a husband and a young brother active in the game.

Kathleen and Nancy Kirby maintain the home stations (ZL4DT and ZL4FN) at Douglas Street, Balclutha, New Zealand. Their sister, Mrs. Peggy Cameron, operates her station, ZL4CL, at 40, Cargill Street, Dunedin. Her husband, Ewen Cameron, ZL4BJ, is one of New Zealand's best-known amateurs.

Ici on Parle . . . English.

NO fewer than eighty per cent. of Europe's amateur transmitters can converse in English. This is the illuminating result of an enquiry made by that organisation of ultra-efficient "ham" operators—the Rag-chewing Club. German and French are the only other tongues that are anywhere in the running, and the hundred or so amateurs from all European countries who replied to the R.C.C. questionnaire emphatically emphasise their preference to English. A few of them, incidentally, can claim fluency in no fewer than seven languages, including ancient Latin and modern Greek!

Spanish amateurs seem to be least conversant with English. Few of them, in fact, can even make themselves understood in French, and "Spanish only" appears to be the watchword with many. The Dutch, on the other hand, show remarkable cosmopolitanism, while Britain, although indicating a "French and English only" complex, yet possesses many multi-lingual amateurs.

www.americanradiohistory.com

For Dinner-time Broadcasters.

"DON'T turn your back on the microphone" is one of the don'ts for radio speakers issued by the American broadcasting station WOR, Newark. "Don't bang the table with your fists" is another, and, for the benefit of after-dinner speakers, "Don't rattle the cutlery." "Enjoy your soup," they might have added, "but make sure the mike is dead."

Bringing H.T. to Your Doorstep.

TO wireless users without the benefit of mains supply, there is much to be said for using high tension at a stated voltage which does not drop. This point is emphasised in a pamphlet issued by Radio Service (London), Ltd., 105, Torriano Avenue, London, N.W.5, who are now providing over 16,000 London listeners with a regular high-tension accumulator service. The company also undertakes set servicing and a "New Sets for Old" scheme.

CLUB NEWS.

Ratepayers' Radio.

THE new secretary of the New Eltham Ratepayers' Association, Radio Section, is Mr. A. E. Gillborn, 87, Montbelle Road, New Eltham, S.E.9.

Radio at Rawmarsh.

AT Rawmarsh, near Rotherham, Yorkshire, short-wave amateurs are catered for by a vigorous Society—the Rawmarsh Radio Society and Short-wave Club. Meetings are held fortnightly at the headquarters, Haugh Road Senior School.

Hon. Assist. Secretary, Mr. E. Small, 47, Goosebutt Street, Parkgate, Rotherham, Yorks.

Ultra Short-wave Working for Amateurs.

PRACTICAL 5-metre working forms part of the work now being conducted by the Kentish Town and District Radio Society.

New members are welcome to the meetings and full particulars concerning the Society can be obtained from the Hon. Secretary, Mr. E. A. C. Jones, 46, Lady Margaret Road, Kentish Town, N.W.5.

An Eleven-year-old.

PROBABLY all societies which have endured the ups and downs of life for ten years can class themselves as veterans in the movement. Among them is the Smethwick Wireless Society, which was founded in 1921, and has just changed its headquarters to the Club Room at the Crown Inn, High Street, Smethwick. The Society numbers among its members no fewer than five transmitters, one of whom, Mr. C. Crew (6CG), has been licensed specially for television experiments.

Membership is open to both sexes, and all interested are asked to communicate with the Hon. Secretary, Mr. E. Fisher, M.A., of 33, Freeth Street, Oldbury.

The Good Old Days.

"WHY I Joined the Society," was the title of a humorous talk given by Mr. Remacot at the last meeting of the Croydon Radio Society. Mr. Remacot's reminiscences took members back to the early days of wireless when the mysterious complaints which assailed receivers sent listeners to the radio societies for help. Sometimes their troubles consisted of nothing more than the radiations caused by their own electric bells.

At the same meeting the election of officers for the 1932-33 session took place, Mr. F. Nightingale being re-elected Chairman.

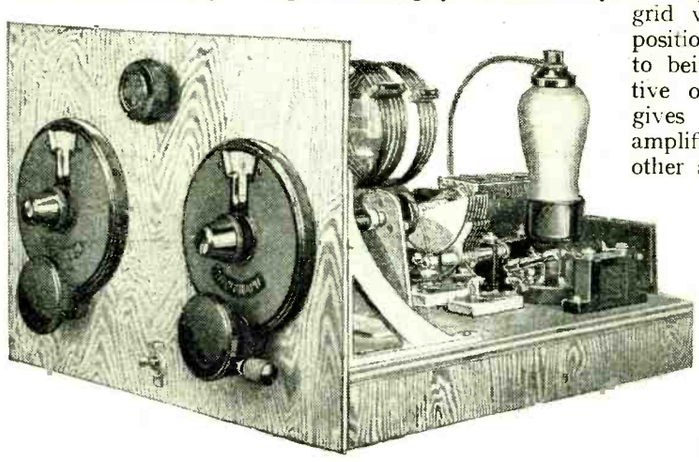
Hon. Secretary: Mr. E. L. Cumbers, 14, Campden Road, S. Croydon.

IN NEXT WEEK'S ISSUE.

Short-Wave 2.

Screen-grid Battery-operated Receiver.

DESIGNED especially for short-wave use this receiver embodies a two-valve circuit arranged as a regenerative detector and power amplifier. Since the sensibility is dependent largely upon the effectiveness of the reaction control particular care has been taken to make this as smooth as possible over the whole wave range covered. This has been achieved by the employment of a screen-grid valve in the detector position, which, in addition to being particularly effective on the short waves, gives considerably greater amplification than any other arrangement.



The low frequency amplifier comprises a resistance coupled L.F. transformer unit affording a voltage step-up and in conjunction with the pentode output valve provides ample amplification for loud speaker reproduction.

LIST OF PARTS REQUIRED.

After the particular make of component used in the original model, suitable alternative products are given in some instances.

2 Short-wave variable condensers, 0.00015 mfd. **(J.B. S.W. Special)**
1 Short-wave valve holder, 4-pin **(Eddystone)**
1 Short-wave valve holder, 5-pin **(Eddystone)**
1 Midget variable condenser (Eddystone)
1 Fixed potentiometer (8-W model) **(Eddystone)**
5 Two-pin plug-in short-wave coils (two No. 3, one No. 4, one No. 6, one No. 12) **(Eddystone)**
Equivalent values in Atlas and Igranic.
1 Short-wave H.F. choke (Igranic)
Bulgin H.F.3, Wearite H.F.3.
1 Indigraph Vernier Dial, fitted with micrometer adjustment **(Igranic)**
Burndept, Utility.
1 Indigraph Vernier Dial, fitted with large knob **(Igranic)**
Burndept, Utility.
1 Transcoupler L.F. Unit (Bulgin)
Benjamin, Formo, R.I.
2 Intermediate tuning condensers, semi-variable, 70-140 m-mfd. **(Cyldon S.T.140)**
Colvern Pre-set 0.0001 mfd., J.B. 0.0001 mfd. trimmer.
2 Single coil holders (Lotus)
Igranic.
2 Fixed condensers, 0.01 mfd., mica **(Dubilier Type 620)**
Graham Farish, T.C.C. Type 34, Telsen.
1 Fixed condenser, 0.001 mfd., mica **(Dubilier Type 620)**
Graham Farish, T.C.C. Type 34, Telsen.
1 Grid leak, 2 megohms **(Loewe Type F.Z.128/30)**
Dubilier, Erie, Igranic, Claude Lyons.
1 Fixed resistor, 5,000 ohms, 1 watt **(Erie)**
Dubilier, Claude Lyons
2 Terminal mounts (Junit)
Belling-Lee, Goltone.
4 Terminals, A, E, L.S.+, L.S.− **(Burton)**
Belling-Lee, Igranic.
1 On-off toggle switch (Claude Lyons, B.A.T. No. 728)
British Radiophone, Bulgin, Igranic, Utility, Wearite.
1 Pair panel brackets, 4in.×4in. **(Magnum)**
Bulgin.
2 Condenser extension rods, 4in. long **(Bulgin E.H.10)**
Red Diamond.
1 Grid battery, 9-volt **(Grosvenor)**
Ever Ready, Oldham, Pertrix, Ripaults, Siemens.
1 Battery cable, 5-way **(Goltone)**
Belling-Lee, Bulgin, Concord, Harbros, Lewcos.
1 Pair grid battery clips (Bulgin No. 5)
Wood, wire, screws, systoflex, 2 wander plugs, etc.

Home Talkies.

CINE-TALKIES are being experimented with by a sub-section of the Golders Green and Hendon Radio Scientific Society. The Society is holding an active session. On Wednesday, October 26th, Mr. A. J. Bremner, B.Sc., lectured on "How to Use the Society's Valve Testing Panel." On Thursday, November 3rd, a party of members will visit the B.B.C. Headquarters, and on the day following the Society's annual Dinner and Dance will be held at the Holborn Restaurant.

Hon. Secretary: Mr. W. A. Hudson, 25, Llanvanor Road, N.W.2.

The International S.W. Club.

THE London Chapter of the International Short-wave Club recently held the session's opening meeting, at which lantern lectures sponsored by the Marconiphone Company and Philips Lamps interested an appreciative audience. The meetings are open to all, members and non-members alike.

European Representative: Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16.

Junk Sale.

ONE of the famous "junk sales" associated with Slade Radio, Birmingham, took place at the last meeting, at which an extraordinarily large quantity of surplus apparatus changed hands. The Society has prepared an excellent programme for the coming quarter and extends a hearty welcome to anyone interested in wireless.

Full details are obtainable from the Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

For Coventry Short-wave Enthusiasts.

THE Coventry Short-wave Radio Club opened the new season with an enthusiastic meeting at the Ragged School, Coventry, at which new officers and committee were elected. As its name implies, the Society uses all its efforts to stimulate interest in short-wave work. Efforts are being made to arrange visits to places of interest to short-wave fans.

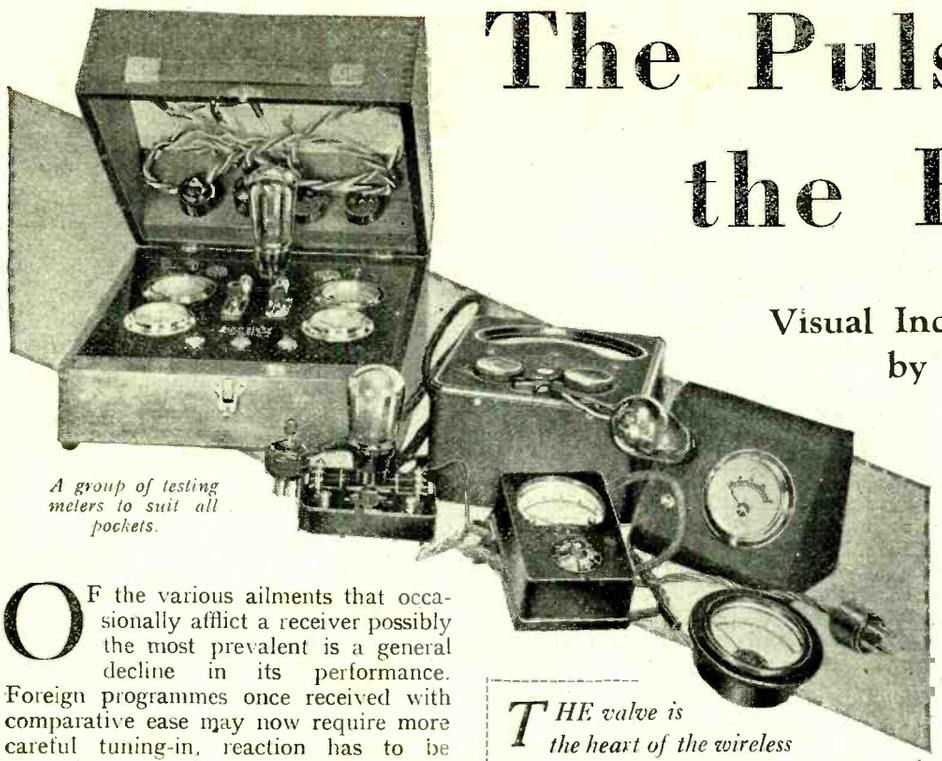
Full particulars of the Society will be gladly furnished by the Hon. Secretary, Mr. Cyril Taylor (BRS149), 37, Kingsland Avenue, Coventry.

www.americanradiohistory.com

The Pulse of the Receiver.

Visual Indication of Performance by Means of a Meter.

By H. B. DENT.



A group of testing meters to suit all pockets.

OF the various ailments that occasionally afflict a receiver possibly the most prevalent is a general decline in its performance. Foreign programmes once received with comparative ease may now require more careful tuning-in, reaction has to be pressed to its limit, and, in addition, the quality of reproduction shows a marked deterioration. Replacing the batteries, if these provide the operating power, leads to a temporary improvement only, and the listener finds himself at a loss to account for the unsatisfactory state of affairs. Finally, yielding to expert advice, a new set of valves is obtained, and once again the receiver recovers its earlier liveliness.

It is well within the bounds of probability that one, or maybe two only, of the valves had deteriorated with use, and if a few simple measurements had been made occasionally and a record kept of the condition of each valve, replacements could have been made when necessary and many months of unsatisfactory reception avoided. The essential information can be gleaned by the judicious use of an inexpensive measuring instrument—one of the combined volt-milliammeters would prove the most serviceable in the case of battery-operated sets. For with this not only can the anode currents taken by the valves be ascertained, but the voltage of the H.T. battery checked from time to time.

Selecting a Meter.

The meter should have a resistance of not less than 200 ohms per volt, while the current ranges, of which there should be two for preference, should give full scale deflections with between 5 and 10 mA on one range and about 30 mA on the other. Voltage measurements of the H.T. battery, if this is of the smaller dry-cell type, should be made with the receiver switched off, for the meter will draw some 5 mA for a full-scale deflection. A high-grade instrument having a resistance of 1,000 ohms per volt would give a far truer indication of the state of the battery since voltage readings could then be taken with the set working and the battery under normal load.

THE valve is the heart of the wireless set. Some ready means of testing if valves are functioning properly is as important to the set owner as for a doctor to feel the pulse of his patient.

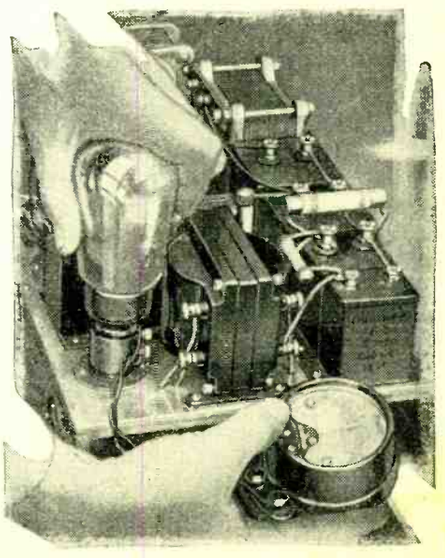
Whenever a new battery is installed a few minutes might be devoted profitably to "vetting" each valve and recording its anode current on a chart. Comparing each entry from time to time will show at a glance the condition of each, and if one or more show a marked reduction after a time serious consideration should be given to its replacement. Tests of this nature can be effected quite simply, in the case of triodes, by using one of the special valve adaptors, such as the Bulgin model shown on page 402, and a milliammeter. The adaptor is provided with a split anode connection, and two terminals are fitted on the side to which the meter is connected. In the case of screen-grid valves the milliammeter must be interposed between the top terminal and its connecting lead, but should this incite instability of the H.F. stage self-oscillation can be damped out by touching the grid terminal with a finger or short-circuiting either the anode, or the grid coil, whichever is the more accessible.

So far as mains-operated receivers are concerned, the most convenient measurement to take is that of anode current only, since it is often very inconvenient to obtain access to suitable points on the circuit for measuring the various voltages. Furthermore, the H.T. supply voltage is not subject to marked variation unless, of course, the mains rectifier deteriorates when all anode current readings will be lowered by an equal percentage.

The most useful instrument for use with this class of receiver is one having three current ranges, although a dual range meter could be made to serve the purpose, but one scale should be capable of measuring D.C. currents up to 100 mA. Where a variable-mu valve is fitted all measurements should be taken with the volume control, if this takes the form of a resistance for varying grid bias voltage, set at the same position on all occasions.

The measurements will prove of little value unless a record is kept, but it is not necessary to know what order of anode current each valve should take according to its type, but merely what change, if any, is taking place from month to month. Therefore a valve history chart should be prepared when a receiver is first installed, and for safe keeping might well be kept inside the cabinet.

The simple apparatus discussed so far does not provide the means for completely overhauling a receiver, for its usefulness is limited to making one essential measurement only. There is a wide selection of complete testing sets available, designed especially for more thorough investigation into the operating condition of the set and the valves. In the title illustration are shown a few representa-



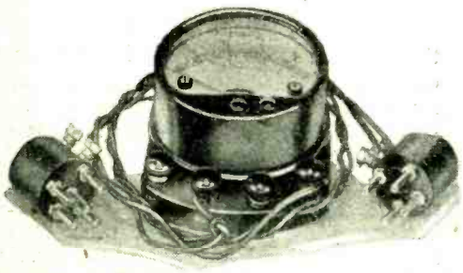
Watching the output stage. A milliammeter in the plate circuit of the amplifying valve.

www.americanradiohistory.com

The Pulse of the Receiver.—

tive models of self-contained test sets; the majority are fitted with valveholder adaptors so that all voltage and current measurements can be made under the actual conditions obtaining in the set.

The Ferranti Valve Tester makes use of a single instrument, and a switch places this in the appropriate part of the circuit according to the measurements desired. It provides three voltage ranges, 0-10, 0-100 and 0-300, and two current ranges, 0-10 and 0-100 mA respectively. There is an alternative model with the highest voltage range reading up to 500 volts. These instruments are for D.C. measurements only.



A three-range milliammeter with Bulgin split anode valve holders makes an economic testing unit.

A. F. Bulgin and Co., Ltd., make a Valve Emission Tester which does not give precise measurements but indicates whether or not a valve is in good condition. The Avo-Daptor does not embody a measuring instrument, but is intended for use with the well-known Avometer. It consists of a small valve platform carrying a switch and terminals to provide access to all circuits connected with the valve so that current and voltage measurements can be made. The special Avo-Daptor plug is of particular interest, for it embodies an adjustable centre-pin which is withdrawn for insertion in 4-pin valve-holders.

The Six-Sixty Valve and Set Tester is a more ambitious instrument, as with it a receiver can be completely overhauled. Voltages and currents, both H.T. and L.T., associated with every circuit can be accurately measured. The tester is eminently suitable for the service engineer or for those who require something a little more elaborate than the simpler apparatus discussed here.

The Weston meter is of unique construction, in that it can be employed as the nucleus of a combined A.C. and D.C. test set. With the addition of suitable resistances in series and in shunt with the moving coil meter it can be utilised to read A.C. and D.C. voltages up to 1,000 volts or more, the lowest range covering 0-5 volts. Used as a milliammeter A.C. ranges from 0-1 mA upward are available, while D.C. currents of all reasonable magnitudes can be dealt with by including shunts of suitable value. This is known as the Model 301 Universal Meter, and is a high-grade moving-coil instrument, which on voltage ranges is designed to have a resistance of 1,000 ohms per volt.

NEW YORK'S GHOST SHOW.

Eleventh-hour Effort to Avoid Fiasco.

By Our New York Correspondent.

PUT in the briefest, if baldest, possible manner, the American radio industry has gone broke. Last year's radio show only just made a profit and no more, and the promoters cancelled this year's show at the last minute because of lack of support from the radio manufacturers.

However, through sources of information not available to the man in the street, I learned that a small trade show was in progress in the ballroom of one of New York's hotels. On arrival at the hotel, I found in the lobby a list of some 64 exhibitors who were represented as having stands in the ballroom. I was the sole and only visitor at the time, and sauntered round all the exhibits in six minutes flat! I then proceeded to talk to some of the exhibitors. They were sorely depressed at the state of affairs in the American radio industry, and considerably surprised and envious of the great success of Radiolympia in London.

The outstanding demand has been for better reproduction, and, to meet it, many manufacturers have turned to Class B amplifiers. In this move they were aided by the recent introduction of new valves, type-numbered 56, 57, 58 and 82*. Type 57 is a triple-grid amplifier; 58 is a triple-grid super-control amplifier. Both have six-pin bases, and the manufacturers have made much of the fact that they cannot be used in older sets. But some enterprising gents are already selling adaptors! Type 82 is a full-wave mercury vapour rectifier.

As a matter of fact, the new amplifier valves are essential to the Class B amplifiers, and the latter, in turn, make desirable the adoption of the season's most outstanding feature, dual loud speakers. The type of amplifier hitherto used in radio receivers is known as Class A. Class B amplifiers usually consist of two valves in push-pull, so supplied with grid bias that enormous volume is possible without causing blasting in the loud speaker.

The overall effect is such that the amplifiers put out better quality than the usual single loud speaker is capable of doing justice to. By coupling up to the same receiving set two speakers of slightly different size and characteristics, properly spaced and baffled, very considerably improved reproduction can be secured. This doubling up of speakers is not evident in the new 1933 models, for the two speakers are hidden behind a single grill. Many of the new receivers, thus equipped, give a practically even response from 50 to 6,000 or 8,000 cycles.

More Battery Sets.

While the superheterodyne circuit reigns almost supreme, a number of straight H.F. sets are to be found. These have been redesigned round the new valves, which latter make all neutralising devices unnecessary, thus increasing efficiency by eliminating deliberately introduced losses.

Last year about the hardest thing in the world to find was a battery-operated set, and this in spite of the fact that millions of American homes are still unsupplied with electric power. This deficiency has been made up for this year by several manufacturers. An increasing number of motor car and boat sets is available, the former being supplied in three units: the set itself, in a metal container from which emerge a power supply cable, a cable leading to the second unit, the loud speaker (permanent magnet dynamic), and a thicker, speedometer-like cable leading to the third unit, the tuning control, which is attached by means of a metal strap to the steering column. This unit contains, besides the tuning knob and visible tuning dial, volume-control knob and a key-operated on-and-off switch.

No great changes have been made in cabinets. The same "high-boys," "low-boys," and grandfather clocks are in evidence. In the midget class, however, a departure has been made this season by housing the complete set in a small wooden chest, appropriately embellished. On opening the lid you find a small speaker grill surrounded by control knobs. The lid is left open during operation, for it is claimed that it acts as a sounding board and improves reproduction. The season's freak is a 4-valve set for A.C. or D.C. contained complete with speaker within a box measuring 9 x 5 x 3 inches.

THE PERSONAL RADIO CHEST by the American Bosch Co. is the latest in midget sets. It is switched on by opening the lid, which acts as a sound reflector. Five valves are included and a "police switch" brings in the short waves used by the police and amateur transmitters.

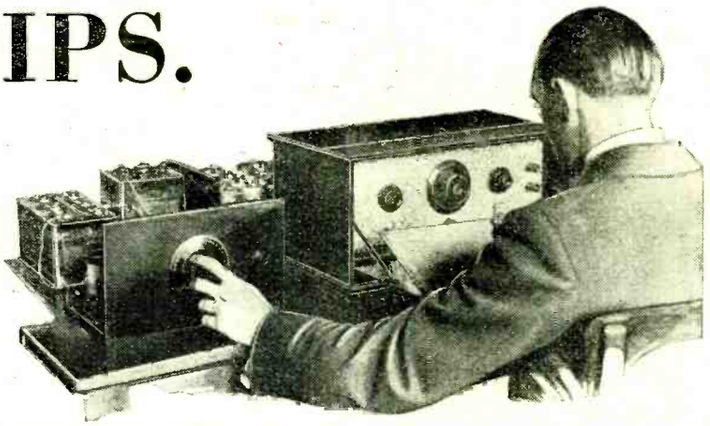
The price ranges remain about the same as last year, midget sets selling for $20 to $35, and console sets ranging in price from $60 to $150. There is a slight indication that some manufacturers are raising their prices. Economic conditions do not justify a price increase at this time, but there is a sort of desperation in the air which suggests that very few sets will be sold anyway, so a little profit may as well be made on those which *are* sold!

* Characteristics of these were given in the article, "Automatic Gain Control," by A. Dinsdale, *The Wireless World*, Sept. 23rd, pp. 290—292; Sept. 30th, pp. 327—328.

www.americanradiohistory.com

HINTS and TIPS.

PRACTICAL AIDS TO BETTER RECEPTION.



THOSE who use the ordinary type of potentiometer for volume regulation will notice that this device seems to work most effectively over a limited range of rotation of the control knob. In its most usual application there is little apparent falling off in loudness when the slider is moved, say, from the "maximum" end of the resistance to the mid point, but further rotation in an anti-clockwise direction begins to have a very appreciable effect.

Graded Potentiometers.

These remarks apply mainly to post-detection volume controls, and especially to potentiometers used in conjunction with gramophone pick-ups. The effect is basically due to the fact that the sound-wave output from the loud speaker is proportional to the square of the input voltage applied to the amplifier which feeds it.

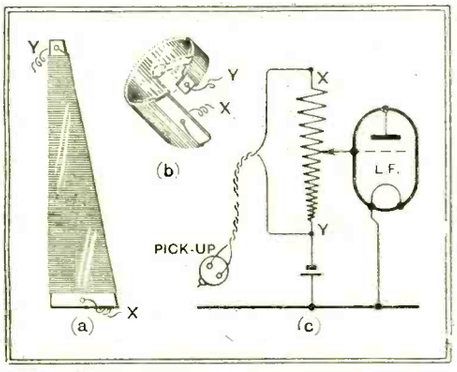


Fig. 1.—Construction and connections of a potentiometer of the graded resistance type, which gives a more even control of volume than the ordinary pattern.

In other words, although the voltage applied from a gramophone pick-up may be reduced to a half by setting the potentiometer slider at the mid point of its travel, the apparent loudness of reproduction will not also be halved, or anything approaching it.

This lack of uniformity in volume controls is often overcome by fitting a "graded track" potentiometer, of which the resistance element is tapered more or less in the manner shown in Fig. 1 (*a*) and (*b*). With the ordinary straight-line potentiometer, equal angular displacements of the contact brush will bring about equal changes in resistance, but with the newer type of component matters are arranged differently. Referring to diagram (*a*), it will be appreciated that a single turn of wire at the end of the resistance strip marked X will have a much greater length, and so a much greater resistance, than at the other end. In consequence, the resistance of the element is not equally distributed along its length.

By a suitable distribution of the resistance it is possible to obtain sensibly a "linear" control of volume, or equal increments of loudness for equal angular displacements of the contact brush. Those who use this type of potentiometer should realise that it is a matter of importance that it should be connected the "right way round." The high-resistance end of the element should always be joined to the high-voltage end of the circuit; this point is shown diagrammatically in Fig. 1 (*c*).

THE idea of a two-station set which, by the turn of a switch, may be tuned at will to the transmissions of one or other of a pair of twin local stations, is apparently attractive to a number of listeners. Even the long-distance enthusiast may consider the possibilities of such a set as an adjunct to an ambitious and much more sensitive outfit.

Two-Station Receivers.

There are many ways of arranging "switch tuning" when no more than two stations are required, but that shown in Fig. 2 is probably as satisfactory as any; it is certainly as simple and easy to get into a state of satisfactory operation as anything could well be. Other arrangements may be, perhaps, a little cheaper, but the making of initial adjustments may be found more difficult.

The circuit arrangement suggested comprises a pair of "Hartley" circuits, with centre-tapped tuning coils, which function both for purposes of tuning and reaction. Entirely separate units are needed for each station; the semi-variable condensers indicated may be of the compression type. Similar condensers may be employed for reaction control.

A detector-L.F. mains-operated set on these lines is particularly satisfactory, and, provided the compression condensers are well made, and consequently capable of retaining their adjustment, will go on working almost indefinitely. Of course, such a set should not be operated under conditions where an excessive amount of reaction is necessary.

An on-off switch may with advantage be combined with the tuning switch when the latter has a definite "off" position.

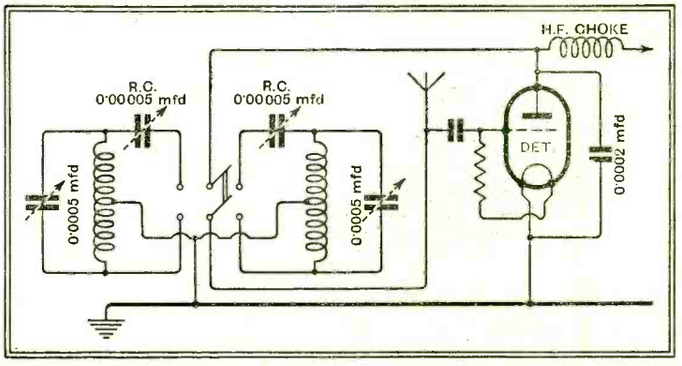


Fig. 2.—A simple duplex tuning system, applicable to two-station receivers with programme selection switch.

IT is a sound plan to make it a rule always to include a fixed condenser in the aerial circuit (i.e., between the aerial and the input tuning coil) of any D.C. receiver. A mica dielectric condenser is suitable, and if it has a capacity of 0.002 mfd. or larger its inclusion will not affect the functioning of the receiver or the alignment of the ganged tuning system.

D.C. Mains Precautions

A condenser in this position will prevent the possibility of harm being done should the aerial be blown down during a storm, and, particularly in the case of positively earthed mains, it will remove the risk of shock to anyone who touches the aerial wire. The aerial condenser is, of course, an addition to the usual high-capacity condenser through which a D.C. set is normally earthed.

MANY modern energised moving-coil loud speakers are fitted with a so-called "hum-bucking" coil, of which the purpose is to neutralise the effect of ripple voltages introduced into the field winding and so to prevent audible hum.

Neutralisation of Hum.

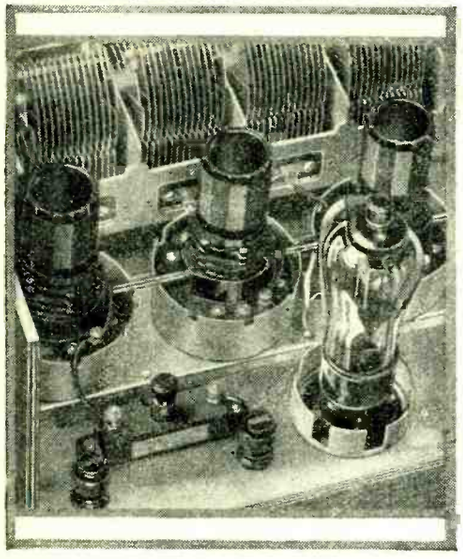
It must not be thought that when the connections of this hum-bucking coil are shown in a complete circuit diagram that they are an integral and indispensable part of the design.

The facts are that the hum-bucking coil is a local cure for a local trouble and, for instance, if a permanent-magnet loud speaker be substituted for one of the energised type, there is no need to be perturbed at the absence of the hum-bucking coil, which is no longer applicable.

www.americanradiohistory.com

The Signal Through the Receiver.

Part IV.—The Variable-mu Valve.



The input to a modern straight receiver. Screening covers have been removed from the coils and variable-mu valve.

THIS is the fourth instalment of a series of articles explaining in non-technical terms the part played by the more important components as the signal passes through the receiver. Amplification by the variable-mu valve is treated this week and the intervalve coupling will form the subject for the next instalment.

IN the previous instalment we saw how the tuned circuits connected between the aerial and the grid of the variable-mu valve behaved, in general terms. In converting into practical form the various matters there discussed we shall probably cut the Gordian knot of filter-design by purchasing a pair of screened coils designed to operate together as the two halves of a mixed filter.

To ensure that the coils shall tune over the desired wavelength it is necessary that they should be tuned by a variable condenser of the correct capacity. In purchasing a coil one is generally informed as to the right size of condenser to use with it; in the last year or so this has become standardised at 0.0005 mfd., and if the recommended capacity is taken one may be quite confident that the maximum wavelength specified will be attained.

Effect of Stray Capacities.

The lowest wavelength to which the coil can be tuned depends entirely upon the residual capacity left in circuit when the tuning condenser is set to 0° on the dial. If this setting truly represented zero capacity the wavelength tuned in would be indefinitely short, since wavelength is determined by the product of inductance and capacity. The sources of capacity external to the tuning condenser —the self-capacity of the coil, between coil and screen, between grid and filament of valve and valve-holder—all remain unchanged whatever the setting of the tuning condenser, and the total value of all these, added to the minimum capacity of the condenser itself, sets a lower limit to the wave-range.

If, in practice, the lowest wavelength required (generally 200 metres) cannot be reached, the wiring should be gone over to see that no leads connected to the high-potential ends of the coils run along close to earthed metal-work. Such wiring is sometimes indulged in by those who, when wiring up, allow neatness and tidiness to take precedence of more vital electrical requirements.

These remarks on stray capacities will serve to make it clear that it will be a pure accident if the "strays" in each of the tuned circuits have the same numerical value, or that the three circuits should tune to the same wavelength when the tuning condenser is set at zero. Although not shown on the circuit of the set, it will be found that each section of the gang condenser has a small trimming condenser connected in parallel with it. These trimmers make it possible to add the necessary small capacity to those two circuits in which the strays have the lowest value, thus ensuring that all tune alike so long as coils and condenser-sections are properly matched by their respective makers.

The purpose of the condenser C_3 and the coupling coils L_4 and L_5 has already been discussed. The number of turns on L_4 and L_5 will be fixed by the makers of the coils after some rather involved calculations which we may well take for granted; the same calculations will prescribe the capacity of C_3. This will usually be 0.05 mfd. or thereabouts, but in all cases the correct value is that recommended in the instructions accompanying the coils.

If the grid-circuit of the variable-mu valve is traced out, beginning at the grid and returning to the filament, it will be found that if the resistance R_1 were not included there would be no continuous path. In other words, there would be no means of controlling the bias on the grid. From the point of view of the direct-current connection required for the bias, the substitution of a piece of wire for R_1 would be satisfactory enough, but this would short-circuit the coupling condenser C_3 whenever the slider of R_2 was at the filament end. Since neither an open-circuit nor a short-circuit can be used, we have to compromise on a resistance which is something between the two.

From what has been said it will be clear that all we require of R_1 is that it should not short-circuit C_3. Now the reactance of the condenser is highest at the lowest wavelengths; at 2,000 metres C_3, if its capacity is 0.05 mfd., will have

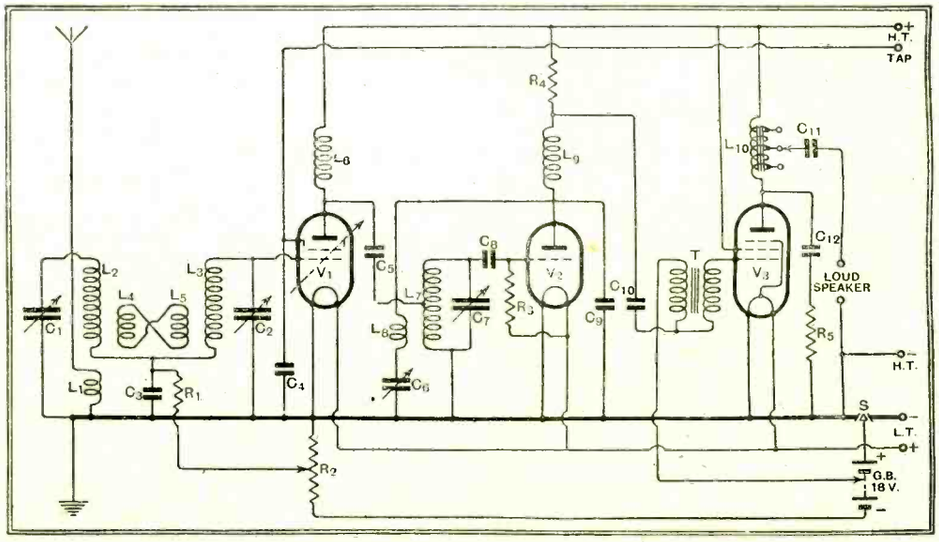


Fig. 19.—Circuit details of the modern receiver through which the signal is being traced.

www.americanradiohistory.com

The Signal Through the Receiver.—
a reactance of a little over 20 ohms. The resistance of R_1, therefore, will have to be high compared with this figure; one might suggest 1,000 ohms as a suitable standard value. But the set will work equally well if 10,000 ohms is used.

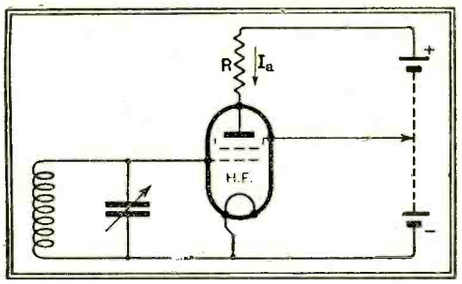


Fig. 20.—At an instant when the signal makes the grid positive, the anode current (Ia) is increased. This increases the voltage dropped in R, tending to prevent Ia from rising to its full extent.

The resistance R_2 is a variable potentiometer connected across the grid-bias battery, and serves to apply any desired voltage up to the maximum of the battery, through R_1, to the grid of the variable-mu valve V_1. The effect of increasing this bias is chiefly to permit the valve to accept a greater signal-voltage without the grid becoming momentarily positive at the peaks of the applied high-frequency voltage. Distortion of the signal is thus avoided, and with it an annoying defect known as cross-modulation.

If, when the set is tuned to a station not far removed in wavelength from the local transmitter, the signal from the latter, or from both together, reaching the grid of V_1 is enough to overload that valve, the resulting distortion has the effect of mixing the two programmes inextricably together, so that no amount of selectivity later on in the receiver can separate them. The band-pass filter, by providing a fair measure of selectivity before V_1 is reached, is to some extent a precaution against this source of unselectivity; the use of a variable-mu valve, which by increase of bias can be made to accept without distortion quite a strong signal, is a final precaution.

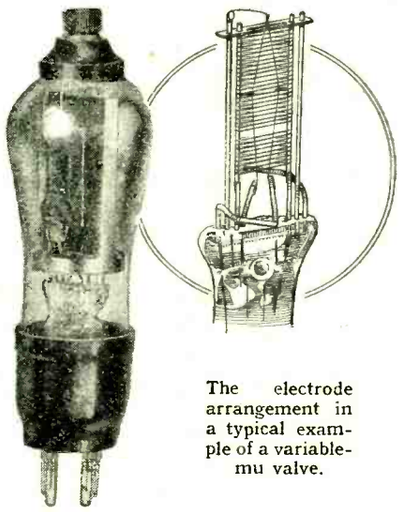
What Valve Curves Reveal.

Reference to the published curves of any make of variable-mu valve will disclose the fact that as the bias is increased the mutual conductance of the valve—which, in plain English, means its power to amplify—decreases as the bias is raised. It follows, therefore, that we do not wish to apply to the valve a bias greater than the needs of selectivity dictate at any particular moment, unless, of course, the signal is stronger than we need it to be. The bias is therefore made variable, as is indicated by the arrow which indicates the slider of the potentiometer R_2 on the circuit diagram.

The alteration of the conductance of the valve makes the bias-control R_2 operate also as a volume control, for it is natural so to adjust it that any signal that may happen to be tuned in reaches the detector-valve V_2 at the right strength for correct detection. Further, since increase of bias allows the valve to accept a larger signal, this use of the control automatically keeps the valve sufficiently underloaded to prevent distortion, even when receiving the signals of the local station.

The valve filament, as everyone knows, gives off a continuous stream of electrons as long as it is heated, and these negative electrons are attracted to the screen by its positive potential of some 60 volts. Arrived there, the bulk of them fall within the attraction of the anode, which is maintained at a potential some sixty or more volts higher still; they are therefore drawn on through the meshes of the screen to the anode.

When a high-frequency voltage is applied to the grid by tuning in a station on the band-pass filter, the grid varies in voltage in a manner best expressed by the curve we have already used to represent the signals at other stages of their progress. The grid, therefore, becomes



The electrode arrangement in a typical example of a variable-mu valve.

alternately more negative and more positive than the steady bias imposed upon it by adjustment of R_2. These alternations, though enormously rapid, can be followed by the flying electrons, which are helped on their way at moments when the grid is positive and checked when it is negative. By this controlling action of the grid the signals are converted from a voltage into a flow of electrons, which is a current. The power for the current is drawn from the high-tension battery and not from the signals themselves.

Leaving the signals in the rather disembodied form of flying electrons till next week, let us look at the implications of this control of power by a pure voltage. In the first place, it is the key to the way in which the valve amplifies, for no matter how small the current variation caused by the alternating voltage applied to the grid we can always interpose in its path a resistance so large that the voltage developed across it by the passage of the current is greater than the original voltage. It is true that the amplified voltage so obtained will tend, as Fig. 20 shows, to check the current by causing the anode voltage to vary, but the description just given of the screen-grid valve shows that since this voltage only occurs beyond the screen it will have little or no effect on the passage of current through the valve so long as the anode-voltage variations are not so large as to bring the anode momentarily down to the potential of the screen.

Constant Current Device.

The screen-grid valve is thus a constant-current device, since an alternating voltage applied to the grid controls a fluctuating current which is practically independent of the fluctuations in anode voltage, and hence of the magnitude of the impedance across which the amplified alternating voltage is to be built up. The amplifying ability of a screen-grid valve can thus be specified as the current fluctuations called forth by some definite voltage change applied to the grid—expressed in milliamperes of anode current per volt on the grid it is called the *mutual conductance* or *slope* of the valve (Fig. 21). For battery screen-grid valves 1.5 milliamperes per volt is a usual figure, so that if we connect 100,000 ohms in the anode circuit and apply one volt (alternating) to the grid we shall obtain in the anode circuit 1.5/1,000 amperes flowing through 100,000 ohms, which gives 150 volts.

An impossible figure, of course, because so large a swing of anode voltage would violate our assumption that the voltage of the anode is at all times well above that of the screen; we are, in fact, grossly overloading the valve. Nevertheless, the *stage gain*, or amplification yielded by valve and resistance taken together, is correctly stated at 150 times, because in practice we should only put perhaps one-hundredth of a volt on the grid, and the amplified voltage of 1.5 volts would then not disturb our assumed conditions.

We see, therefore, that in a high-frequency stage the slope of the screen-

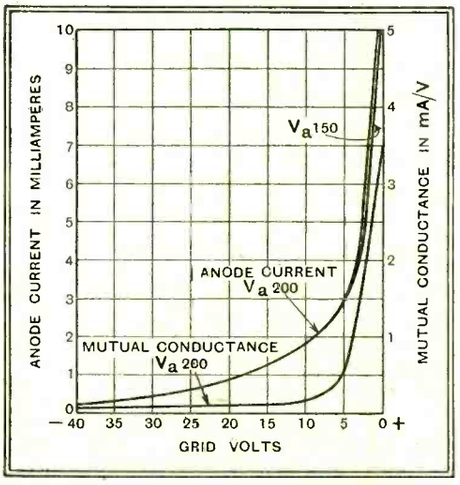


Fig. 21.—Typical characteristics of a variable-mu valve showing the tailing curve. The non-uniform spacing of turns of the grid wire produces the variable-mu characteristics.

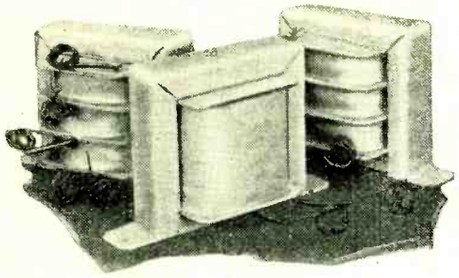
grid valve, considered in conjunction with the impedance in its anode circuit, settles the amplification that we shall get from the stage. This conclusion will give us a flying start into the next instalment.

www.americanradiohistory.com

LABORATORY TESTS.

SPECIAL CHOKE TO REPLACE LOUD SPEAKER FIELDS.

AN L.F. choke designed especially to replace the loud speaker field winding, which in some of the more recent *Wireless World* receivers is used to smooth the H.T.



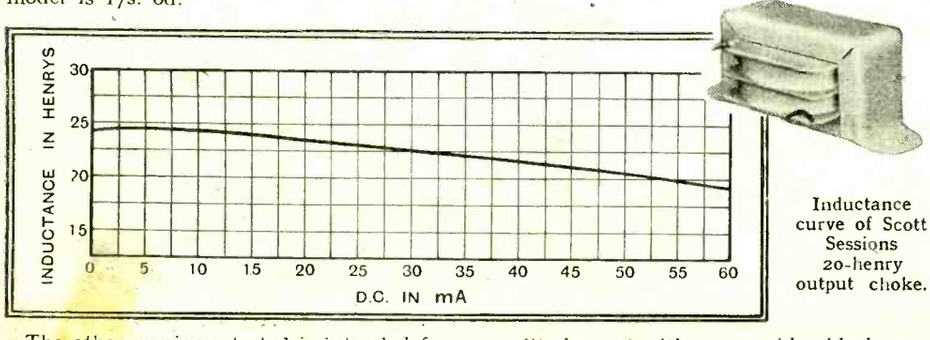
Selection of Scott Sessions L.F. chokes; the 2,500-ohm model is wound on a single bobbin.

supply, has been introduced by G. Scott Sessions and Co., King's Buildings, Dean Stanley Street, Westminster, London, S.W.1. This choke has a resistance of 2,500 ohms, and is rated to carry up to 50 mA. of D.C. measured at a frequency of 50 cycles, and with 10 volts A.C. applied across the choke its inductance with various amounts of D.C. flowing was found to be as follows:—

D.C. in mA.	Inductance in henrys.	D.C. in mA.	Inductance in henrys.
0	300	30	163
10	189	40	154
20	173	50	145

When carrying some 50 mA. of D.C. the inductance of the choke is approximately 2½ times that of the field winding on an average specimen loud speaker of the type it will replace. Thus there can be no doubt as to the efficacy of the choke as a medium for smoothing the H.T. supply. A practical test fully confirmed this, for when fitted to a "Monodial" receiver as a substitute for the loud speaker field it proved entirely satisfactory. The price is 16s.

Tests were made also with two other specimen chokes. The Model 20/60 is an output type, rated at 20 henrys, and designed to carry 60 mA. of D.C. It exhibits constant inductance characteristics, as will be seen from the curve reproduced here. A two-section winding is adopted, with the view to minimising the self-capacity and so assuring an adequate response at the upper end of the audible scale. The price of this model is 17s. 6d.



Inductance curve of Scott Sessions 20-henry output choke.

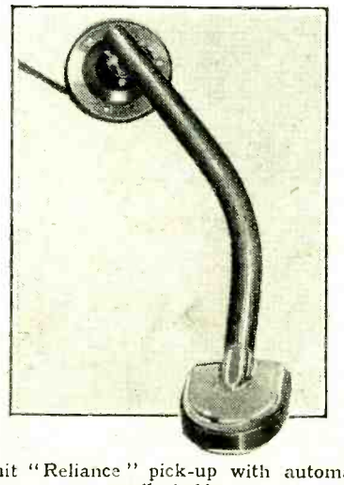
The other specimen tested is intended for use as the anode impedance in conjunction with power grid detectors. It has a nominal value of 200 henrys, and will carry 10 mA. of D.C. Listed as the Model 200/10, this choke showed an inductance of 248 henrys with no D.C. flowing, and 211 henrys when passing the maximum rated amount of 10 mA. The measured resistance of the winding is 2,000 ohms, and in this case a three-section bobbin is employed. The price is 17s. 6d.

There is also a special pentode output choke costing 17s. 6d., which is rated to carry 20 mA., and has a nominal inductance of 70 henrys. It is wound in three sections and provided with tappings giving 2, 3, and 4 to 1 stepdown ratios.

NEW RADIO PRODUCTS REVIEWED.

LIMIT "RELIANCE" PICK-UP.

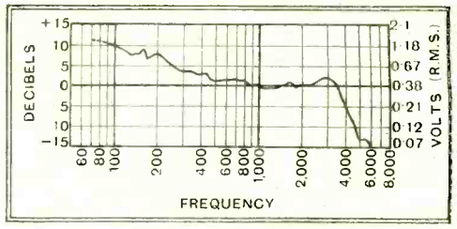
IN this latest product of Limit Radio, Ltd., the needle is held in position in the head by the weight of the tone arm, and no set-screw is provided. This method has from time to time been criticised from the point of view that there is nothing to prevent the needle from rotating during the playing of a record. This point was therefore carefully checked, and it can be quite definitely stated that in the Limit "Reliance" model no rotational movement of the needle takes place once the needle is in contact with the record.



Limit "Reliance" pick-up with automatic needle holder.

The movement does not follow the standard frequency records quite happily below 100 cycles, but with ordinary records no trouble should be experienced, as the amplitudes met with are considerably lower. It will be seen that between 100 and 3,000 cycles the output characteristic is ideal, and an early cut-off ensures absolute freedom from needle scratch. At 15s. 6d. the "Reliance" pick-up provides an exceptionally good performance for the money.

A specially designed volume control is obtainable as an extra for 2s. 6d., and the makers are Limit Radio, Ltd., 15-29, Windsor Street, Essex Road, London, N.1

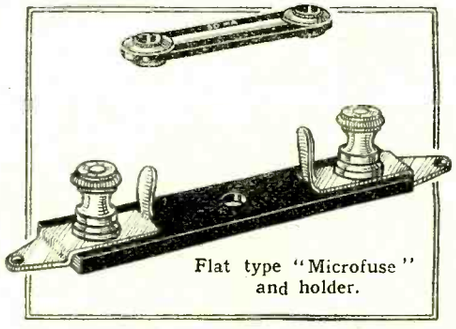


Open-circuit output characteristic of Limit "Reliance" pick-up with H.M.V. loud needle.

MICROFUSES.

WE have recently received for test some samples of the latest flat-type Microfuses. It will be remembered* that the active element in these fuses consists of an exceedingly thin gold foil with a very small heat content, and consequently a "blowing" period of the order of milli-seconds.

In their present form the fuse elements are mounted on a flat ebonite base fitted with eyelets which engage with spring contacts on the special base provided, and are readily replaceable. No fewer than 18 types of fuses are available with current-carrying ratings from 3 to 750 mA., and the prices ranging from 3s. to 6d. each respectively. They are made in three types for voltages up to 260, 750, and 1,500. An additional charge of 6d. is made for the holder. Other types for high voltages, etc., are made to order, and we understand that research is now proceeding on a fuse blowing at the remarkably low current of 0.0005 amp.



Flat type "Microfuse" and holder.

The fuses are designed to blow at twice their current-carrying rating. Tests on eighteen fuses ranging from 3 to 500 milliamps. showed that the fusing current was between 75 and 105 per cent. above the current-carrying capacity. The rated currents were carried for several hours without the slightest sign of overheating. The fuses are now mounted on a cellulose acetate strip which is non-inflammable, and are a distinct advance on the earlier types. The makers are Microfuses, Ltd., 36, Clerkenwell Road, London, E.C.1.

Lamplugh P.M. Loud Speaker.

In connection with our review of the "Silver Ghost" Senior P.M. loud speaker, the makers ask us to point out that the price of the unit as illustrated is 42s., and that the price of 35s. does not include the transformer.

* *The Wireless World*, March 21st, 1928, page 315.

www.americanradiohistory.com

BROADCAST BREVITIES.

By Our Special Correspondent.

Lady Snowden's Future.

LADY SNOWDEN is the only member of the B.B.C. Board of Governors who is due to retire at the end of the year, and I am sorry to think that the occasion is being seized upon by the political axe-grinders.

As a Governor, Lady Snowden has been one of the most active and really "keen" occupants of the B.B.C. Board Room; if it should be her own desire to transfer her activities elsewhere, no one will have the right to complain, but it would be a pity if listeners were to associate decisions at Portland Place with recent happenings in the political sphere.

Will the B.B.C. be "Taken Over"?

Meanwhile the subject of broadcasting has been enthusiastically discussed in political circles ever since the M.P.s accepted the invitation to visit Broadcasting House last August. And not only private Members are casting envious eyes on that "stately pleasure dome" in Portland Place.

It is expected that there will soon be a definite movement in favour of complete State ownership.

A Flourishing Concern.

The Government would take over the B.B.C. as a flourishing concern—a different proposition from the nationalisation of the telephone service in 1912, when the Government simply stepped in to save the telephones from disaster.

Staff as Civil Servants.

State control would doubtless lead to widespread economies in the service, and possibly a staff "comb-out" by means of a competitive examination, though I doubt whether the exam. would have many terrors for the B.B.C. staff. Most members were originally chosen for their educational attainments.

And What of Sir John?

I wonder whether Sir John Reith would elect to remain with the B.B.C., or whether Mr. Harold Nicolson's prophetic instincts are on the right track in his new novel, "Public Faces"? (London: Constable and Co., 7s. 6d. net.) In this disturbing but fascinating book, telling of a world crisis seven years hence, Sir John Reith is introduced as British Ambassador in New York.

But I take leave to doubt whether Sir John's talk over the transatlantic 'phone is truly characteristic.

Empire Broadcasting Date.

STAND by for Empire transmissions! I understand that, contrary to a public announcement already made, the inauguration of Empire programmes will not be delayed till Christmas Day. December 19th is the chosen date for the opening of regular short-wave transmissions from Daventry, while preliminary tests are likely to begin a week earlier.

Our Uttermost Reader.

I am living in the hope that the very last *Wireless World* reader to receive his copy each week—someone on the edge of the world, a week's march from the nearest petrol pump—will get this piece of news in time. I wish I could give the first wavelength to be used, but this has not been decided; it will be one of the eight announced in *The Wireless World* of October 14th.

Changes in the B.B.C. Dance Band.

HENRY HALL'S band will sound like a new combination when bereft of Val Rosing (vocalist), Harry Robbins (xylophone and drums), and J. Denahey (tenor sax.). Little Richard Matthews, the oboist and "baby" of the band, has left already, and the other departures are timed for the next day or two.

A Vocal "Discovery."

The revised dance band will sound more "brassy" with the addition of B. Williams as second trumpet. There are two other newcomers on the instrumental side—L. L. Bermon (drums) and J. Halsall (tenor saxophone).

The whole character of the band is coloured by the personality of the vocalist, and I am glad that Henry Hall is so confident over his "discovery" of Leslie Allen, who hails from Canada and is said to have a smile in his voice.

"Les" Allen, as he calls himself, will greet listeners on November 14th.

The Premier's Next Broadcast.

THE speech of the Prime Minister, Mr. Ramsay MacDonald, at the Lord Mayor's Banquet will be relayed from the Guildhall, London, in the National programme on November 9th.

Mr. MacDonald's platform utterances are as effective on the wireless as those delivered in the quiet intimacy of the talks studio.

Jury Service Postpones Symphony.

A NEW symphony by a British composer is to have its first performance in the Sunday orchestral concert on October 30th. It is the work which was to have been broadcast last July, but the enforced absence of the conductor made it necessary to alter the programme almost at the last moment. Dr. Adrian Boult, B.B.C. Music Director, was unable to attend rehearsals, as he was summoned to serve on a jury.

"A Great Protest."

The work in question is Symphony No. 1, in E, by Armstrong Gibbs, whose name is known to a very wide public as that of a composer of songs and short choral pieces to texts from the works of Walter de la Mare and other English poets.

The symphony has no programme, but the composer admits that the following comment made to him by one who heard the work on the piano acutely describes what was unconsciously in his mind while composing it: "The whole work sounds like a great protest against the soulless cynical modern outlook. It is written by one who hates the age he lives in, with its rush and hurry and lack of leisure."

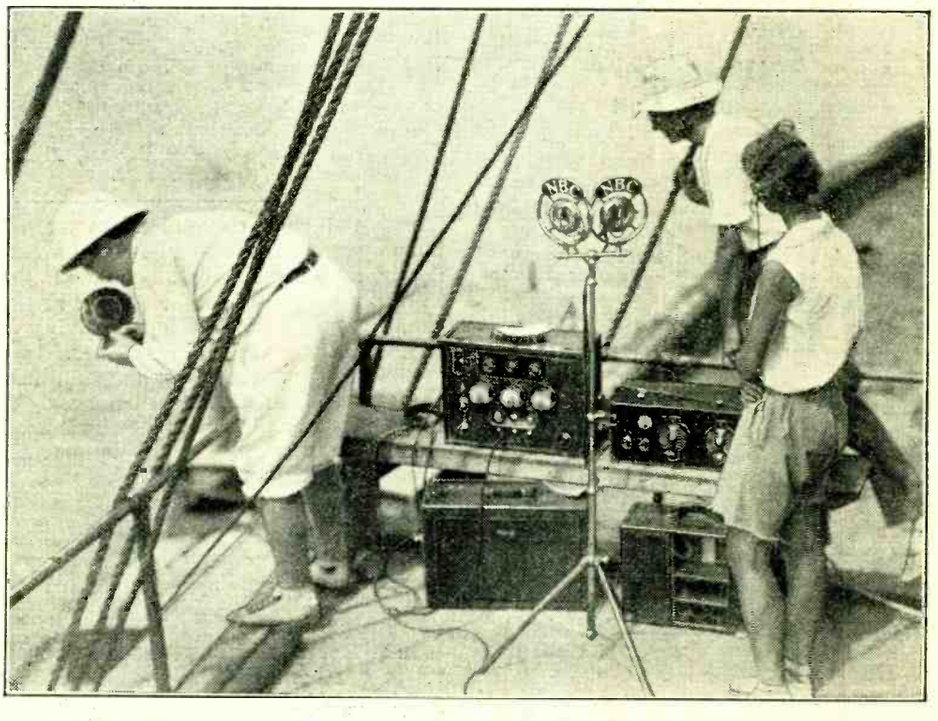
Another Gold Rush.

A MILD squabble over "mineral rights" seems to be holding up the B.B.C. negotiations for the new 5XX site in the Droitwich area. Apparently the Corporation wishes to be perfectly certain that no party can proceed to dig a hole under 5XX in search of gold or other mineral.

Minerals being fairly common near Droitwich Spa, the B.B.C. is anxious not to miss anything good.

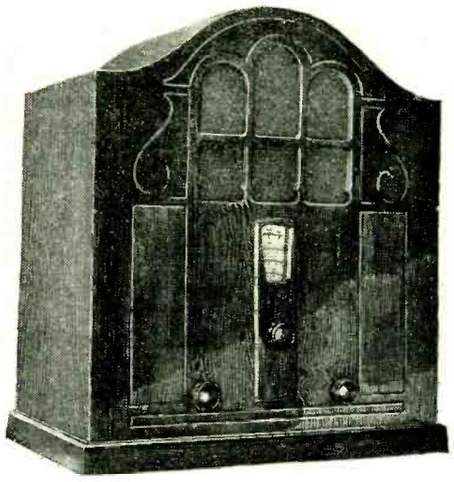
Spare Time Job?

I am not sure whether its Charter permits the B.B.C. to engage in mining operations, but I imagine some provision was made for such a contingency, considering that the Charter enables the B.B.C. to do almost anything which does not defy Criminal Law.



A BRINY BROADCAST. Tests in progress for a world-wide relay of a talk by William Beebe, the undersea explorer, who describes the flora and fauna on the sea bed off Bermuda.

www.americanradiohistory.com



Faraday

MODEL S.620.

ALLWAVE SUPERHET.

Normal Broadcasting and Short Wavelengths with Switch Change-over.

UP to the present most of us have had to satisfy ourselves with the prosaic "medium" and "long" broadcasting wavebands, to the complete exclusion of the more exciting short waves, which have hitherto been regarded as the prerogative of the advanced amateur. It is an undisputed fact that these channels provide more certain intercontinental reception than any others; true, short waves are not entirely dependable, but this element of uncertainty accounts in part for their attractiveness.

In order that the British listening public at home, and especially overseas, may be attracted to this fascinating aspect of broadcasting, we need a set designed to receive both normal and short wavelengths which at the same time is just as simple and easy to operate as an ordinary domestic receiver. This description precisely fits the Faraday Allwave Superhet; externally, it is a typical mains-operated broadcast receiver, self-contained with its loud speaker, but, in addition to the medium and long wavebands, provision is made for the reception of transmissions between 15 and 60 metres.

A very unusual circuit arrangement is included in this new receiver. As the diagram on the opposite page is complicated by switch connections, and so is rather difficult to follow, a simplified diagram of the H.F. stage and frequency changer, as they function on the medium band, has been prepared.

Four-range Waveband Switching.

The preliminary H.F. stage, up to the intervalve coupling, is conventional enough, the circuits being of the single-tuned variety. With regard to the frequency changer, the circuit LC, which comprises the tuned intervalve coupling, is linked to the succeeding circuit by means of the resistance R, which is common to both of them. The circuit L_1, C_1, is tuned to a frequency differing by 115 kc. from that of the two preceding circuits. This frequency difference is maintained by a padding condenser.

On changing over to the long waves, the circuit remains substantially the same, except that the alignment of the oscillator circuit is maintained by the addition of a trimming condenser across L_1, and the coupling resistance is changed.

For both of the short-wave bands the H.F. stage becomes aperiodic. At the same time the H.F. feed condenser C_2 is joined to the high-potential end of the tuned circuit L_1, C_1, and the resistance R is removed from circuit. Of course, all these operations are carried out automatically by the ganged wave-range switch. On the short waves the set becomes a single-circuit autodyne, with a fixed capacity in series with the variable condenser.

As shown in the complete diagram, linkage between the detector-oscillator and the I.F. amplifier, and so on to the anode bend second detector, is effected by double-tuned band-pass filters; the detector is self-biased, and feeds the output pentode through a resistance-capacity coupling.

Another detail to which attention should be drawn is the high-note attenuator, consisting of the condenser C, which may be thrown into circuit by the switch SW.

In a theoretical circuit diagram no attempt can be made to show all the finer points which must contribute to the success of this set. For instance, a number of the H.F. leads are screened, and particular care is evident in the connections of the various H.F. return leads, which are run to special earthing points, and not indiscriminately to the metal chassis.

As the pentode output valve acts rather as an automatic tone corrector for high-note loss in the tuned circuits, the reproduction of gramophone records would normally be too shrill, but this tendency is offset by arranging for the volume-control potentiometer, which normally determines the bias of the H.F. and I.F. valves, to act as a variable shunt to the pick-up.

FEATURES.

General.—*A self-contained five-valve superheterodyne with built-in moving-coil loud speaker of the energised type. For operation on A.C. mains with external or mains aerial; D.C. model also available. Four wave-ranges: short, 15–30 metres; long-short, 30–60 metres; medium, 215–550 metres; long, 950–2,000 metres. Provision for gramophone pick-up.*

Circuit.—*Signal-frequency H.F. stage; combined detector-oscillator, one I.F. stage, anode-bend second detector, resistance-coupled to output pentode. Full-wave power rectifying valve.*

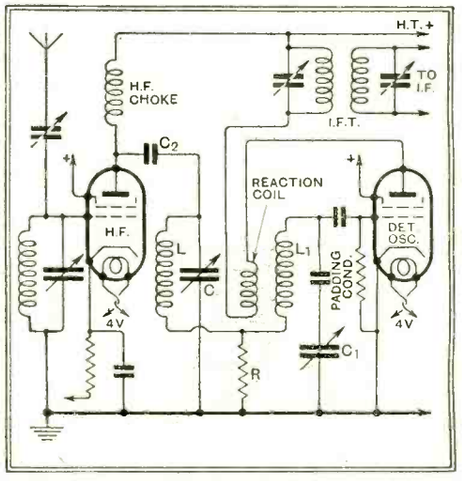
Controls.—*(1) Single-knob tuning. (2) 4-position waverange switch. (3) Combined volume control and on-off switch. (4) Tone control switch.*

Price.—*27 guineas.*

Makers.—*Faraday Allwave Wireless, Ltd., 1, Salcott Road, London, S.W.11.*

Judged on its merits as a broadcast receiver pure and simple, and without making any allowances for the attractions that it offers in the way of short-wave reception, the Faraday set makes a remarkably good showing. Selectivity on the broadcast band, in spite of the relatively small number of tuned circuits, is surprisingly good, and, except under unusually difficult conditions, may fairly be described as "9-kilocycle." On the long waves there is no apparent falling-off in selectivity, although sensitivity is not quite so striking as on the medium band. Quality of reproduction is satisfactory, and much brighter than that of the average small superheterodyne, response being well maintained up to at least 4,000 cycles. Ample volume is available, but best quality is obtained at a reasonable level for an average room.

On the short waves the set bore comparison with a specialised "super" of the type which appeals to the amateur short-wave enthusiast, and which was vastly more difficult to operate. Sensitivity of the Faraday receiver was virtually as good, and quality was better. Both sets had the duplicated tuning points typical of autodyne circuits, but this is not a serious disadvantage. It should be made clear that this double tuning is not evident on the normal bands, and so the indicator scales are calibrated in wavelengths with a high degree of accuracy.

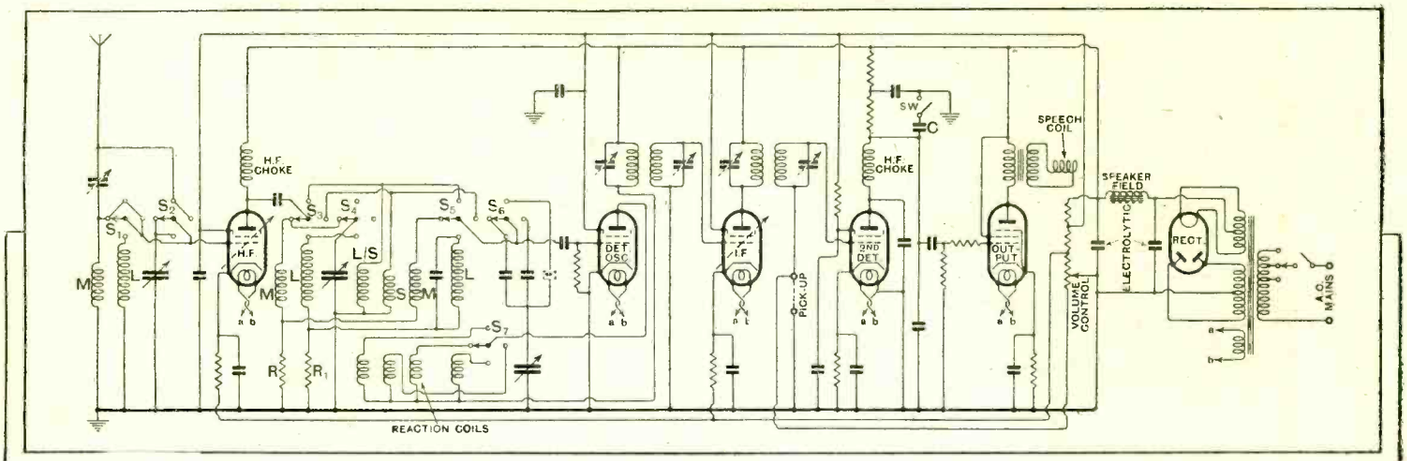


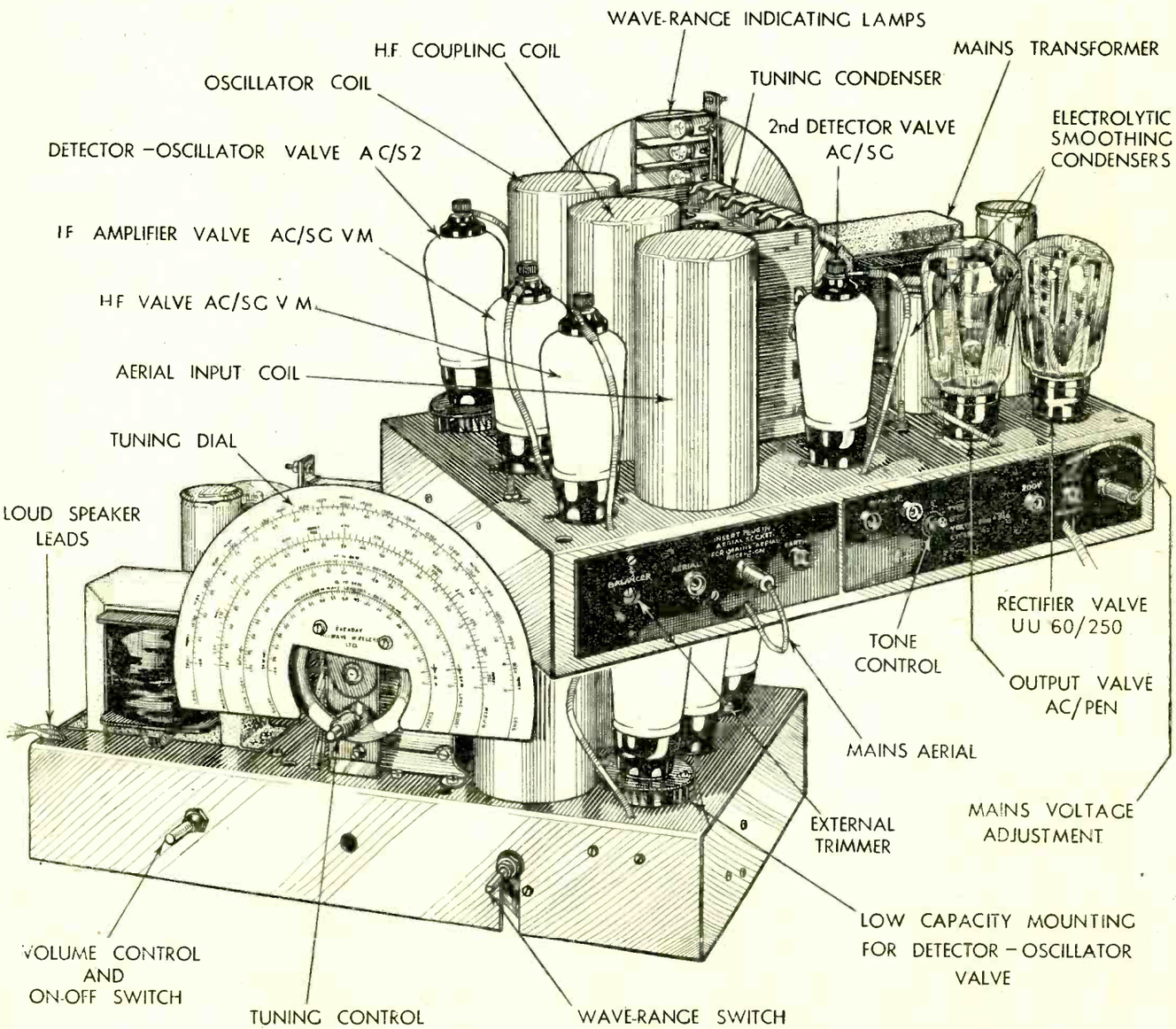
Simplified circuit of the H.F. amplifier and frequency changer.

The designers are to be congratulated on having produced a well-built set in which the problems of "all-wave" reception have been solved in a very practical manner.

www.americanradiohistory.com

FOUR WAVE-RANGES WITH SINGLE-KNOB TUNING.





Designed both for use in this country and for the reception of Empire broadcasting overseas: two views of the Faraday chassis and (inset) the complete circuit diagram. S_1—S_7, ganged 4-way wave-range switches; L, long-wave coils; M, medium-wave coils: L/S. long-short wave coil; S, short-wave coil.

www.americanradiohistory.com

WIRELESS ENCYCLOPEDIA.

Brief Definitions with Expanded Explanations.

THE moving-coil type of loud speaker is one of the most satisfactory in use at the present time, chiefly on account of its moderately even response over a wide range of frequencies. In its most general form it consists essentially of a light conical diaphragm with a circular driving coil, or "speech coil," mounted centrally and coaxially at the apex. The cone or diaphragm, which is made from suitable paper or composition, is attached at its outer edge by means of flexible material, such as kid leather, to a circular supporting ring comprising part of the chassis or frame. The cone is mounted in such a way as to be free to move over a limited range in a direction along its own axis, but not radially.

The driving coil is wound on a light cylindrical former made of insulating material, and is situated in a powerful radial magnetic field in a narrow circular or annular airgap in a magnetic circuit of special form. The magnet, which is generally referred to as the "pot magnet" on account of its shape, may be either

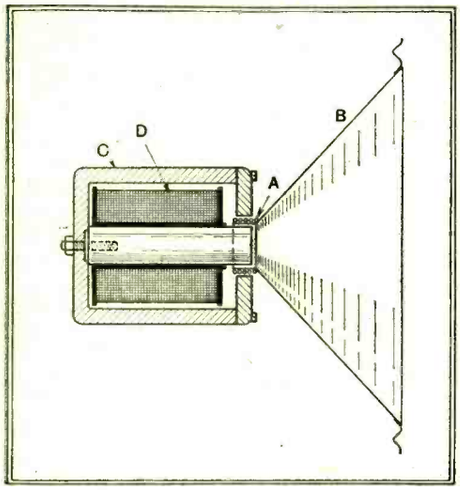


Fig. 1.—General arrangement of moving-coil speaker with electromagnet. A, moving coil; B, paper or composition cone; C, pot magnet; D, exciting coil.

permanent or energised electrically by direct current passed through a magnetising coil on the central core. The general arrangement of a moving-coil speaker with an electromagnet is shown in section in Fig. 1.

The moving coil is centralised in the airgap by a flexible device attached between the circumference at the forward end of the coil and the centre of the pole-piece. This allows a limited range of axial motion but no radial motion, so that the coil cannot come into contact with the pole faces.

When a current is passed through a conductor situated in a magnetic field a force is set up on the conductor at right angles to its length and at right angles to the lines of magnetic flux. The magnitude of this force is proportional to the current

MOVING COIL SPEAKER. ***The type of loud speaker in which the diaphragm is driven by a light circular coil mounted in a radial magnetic field passing through an annular air gap in a magnetic circuit, the magnetism being either permanent or produced electromagnetically.***

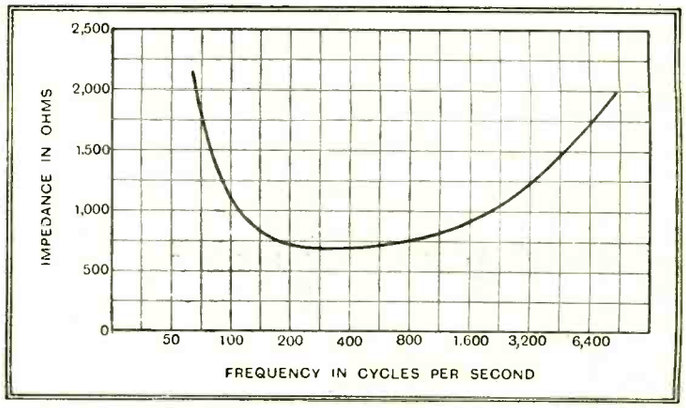


Fig. 3.—Measured impedance curve of a typical high-resistance moving-coil speaker.

and to the strength of the field; and when the current is reversed the force also reverses. So when a current is passed through the moving coil of the speaker, with the field energised, a force is set up on the coil in an axial direction. Consequently, when the audio-frequency current representing the sounds to be reproduced is passed through the speech coil a varying force is set up on the latter, being at every instant proportional to the current. Since the current is an alternating one, and since the coil and cone are free to move axially, the cone is vibrated to and fro in unison with the current and imparts its motion to the air in the immediate vicinity, setting up the necessary sound-waves.

Theory of the Moving-coil Speaker.

The theory of the moving-coil speaker is very simple if it is assumed that the coil and cone vibrate as a rigid body, as one might imagine at first sight. In practice, however, the diaphragm does not vibrate

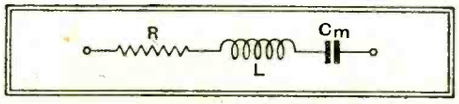


Fig. 2.—Circuit equivalent of moving coil under working conditions. R, total effective resistance; L, inductance of the coil; C_m, equivalent motional capacity.

as a rigid cone at all frequencies; the disturbances imparted to the apex travel outwards with a definite velocity depending on the mass and elasticity of the material from which the cone is made, and various resonances are likely to occur at the higher frequencies, tending to accentuate certain notes in the upper register. At moderate and very low frequencies, however, these effects do not occur, and when motion as a rigid body or piston is assumed the characteristics of the speaker can be determined theoretically.

The air pressure set up at some distance from the cone, on its axis, is proportional to the current in the driving coil. To give the most realistic production, then, the current should be the same at all frequencies for a given applied voltage, that is to say, the impedance of the speech coil should be independent of frequency. This, however, is far from being the case. In the first place, the coil possesses self-inductance, giving rise to inductive reactance, whose magnitude increases in direct proportion to the frequency, so raising the impedance as the frequency rises. The ohmic resistance, of course, remains sensibly constant over the whole range of frequencies. Secondly, as the coil moves in the airgap, its turns cut the lines of force and an alternating E.M.F. is induced in them. Now, it so happens that this motional-induced E.M.F. is very nearly in phase opposition to the induced E.M.F. of self-induction, and so the E.M.F. due to the motion tends to neutralise the self-induced E.M.F. of the coil; in other words, the inductive reactance of the coil is opposed by an apparent reactance of opposite sign. Further, this apparent reactance arising from the motion is inversely proportional to the frequency, just as in the case of a condenser. And so it follows that the circuit through the loud speaker coil behaves as though there were a condenser in series, the equivalent circuit being shown in Fig. 2, where C_m is the imaginary condenser whose effect is the same as that due to the motion of the coil.

Now, a circuit of the nature of Fig. 2 is one whose impedance is a minimum at one particular frequency, at which the condensive and inductive reactances are equal and opposite, the impedance rising

www.americanradiohistory.com

Wireless Encyclopedia.—
for frequencies both above and below this critical or resonant value. It is obvious that the response of the speaker will be greatest at the frequency for which the impedance is least, and in practice this maximum response is prone to occur in the middle register, and accounts for the booming effect which occurs in speakers which are not correctly designed or compensated. The curve of Fig. 3 shows the impedance at various frequencies for a moving-coil speaker of the high-reactance type, which is fed through a choke-condenser filter or a transformer with a one-to-one ratio.

When the speaker is in operation the A.C. resistance of the output valve is virtually in series with the moving coil, and this resistance has the effect of flattening out to some extent the impedance curve of the complete circuit, and so tends to level up the response. The overall volume is greatest when the average impedance of the speaker is about equal to the A.C. resistance of the valve. Addition of extra series resistance will generally improve the response level, but lowers the volume.

The rising impedance at the higher frequencies theoretically reduces the output in the upper register, but various resonances in the cone compensate for this, and by a suitable design and choice of material the higher notes can be retained in more or less their correct proportion.

The falling off in response at the lower end of the scale is more difficult to correct, but a method that has proved fairly successful is to design the surround and the central supports so that a resonance occurs at or about 50 cycles per second. This, of course, increases the response at the extreme lower end of the musical scale and gives a measure of compensation. A large baffle should always be used to prevent loss of low notes by interference from the back of the cone.

The frequency-response curve of a moving-coil speaker is better than that of most other types.

Correspondence.

The Editor does not hold himself responsible for the opinions of his correspondents.

Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Tudor Street, E.C.4, and must be accompanied by the writer's name and address.

Morse Interference

I HAVE followed the very interesting correspondence in your journal for a number of years, but I have looked in vain for reference to the one subject which is of paramount importance and which must be a cause of daily exasperation to thousands of listeners who are resident in coastal districts.

I refer to interference on the Broadcast and the Long Wave Band by Morse telegraphy stations.

Why is it that this all-important subject is, apparently, "taboo" and is only referred to in the technical Press with "bated breath" so to speak?

No listener would object to urgent messages from or to shipping on any wave length, but the continuous Morse telegraphy which in this neighbourhood, as in others probably, blots out all programmes from Budapest to Rome, day after day and month after month, certainly does not fall within the above category. Nor is it due to passing ships, but to fixed land stations, one in particular.

This interference is not confined to the Broadcast Band from 550 metres downwards, but occurs also constantly at the lower end of the Band from 200 to 300 metres, and also on the whole of the Long Wave Band at intervals throughout the day and night.

What one would like to know is:—

(1) Why these stations have been allowed to operate on the Broadcast Band for years past.

(2) What steps, if any, are being taken by the authorities concerned to put matters right.

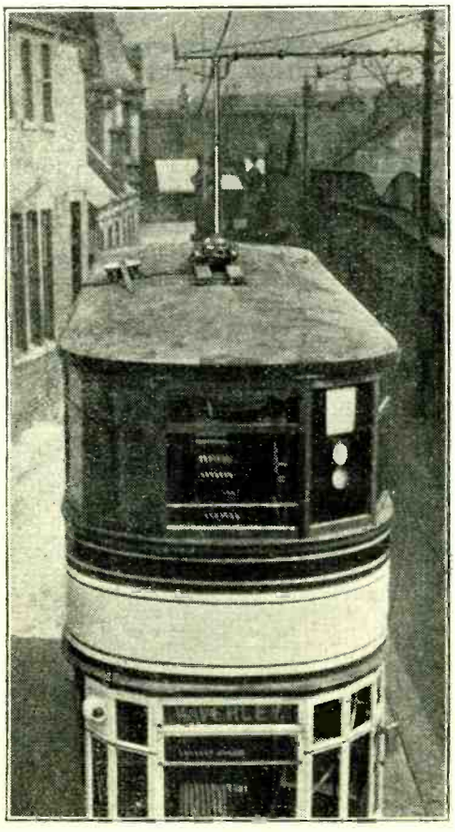
(3) If these stations must work on the Broadcast Band, why not on a definite and sharply tuned frequency instead of one covering 100 k/cs or more.

(4) If sharp tuning requires new apparatus why has not this been installed long ago.

(5) As regards interference from shipping, what steps are being taken to confine their transmissions to 600 metres or whatever their proper wave length is.

One would have thought that the Radio Societies of Great Britain would have got together long since and approached the Postmaster-General on this matter. If they have already done so, the effect is not evident.

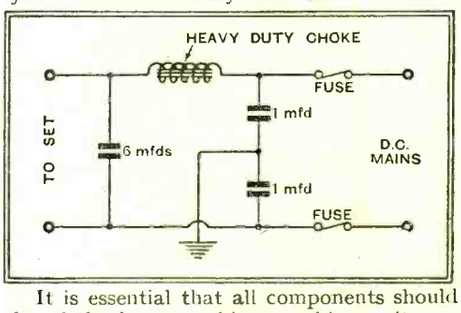
Bournemouth. G. G.



Edinburgh City Tramways are helping listeners to "cut out the crackle" by equipping two cars with spiral experimental chokes in the trolley circuit.

Mains Interference.

AS I live in a district employing very rough D.C. mains rectified by the mercury arc sub-station system of rectification and distribution I set out to take serious steps to eliminate an exceedingly troublesome hum. The accompanying circuit of a smoothing unit which entirely eliminated all hum may possibly be of use to some of your readers similarly troubled.



It is essential that all components should be of the best, as this smoothing unit preceeds the set and has to stand up to the full mains voltage. H. R. VIDLER.

Golders Green, N.W.11.

International "Wrangling."

I WAS interested (but not surprised) to read the remark in Broadcast Brevities reporting that "the delegates (to the Madrid Conference) wrangled for the whole day on the question of what should be the official language for use in the discussions."

This is only one example of what occurs almost every day in some way among people of different nations—occurrences which show that an international language is wanted. It is obvious, too, that a great field of activity in the world of radio is of an international character, and yet there is no "official" international language. Even the B.B.C., whose motto is "Nation shall speak peace unto Nation," do not seem to have made any move towards the justification of that motto by the adoption of any such language; but on this point I stand to be corrected—having great respect for the B.B.C. and its movements.

But, while it is obvious that such a language is required, it is equally obvious that no national language could be adopted—that would create jealousy and put the particular country whose language might be chosen on an unfair footing. There are many international languages current—some of them in a highly advanced state, and it is only a question of choice. I admit this latter question might be difficult, but it has got to be tackled some day!

I have used such a language myself when speaking to persons whose native language I did not know nor had they any knowledge of my native tongue, and, therefore, when I assert that for simplicity and utility they far surpass any national language, I say it with a certain amount of authority!

I should like to know what your readers think as to the need for such a tongue. I am sure from the enterprising nature of your paper that, with sufficient support, you would take this matter up.

Ipswich. LESLIE W. MELVILLE.

www.americanradiohistory.com

READERS' PROBLEMS.

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers.

Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found on this page.

External or Internal?

IN order to determine whether a noisy background is due to the set itself or to some external cause such as atmospherics or electrical interference, it is usual to disconnect the aerial. If the noise persists, then the set is probably at fault, but if it stops it is due to outside causes, and will probably be incurable.

This is a simple and well-known common-sense test that seldom fails. After trying it a reader found that the noises disappeared, but was still not quite satisfied that his set was blameless. Accordingly he borrowed another receiver; on connecting it up to the same aerial it was observed that the background of interference was greatly reduced.

As a consequence he has come to the conclusion that his own receiver is not so free of blame as it might be, and asks our opinion on the matter.

A comparative test between two receivers on these lines is only of value when the two receivers are of equal sensitivity. We consider it likely that the second set tried by our correspondent was probably much less sensitive than the other, and so would naturally reproduce the interference at much less intensity than his own set. We may be wrong in coming to this conclusion; there is admittedly a possibility that the set used for purposes of comparison included a circuit arrangement that was not so susceptible to the peculiar form of interference which existed; for instance, a certain type of interference is often greatly minimised by the use of a two-circuit aerial tuner.

Super-efficient Detector Circuits.

A NUMBER of our readers seem to derive great satisfaction from obtaining a performance vastly superior to that normally expected from an unambitious circuit arrangement. For instance, some of them would obviously prefer to have the best possible detector set (i.e., without H.F. amplification) than the average kind of "H.F." receiver.

A correspondent, whose inclination obviously runs in this direction, asks us to recommend the best type of coils to use in a two-circuit aerial tuner (with reaction) which is to precede the detector valve. He also asks us to give a diagram of connections.

Another reader who seems to be similarly minded asks how he should use a pair of "Autotone" coils in a similar type of tuner. It is probably true that no more efficient coils than those described in this journal for the Autotone Receiver can be obtained for use in a two-circuit tuner; both our querists may best be answered by referring them to the circuit diagram given in Fig. 1, which is lettered to correspond with the markings used to designate the terminal points of the original coils, which, incidentally, are still available commercially.

Thanks to the arrangement of the reaction windings of these coils, regeneration is much more constant than usual, and so one of the main objections to two-circuit tuners with reaction is automatically overcome.

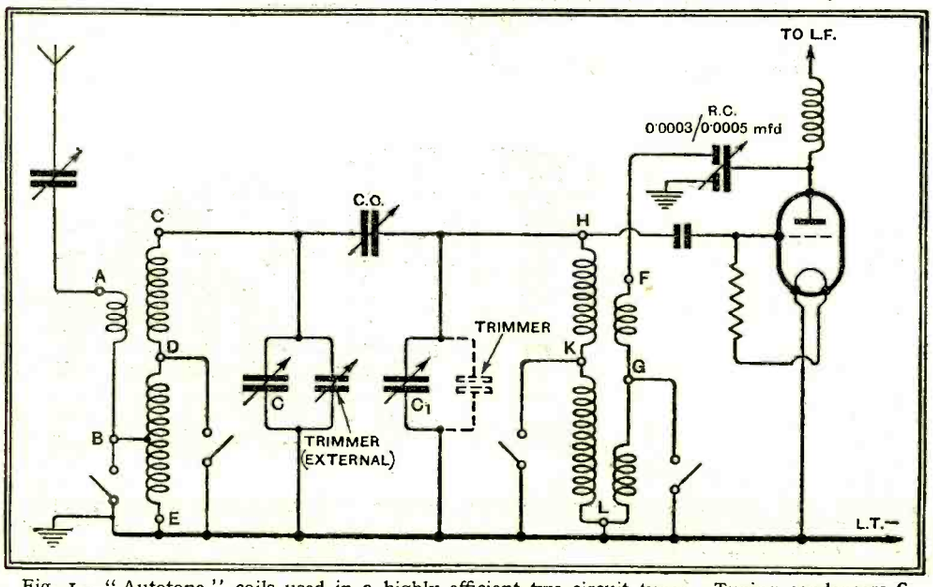


Fig. 1.—"Autotone" coils used in a highly efficient two-circuit tuner. Tuning condensers C and C_1, of 0.0005 mfd., should preferably be ganged with an external trimmer. The coupling condenser C.C. should be very small; 10 mmfds. is enough.

Coil Testing.

ALTHOUGH the windings of modern tuning coils do not often develop defects, the built-in wave-range switches, which now generally form a part of the coil assembly, are inclined on occasion to fail. Neither the windings nor switches of "potted" coils are particularly accessible, and some readers seem to imagine that a test is a matter of some difficulty.

Actually, it is quite an easy matter to ascertain whether the simpler type of coil assembly, with series-connected windings, is in order without dismantling it. Further, it can be determined whether the wave-range switch is functioning properly without examining it. A simple electrical test, applied on the lines suggested in Fig. 2, will reveal any of the more probable faults.

To make a test, an indicating instrument, such as a voltmeter, in series with a suitable battery, is joined across the series-connected coils in the manner shown. The wave-range switch is closed (medium-wave position), and, if the meter then gives a steady deflection, continuity through the winding is indicated. To test both the long-wave winding and the switch, the latter

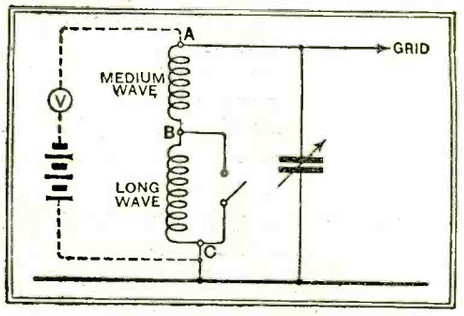


Fig. 2.—When testing a two-range tuning coil the indicating apparatus may be joined across points A and B, the high- and low-potential ends of the windings. The junction point B is often inaccessible.

should be opened (long-wave position) when the meter reading should fall slightly, indicating that there is still continuity, but that the ohmic resistance in series is higher. Actually, the resistance of a typical long-wave winding is quite considerable when compared with that of the medium-wave section.

For tests of this sort, it is not necessary or even desirable to use an expensive meter with a high internal resistance. A low-resistance instrument is distinctly better, as it will show the added ohmic resistance of the long-wave winding much more clearly.

A similar test may be made with a small battery and a flash-lamp bulb in place of a meter; with this form of indicator it may be necessary to increase the voltage applied above the rating of the flash-lamp, in order that an indication may be obtained when the resistance of the long-wave winding is in series.

The Wireless World INFORMATION BUREAU.

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Tudor Street, E.C.4, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.

www.americanradiohistory.com