The Wireless World

THE PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 692. FRIDAY, DECEMBER 2ND, 1932. VOL. XXXI. No. 22.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

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: 6210 Coventry.

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

MANCHESTER: 260, Deansgate.
Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4112 (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.

CONTENTS.

EDITORIAL COMMENT.

Interference.

The Electrical Industry Should Help.

MANY of the firms which are "big noises" in wireless to-day also hold important positions in the electrical industry generally. These electrical firms cannot divorce wireless from their general interests and regard it as an industry apart; the prosperity of the two is linked in such a way that it is of the utmost importance for the electrical industry to see that the public is satisfied with every type of electrical apparatus and encouraged to extend the uses of electricity.

In a Leader last week we urged that immediate steps should be taken to bring about the introduction of some form of legislation to prevent the sale of electrical apparatus in a condition which was likely to cause radiation and so interfere with broadcast reception.

Legislation is very desirable to this end, but we cannot expect that the matter can be put on a legal footing at very short notice, so that it is up to everyone concerned to do whatever is possible in the meantime to bring about a reduction of interference in whatever ways may be possible.

An Inexcusable Position.

The electrical industry is one of the best controlled and organised in this country, and the big electrical firms are unfortunately largely responsible for electrical interference, for the reason that they have been selling, and are still marketing in increasing quantities, electrical apparatus of types which cause interference. Surely, in their own interests, this state of affairs should be remedied at once. It is, in our view, inexcusable, not to say incongruous, for an electrical firm to be selling a customer in one department a wireless set, which, given freedom from interference is capable of a wonderful performance, whilst in the next department the same customer may buy another piece of electrical apparatus which, if he installs it in his house, can completely mar the performance of the wireless set. This state of affairs is still more inexcusable when we realise that in very many cases a few pence added to the production cost of the offending apparatus would effect a remedy.

End the Reproach.

Let the electrical-apparatus manufacturers first put their own wares beyond reproach in this matter and then we may expect that the interference troubles of their associated industry, wireless, will receive sympathetic help from the Post Office, and that legislation also will strengthen the position.

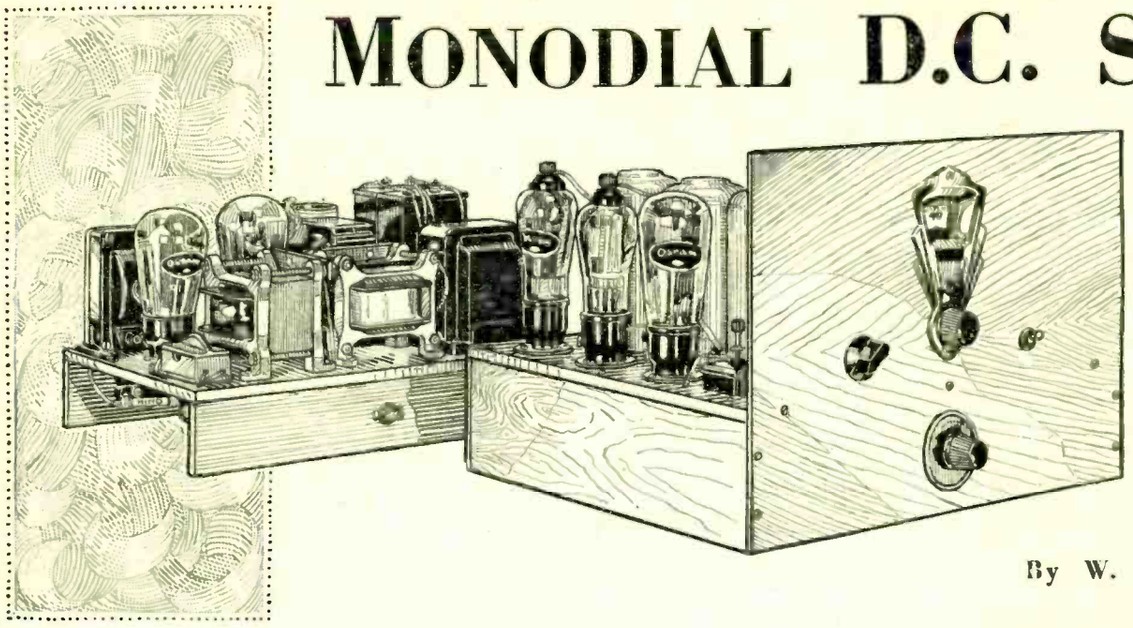
If every responsible electrical manufacturer in this country would adopt the slogan "Apparatus which we manufacture or install must not interfere" we should quickly progress a long way towards the ultimate goal of interference-free reception.

The Wireless Licence.

How Many Receivers?

AFTER ten years of organised broadcasting there should be no excuse for misunderstandings as to the interpretation of regulations relating to the use of broadcast receivers. To avoid any uncertainty we would draw special attention to a letter published, with our comment, on page 505 of this issue.

MONODIAL D.C. SUPER.



An Ultra-Selective Tone-Corrected Receiver.

By W. T. COCKING.

THE primary requisites of a modern wireless receiver are undoubtedly faithful reproduction, high selectivity, and large output, together with a degree of sensitivity adequate for the reception of the worth-while stations even under poor conditions. At the present time, these conflicting requirements can only be satisfactorily reconciled in the superheterodyne, and the large measure of popularity which is now enjoyed by this type of receiver is due entirely to this.

The principle of the superheterodyne was recently outlined in the pages of this journal[1] and needs no description here; nor is it necessary to consider the reasons for the precise arrangements for obtaining selectivity and quality, for these also have been fully dealt with in these pages[2]. The general outline of the receiver, therefore, will follow the lines of the Monodial A.C. Super[3], and the differences will be those necessitated by operating the set from a direct current supply source.

Special D.C. Problems.

The fundamental problems of purely wireless reception are the same whatever the nature of the power supply, and the specific problems confronting the designer of a D.C. mains superheterodyne are the elimination of hum and the prevention of H.F. currents in the supply mains from entering the receiver circuits. This latter is a point of vital importance, for if stray H.F. currents are allowed in the set they may produce whistles throughout the tuning range and thus render the receiver practically useless. This, of course, is a point which may arise in an A.C. set also, but its elimination is then usually much easier, and is often automatic through the circuit isolation provided by the mains transformer.

BY SPECIAL REQUEST.

THE "Wireless World" Monodial Super, as described for A.C. mains, has achieved an amazing popularity, not only for its outstanding performance as regards selectivity, sensitivity and quality, but also because the construction is so straightforward that no practical difficulties have arisen. The present article describes the construction of a model for D.C. mains supply, yet having all the features and performance of the A.C. version. We are confident it will meet the needs of the many readers who have asked for it.

The complete circuit diagram is shown in Fig. 1, and it will be seen that the type V.D.S. variable-mu H.F. valve is preceded by a single tuned circuit loosely coupled to the aerial in order to obtain maximum efficiency, and so give a minimum of background hiss due to thermal agitation. A 0.002 mfd. condenser C_1 is inserted in series with the aerial, and a 2 mfd. condenser C_8 in the earth lead, in order to isolate these points from the mains.

The input circuit is tuned by one section, C_2, of the three-gang condenser, a second similar section, C_3, of which tunes the secondary of the H.F. transformer coupling the H.F. and first detector valves. A transformer coupling is adopted in preference to tuned anode, since a high resistance in the following grid circuit can be avoided, and in preference to tuned grid, since fewer components are required. The first detector is a type DS screen-grid valve biased negatively to act as an anode bend rectifier by the 6,000 ohms resistance R_2 in its cathode lead, the shunt condenser C_{12} of 0.1 mfd. providing a low impedance path to H.F. currents.

The Oscillator and I.F. Circuits.

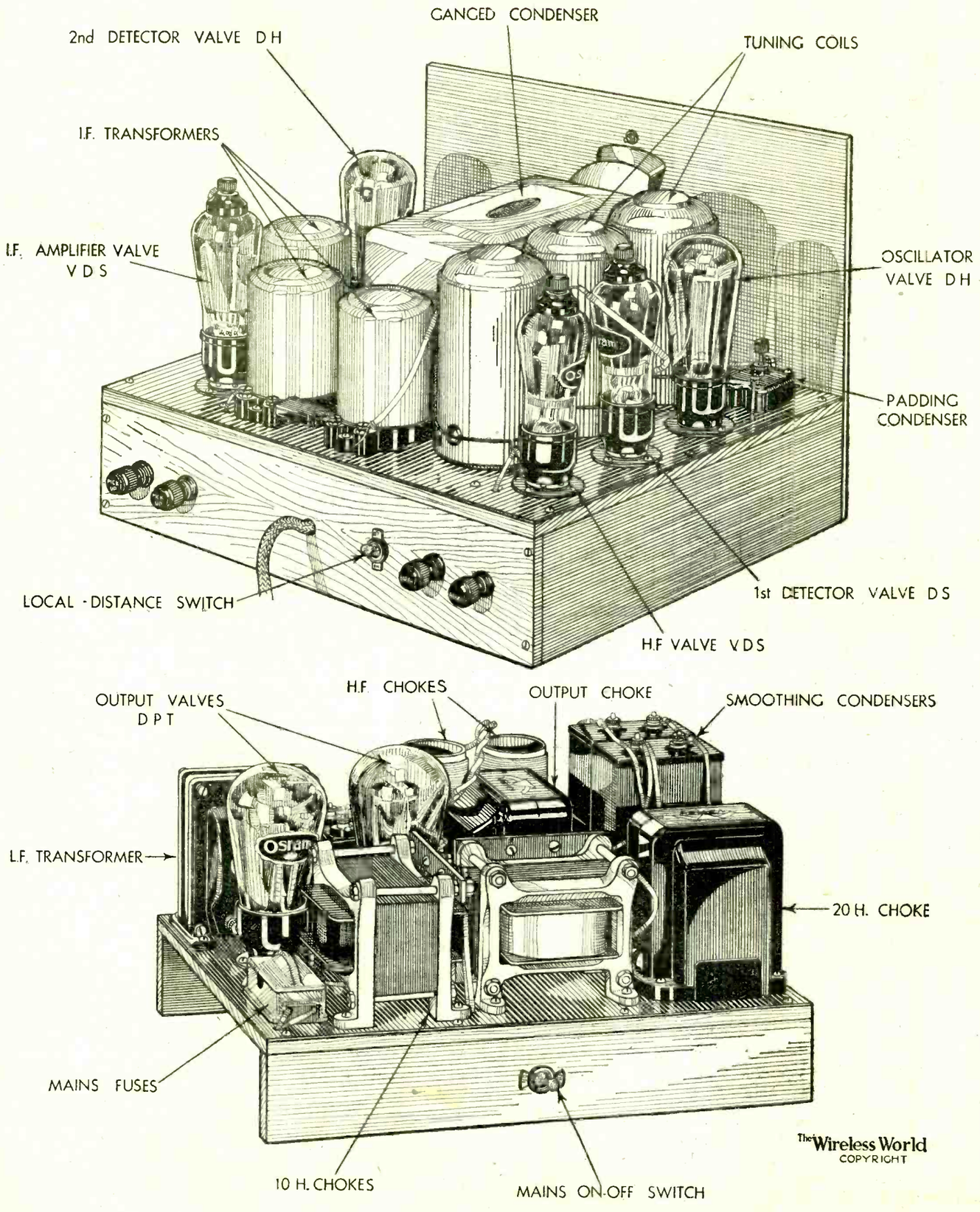
A type DH triode is used for the oscillator and has its grid circuit tuned by C_4, a section of the gang condenser having plates so shaped that on the medium waveband correct ganging is maintained without the use of padding condensers. On the long waveband, a single padding condenser C_5 is introduced. The reaction coil is shunt fed from the anode circuit by the condenser C_7 of 0.0005 mfd. and the 30,000 ohms resistance R_3. The necessary coupling to the first detector is obtained by means of a pick-up coil connected in series with the first detector cathode lead, and the oscillator bias is provided by the voltage drop along the 1,000 ohms resistance R_4, shunted by the 0.1 mfd. condenser C_6.

The first detector is coupled to the I.F. valve through a four-stage band-pass filter which is designed to pass only a very narrow band of frequencies, and to cut sidebands considerably. It consists of two ordinary type I.F. transformers coupled by the 0.0001 mfd. condenser C_{13}, and tuned to 110 kc. The coupling to the to the second detector is by a single similar transformer more tightly coupled to give a double-peaked resonance curve. This tends slightly to counteract the sideband cutting of the first filter, but there is still a very pronounced loss in the upper register, which is compensated by the use of tone-correction in the L.F. circuits. A maximum of useful selectivity is thus obtained while retaining audible frequencies up to about 5,000 cycles in the overall response.

The second detector is a triode, type DH, which serves as a power grid detector on radio, and as an amplifier when reproducing gramophone records. The radio-gram switch, therefore, is fitted in its grid circuit, and is of the single pole

[1] *The Wireless World*, August 26th, 1932.
[2] *The Wireless World*, April 6th, 1932.
[3] *The Wireless World*, April 13th, 20th and 27th, 1932.

THE D.C. VERSION OF A FAMOUS SET.



The principal components of the receiver unit and its accompanying amplifier are clearly indicated. The mains resistances are housed below the power amplifier.

Monodial D.C. Super.—

change-over type, S_2. The negative bias for gramophone work is obtained through the insertion of a 1,000 ohms resistance R_{12}, shunted by a 1 mfd. condenser C_{18}, in the cathode lead.

It will be realised that in a D.C. mains set all parts of the receiver are in direct connection with the supply mains; it would be definitely unsafe, therefore, to connect a pick-up in the usual manner directly between the grid of the detector and the chassis, and a protective filter *must* be inserted. This consists simply of the resistance-capacity type, and 1 mfd. condensers, C_{15} and C_{16}, are inserted in the two leads to the pick-up, and the 0.25 meg. resistance R_{11} is fitted in order that the bias voltage may reach the grid of the valve.

In conjunction with the 0.001 mfd. condenser C_{19}, a 0.5 H. H.F. choke Ch_1 in the detector anode circuit prevents I.F. currents from reaching the L.F. circuits, and in a large measure contributes to the avoidance of undesired responses on the long waveband. The low-frequency coupling is by means of a 3.5-1 ratio transformer of a type having a high primary inductance, even when carrying the steady anode current of the valve. Decoupling is provided by the 50,000 ohms resistance R_{13} (Fig. 2) and the 2 mfd. condenser C_{20}.

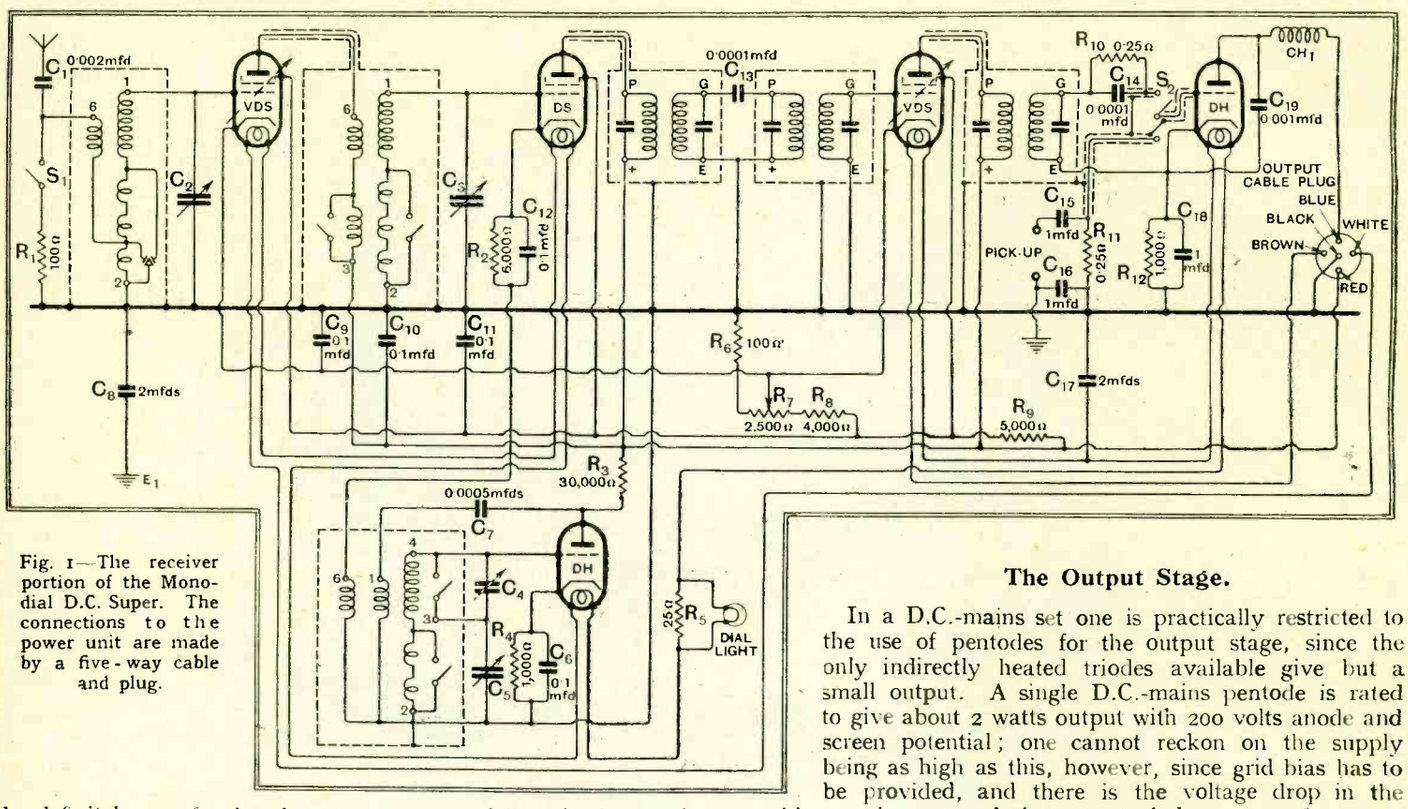


Fig. 1—The receiver portion of the Monodial D.C. Super. The connections to the power unit are made by a five-way cable and plug.

The Output Stage.

In a D.C.-mains set one is practically restricted to the use of pentodes for the output stage, since the only indirectly heated triodes available give but a small output. A single D.C.-mains pentode is rated to give about 2 watts output with 200 volts anode and screen potential; one cannot reckon on the supply being as high as this, however, since grid bias has to be provided, and there is the voltage drop in the smoothing equipment and the output choke or transformer to be taken into account. The net result is that it is difficult to obtain more than about 1 watt from a single pentode. As an output of at least 2 watts must be considered essential in a receiver of this nature, we must have recourse to two pentodes in the output stage.

Now, there are two ways in which two pentodes may be connected; they may be used in paralle lor they can be employed in a push-pull circuit. There is no doubt that the latter is preferable with triodes, but the case is rather different with

LIST OF PARTS.

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

2 Fixed condensers, 2 mfd., 500 volt D.C. test (C8, C17).	Dubilier, Type "BB"
3 Fixed condensers, 1 mfd., 500 volt D.C. test (C15, C16, C18). (Ferranti, Formo, Peak, T.C.C., Telsen, Wego.)	Dubilier, Type "BB"
5 Fixed condensers, 0.1 mfd., 500 volt D.C. test, non-inductive (C6, C9, C10, C11, C12). (T.C.C., Telsen, Wego.)	Dubilier, Type 9200
1 Fixed condenser, 0.001 mfd. (C19).	Dubilier, Type 620
1 Fixed condenser, 0.0001 mfd. (C14).	Dubilier, Type 620
1 Fixed condenser, 0.0005 mfd. (C7).	Dubilier, Type 620
1 Fixed condenser, 0.002 mfd. (C1). (Ferranti, Loewe, T.C.C., Telsen, Wego.)	Dubilier, Type 620
1 Fixed condenser, 0.0001 mfd. (C13). (T.C.C.)	Dubilier, Type 670
1 Potentiometer, 2,500 ohms, wire wound (R7). (Colvern, Claude Lyons, Rothermel, Wearite.)	Watmel, Type No. 1
1 Semi-fixed condenser, 0.0005 mfd./0.002 mfd. (C4). (Formo, Goltone, Polar.)	R.I. "Varicap"
1 5-Way insulated connector.	Wilburn
1 Variable condenser, 0.0005 mfd., 3-gang, screened superhet type, with trimmers on the right, and cover (C2, C3, C5).	British Radiophone
1 Slow motion dial, for above.	British Radiophone
2 Metallised resistances, 100 ohms, 1 watt (R1, R6).	Dubilier
2 Metallised resistances, 1,000 ohms, 1 watt (R4, R12).	Dubilier
1 Metallised resistance, 6,000 ohms, 1 watt (R2).	Dubilier
1 Metallised resistance, 30,000 ohms, 1 watt (R3).	Dubilier
2 Metallised resistances, 250,000 ohms, 1 watt (R10, R11).	Dubilier
1 Metallised resistance, 4,000 ohms, 2 watts (R8).	Dubilier
1 Metallised resistance, 5,000 ohms, 3 watts (R9). (Colvern strip type, Erie, Claude Lyons.)	Dubilier
1 Strip resistance, 25 ohms (R5).	Claude Lyons, Type FW25
3 I.F. transformers, 110 kc. (Varley.)	Colvern "Colverdynes"
5 Valve holders, 5-pin. (British Radiophone, Bulgin, Eddystone, W.B.)	Clix Chassis-mounting type
1 Screened superhet H.F. choke (Ch1). (Keystone, Wearite.)	Bulgin, H.F.10
1 Battery cable, 5-way. (Belling-Lee, Concord, Goltone, Lewcos.)	Harbros
1 Set of canned coils.	Varley "Square Peak" BP.19
4 Ebonite-shrouded terminals, Pick-up (2), aerial, earth. (Burton, Clix, Eelex, Igranic, Swain.)	Belling-Lee, Type "B"
1 Single-pole Q.M.B. change-over switch (S2).	Claude Lyons, B.A.T.729
1 Single-pole Q.M.B. on/off switch (S1). (Bulgin, Keystone.)	Claude Lyons, B.A.T.728
Metal screened sleeving, 3ft. (Concord, Harbros, Lewcos.)	Goltone
1 Plymax baseboard, 12in. × 14in. × ¾in.	Peto-Scott
1 Panel, oak-faced ply, 14in. × 9½in.	Peto-Scott
Plywood ⅜in., screws, 2 ozs. No. 22 tinned copper wire, systoflex, etc., etc.	
POWER PACK.	
1 L.F. transformer.	Ferranti, A.F.5
1 Double-pole Q.M.B. on/off mains switch (S3). (Claude Lyons.)	Bulgin, S.88
1 Twin fuseholder, complete with 1 amp. fuses (FF). (Bulgin, Goltone, Microfuse.)	Belling-Lee, 1033
2 10-Henry chokes (Ch4, Ch5). (Ferranti B2.)	Sound Sales
2 20-Henry chokes (Ch6, Ch7). (R.I. "Hypercore.")	Varley, DP10
2 Fixed condensers, 4 mfd., 500 volt D.C. test (C24, C25).	Dubilier, Type "BS"
1 Fixed condenser, 2 mfds., 500 volt D.C. test (C 20).	Dubilier, Type "BB"
4 Fixed condensers, 1 mfd., 500 volt D.C. test (C21, C22, C26, C27).	Dubilier, Type "BB"
1 Fixed condenser, 0.5 mfd., 500 volt D.C. test (C23).	Dubilier, Type "BB"
2 Metallised resistances, 50,000 ohms, 1 watt (R13, R14).	Dubilier
2 Metallised resistances, 5,000 ohms, 1 watt (R17, R18).	Dubilier
2 Metallised resistances, 250 ohms, 1 watt (R15, R16).	Dubilier
2 Metallised resistances, 100 ohms, 1 watt (R19, R20). (Colvern strip type, Erie, Claude Lyons.)	Dubilier
4 Valve holders, 5-pin. (British Radiophone, Bulgin, Eddystone, W.B.)	Clix Chassis-mounting type
2 Plugs, 5-pin. (Eelex, Keystone.)	Bulgin, P3
1 Ebonite-shrouded terminal, earth. (Burton, Clix, Eelex, Igranic, Swain.)	Belling-Lee, Type "B"
1 Asbestos woven wire resistance net, 200 ohms (R21).	Cressall, Type "ERF"
1 Asbestos woven wire resistance net, 250 ohms (R21).	Cressall, Type "ERH"
1 Asbestos woven wire resistance net, tapped, 195 ohms (R22).	Cressall, Type "SSR.36"
2 doz. porcelain washers, unglazed.	Cressall, Type 9031
2 H.F. chokes (Ch2, Ch3). (See Text.)	
1 Plymax baseboard, 9in. × 12½in. × ¾in.	Peto-Scott
Plywood ⅜in., screws, 2 ozs. No. 20 tinned copper wire, systoflex, etc., etc.	
Valves: Osram 2 V.D.S., 1 D.S., 2 D.H., 2 D.P.T. (Marconi.)	

Monodial D.C. Super.—

pentodes, for the output is limited by the appearance of third-harmonic distortion, which push-pull does nothing to reduce. Moreover, the load impedance required by push-pull pentodes is about 16,000 ohms, and this means that the output transformer would need an effective primary inductance of at least 80H. Such a component would be both expensive and difficult to obtain.

With parallel pentodes, however, the same output is obtained and the load impedance need be no more than 4,000 ohms, a value commonly employed with triodes. The sole difficulty, in fact, is that the total anode current is some 60 mA., which is too high to put through the primary of an ordinary output transformer. It is necessary, therefore, that the transformer be choke-condenser fed, and this gives us still another advantage in that it is possible to make use of the principle of low-frequency resonance[4] in the output circuit to give an increased bass response.

Tone Correction.

It is well known that a pentode in conjunction with all normal loud speaker types gives reproduction in which the upper frequencies are excessively strong in comparison with the lower. This is usually overcome by connecting a compensator circuit across the loud speaker in order to attenuate the high frequencies to the requisite degree.

In this particular case, however, we have already a severe attenuation of the high frequencies by the sideband cutting of the I.F. circuits, and we propose to correct for this by increasing the amplification of the upper register in the L.F. circuits. It will thus be seen that to compensate the sideband cutting we require a tone corrector giving increased amplification of the upper frequencies, and to compensate for pentode shrillness we need a tone corrector giving reduced amplification of the high notes. In practice, therefore, all that we have to do is to omit all deliberate compensation, and let the normal high-note accentuation of the pentode itself correct for the sideband cutting, and the sideband cutting correct for pentode shrillness. We thus obtain, in the simplest, most economical and efficient manner possible, automatic tone correction.

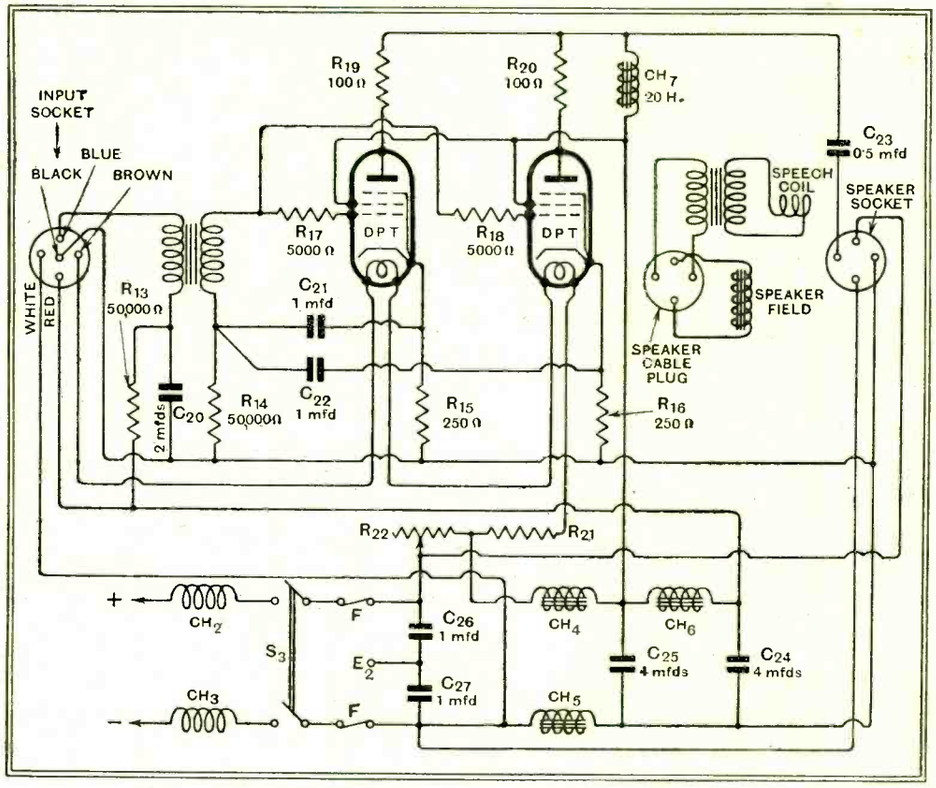


Fig. 2.—The power unit contains the paralleled output valves and an H.F. filter in the mains circuit

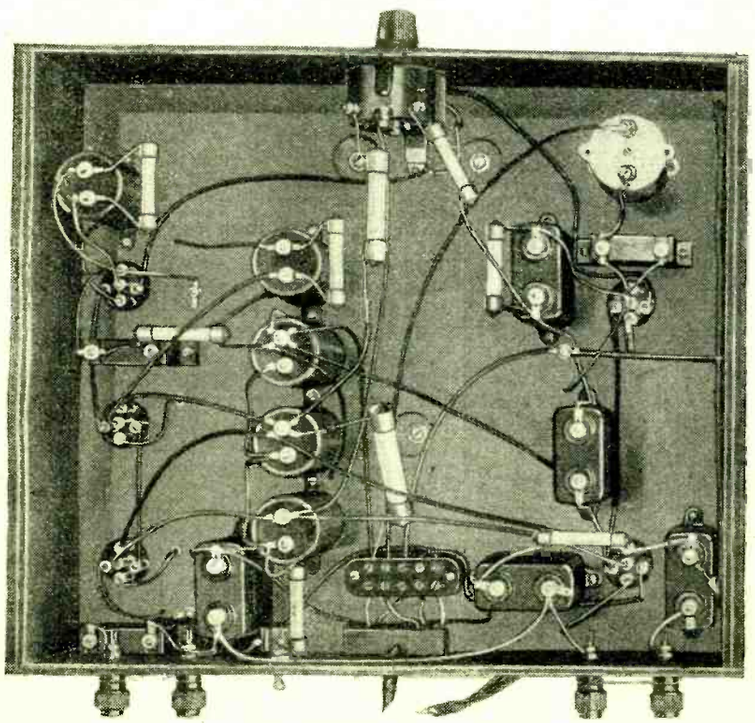
The two pentodes, therefore, have their grids fed in parallel from the secondary of the L.F. transformer (Fig. 2), and isolating resistances R_{17} and R_{18}, of 5,000 ohms each, are inserted in the grid leads in order to avoid any tendency towards parasitic oscillation. For the same reason, a 100 ohms resistance, R_{19} and R_{20}, is inserted in each anode circuit. The valves are independently biased by the 250 ohms resistances R_{15} and R_{16}, and independent grid decoupling is provided by the resistance R_{14}, and the two 1 mfd. condensers C_{21} and C_{22}. The 20H. choke, Ch_7, in the anode circuit and the 0.5 mfd. condenser C_{23} feed the loud speaker, which must be provided with its own transformer to give an effective load of about 4,000 ohms.

Smoothing.

Turning now to the voltage supplies, the heaters of the seven valves are all series connected, and particular note should be made of the order in which they are wired. A total of 112 volts at 0.25 ampere is required, leaving 88 volts to be dropped from the 200 volts point. This is done by two series-connected resistance mats, R_{21}, having a combined value of 350 ohms. The dial light is supplied by connecting it in parallel with a 25 ohms resistance R_3 in the heater circuit.

The mains enter the receiver and pass through two H.F. chokes, Ch_2 and Ch_3, the purpose of which is to prevent H.F. currents in the mains from entering the receiver. These are highly important, and constructional details are given in Fig. 3; both chokes are alike, and one ounce of wire should suffice for both. The double-pole on-off switch S_3 is connected after the chokes in order to avoid bringing the mains leads across the set before

[4] *The Wireless World*, June 29th, 1932.



A number of the components of the receiver unit are housed underneath the baseboard, where the principal wiring connections can be seen.

Monodial D.C. Super.—

the H.F. filtering. A fuse is then inserted in each lead, and two 1 mfd. condensers, C_{26} and C_{27}, are joined in series across the supply. These are for the dual purpose of providing a shunt capacity to H.F. currents and of giving a mid-point earth connection, if this be required.

A 10H. choke of 170 ohms D.C. resistance is next inserted in each mains lead at Ch_4 and Ch_5, and these are followed by the 4 mfd. condenser C_{25}. The H.T. supply to the output valves is now tapped off, but the remainder of the current passes through the 20H. choke Ch_6, where, in conjunction with the 4 mfd. condenser C_{24}, it is still further smoothed for the early stages. The heater current, it should be noted, is tapped off immediately before the chokes Ch_4 and Ch_5, and in the positive lead to this point a tapped resistance mat R_{22} is included in order to drop the mains voltage to the 200 volts required at this point.

A supply of about 160 volts is available across C_{24}, and this feeds the second detector through the decoupling resistance R_{12} and the oscillator through the resistance R_3. The anode supplies for the H.F., first detector, and I.F. valves are taken directly from the common line with the 0.1 mfd. condenser C_{11} shunted to earth. The screen grids of these valves are fed from a common tapping on the potentiometer connected across the supply; this potentiometer comprises the 5,000 ohms, 3 watts, resistance R_9, the 4,000 ohms, 2 watts, resistance R_8, the 2,500 ohms volume control R_7, and the 100 ohms resistance R_6. As the H.T. current consumption is an unimportant item in a D.C. set, these resistance values are lower than is usual in A.C. designs, and better voltage regulation is a consequence.

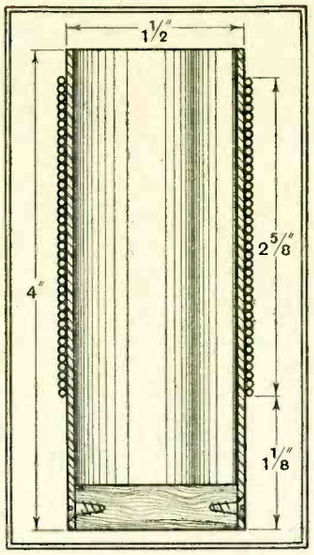


Fig. 3.—The constructional details of the H.F. chokes are apparent in the drawing; each choke consists 85 turns of No. 24 D.C.C. wire.

The screen-grids are by-passed to earth by the 0.1 mfd. condenser C_{10}, and another condenser, C_9, of the same capacity, shunts the cathodes of the two variable-mu valves to earth. These cathodes are taken to the slider of the volume-control potentiometer, which thus provides simultaneous control of the amplification both preceding and following the first detector, and gives sufficient range of control for all normal purposes. Where reception is required of a very powerful local station, it is sometimes found that distortion may occur at very low volume settings, due to overloading of the H.F. valve. To guard against this, therefore, a "Local-distance" switch S_1 is included, and this reduces the aerial input by shunting a 100 ohms resistance R_1 between aerial and earth.

One of the requirements of D.C. sets for the avoidance of hum is that the second detector heater be effectively at earth potential. It is inconvenient so to arrange the wiring that this is directly achieved, and so the 2 mfd. condenser C_{17} is connected between the heater and the chassis, and it is effective in overcoming the difficulty. In next week's issue constructional notes and hints on operation will be given.

DISTANT RECEPTION NOTES.

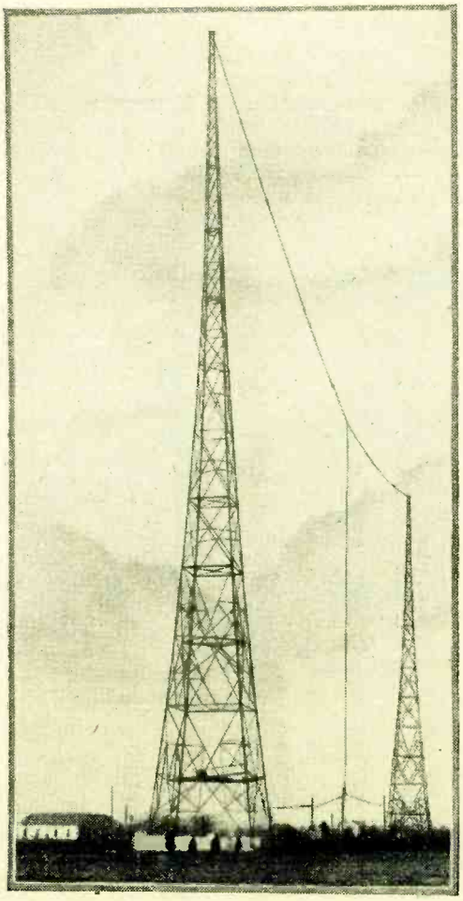
ONE of the most annoying effects to the long-distance enthusiast who owns a highly selective receiving set is that known as sideband splash or "spitting through." It is liable to occur whenever powerful transmitters are operating on adjacent channels with the present 9-kilocycle separation. It is generally observed when the field strength of one of these stations is considerably greater than that of the other and an attempt is made to receive the weaker transmission.

Avoiding Sideband Splash.

In the elimination of ordinary forms of jamming or interference, the set may be able to separate the two well enough, but at frequent intervals sharp "zip-zip-zip" sounds come through. If the field strength of the weaker station is greatly inferior to that of the stronger, these sounds may be sufficient to spoil one's enjoyment of the programme completely. The more optimistic of readers may find some consolation in the fact that the receiving set is in no way responsible for this unpleasant effect. In their recent Report (No. 12) on highly selective receiving sets the Radio Research Board showed that high selectivity could do nothing to prevent it. The only way of avoiding these unpleasant sounds when indulging in foreign listening is to make a rule of specialising upon the stronger of any adjacent pair of stations.

Toulouse Testing

Sideband splash, which would seem to be caused by the beating of the outer sidebands of one station with the carrier wave of the other, is a phenomenon which has only recently come prominently before us; it is one that will have to receive full attention from future Radio Conferences.



HEAR HIM AFTER MIDNIGHT. WJZ, New York, working on 395 metres and a power of 30 kW., is one of the most popular medium-wave American stations.

Toulouse Midi is not yet using the new 60-kilowatt transmitter for regular programme broadcasts, but any reader who desires to know what the reception of Toulouse will shortly be like will probably find the new transmitter in action if he tunes to 385 metres shortly after midnight. The night before these notes were written I came across Toulouse during a search for American stations. It was then radiating a test programme, whilst the giant Leipzig on the next channel was sending out a steady note. Toulouse's field strength was enormous, the quality was good, and there was no audible heterodyne whistle. The station, by the way, is asking for reports from listeners in other countries.

The Best Stations.

A station rarely heard well in this country, since it has two sharers of its wavelength, is the Italian Bolzano on 368.1 metres. A few evenings ago I found Bolzano enjoying the wavelength undisturbed, and obtained remarkably good reception. The best of the European stations at the moment are Turin, Heilsberg, Hilversum, Göteborg, Breslau, the Poste Parisien, Milan, Brussels No. 2, Brno, Strasbourg, Toulouse, Leipzig, Söttens, Katowice, Stockholm, Rome, Beromünster, Langenberg, Prague, Florence, Brussels No. 1, Vienna, and Budapest.

The reception of stations from both North and South America is so good now that a considerable number may be logged between midnight and two o'clock in the morning at any time when atmospherics are not troublesome. In addition to U.S.A. stations, several situated in the Argentine are coming through well, and early on one recent morning I had good reception from Mexico City.

D. EXER.

Practical HINTS and TIPS.

AIDS TO BETTER RECEPTION.

A FEW years ago, H.T. battery eliminators for operation on A.C. mains were often supplied with untapped power transformer primaries; in other words, their input voltage rating was definitely fixed by the makers. The mains-voltage supply of many readers possessing such appliances will doubtless have been increased since the time that the eliminator was obtained, but this does not mean of necessity that it will be useless. By inserting a voltage-absorbing resistance of suitable value in the mains lead the instrument may be adapted to work on the higher voltage. The resistance needed may be roughly estimated.

Eliminator Input Voltage.

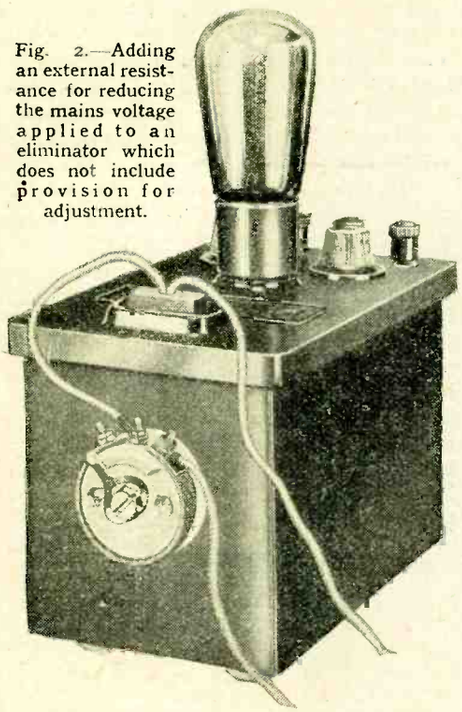


Fig. 2.—Adding an external resistance for reducing the mains voltage applied to an eliminator which does not include provision for adjustment.

As a first step, the various output wattages of the secondary windings (if there are more than one) should be added together. In the simpler type of eliminator with a valve rectifier, these will comprise the rectifier heating circuit (4 volts, 1 amp. equal to 4 watts), and the H.T. secondary. For the purpose of estimating the H.T. output, it will be enough to take the D.C. rating of the instrument, and to multiply volts by amperes—or rather, by fractions of an ampere.

About 25 per cent. or so of the sum of these wattages may be added to represent losses in the transformer.

The calculation of current flowing through the primary winding, and afterwards the estimating of the required voltage-absorbing resistance may be carried out as described last week in the "Readers' Problems" section under the heading of "Absorbing Surplus A.C. Voltage."

In many cases an ohmic value of some 400 ohms or less will be about right, and so the resistance element of a wire-wound potentiometer, such as the Igranic 400-ohm component for baseboard mounting, will be found suitable. It may be mounted externally, as shown in the accompanying illustration, but to prevent risk of shock it should be protected by a cover after the initial adjustment.

When a trickle charger is included in the eliminator it may be necessary to provide for the insertion of a value of resistance differing from that which is appropriate when the eliminator is merely supplying H.T. current to the set.

BY adding the "Flexible Band-pass Unit," described in *The Wireless World* for October 14th, the selectivity of an existing receiver of the simpler kind may be improved to a more than appreciable extent. But this unit will do nothing to increase the range of the receiver; rather the reverse. It will tend to reduce its true sensitivity, although, thanks to the greater freedom from interference, the number of stations receivable should be increased to an appreciable extent.

Extra Selectivity and Range.

It is not impossible to combine the features of the unit in question, or, indeed, of any other constructed on similar lines, with an H.F. amplifying stage, and a reader who has successfully done this has been good enough to send us particulars of his method of conversion, which is illustrated diagrammatically in Fig. 1.

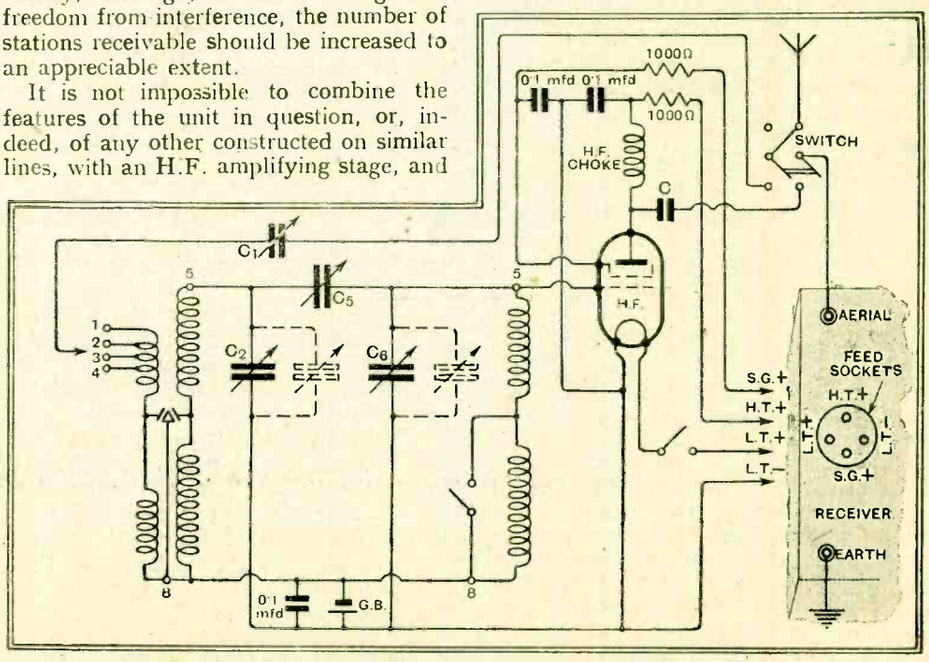


Fig. 1.—The "Flexible Band-pass Unit," elaborated by the addition of an H.F. stage. Current for the valve may be taken from sockets mounted on the set.

Connections to the receiver have been so arranged that the unit may be placed in or out of circuit by operation of a double-pole change-over switch, which at the same time connects the aerial to the appropriate terminal.

Provided that the aerial coupling in the receiver is so arranged that a comparatively small proportion of the aerial capacity is transferred to the first tuned circuit, it is unlikely that "ganging" will be disturbed by connection of the band-pass amplifier unit. It might, however, be desirable to replace the fixed coupling condenser C by a semi-variable component of about 0.0003 mfd.

IT is seldom that the power-supply equipment of an existing A.C. receiver will provide sufficient surplus wattage for energising the field of a moving-coil loud speaker, unless this question has been specially considered in the design. Consequently, those who wish to fit an energised instrument to such sets are left with two alternatives: the necessary field current may be derived from the mains through a separate rectifier and smoothing circuit, or a rectifier of higher power, together with a suitable mains transformer, may be substituted for that already fitted in the receiver.

Speaker Field Current.

It will therefore be seen that the necessary additions are in both cases considerable, and so the majority of amateurs will prefer the simpler alternative of obtaining a permanent-magnet loud speaker, which, of course, needs no energising current.

Unbiased

By FREE GRID.

"Rectifier Inc."

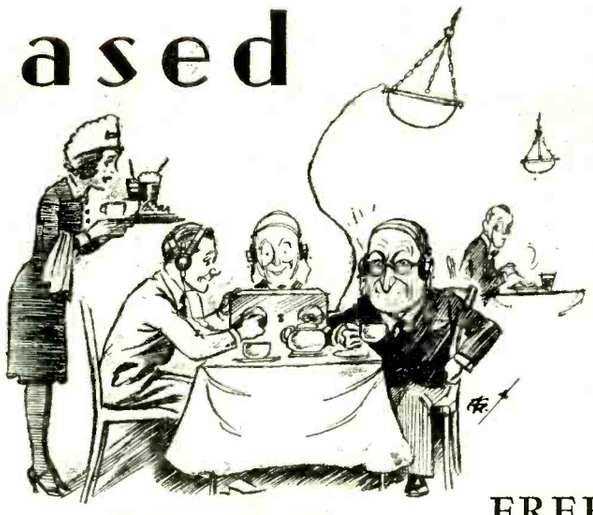
I SEE that once again the mighty question of whether a four-valve receiver, *plus* a rectifying valve, ought to be described as a four-valve or a five-valve instrument is agitating the minds of manufacturers and others. There are undoubtedly five valves in such a set, but, to my mind, to call it a five-valve receiver is, as John Henry used to say, all wrong. Some manufacturers of sets employing a thermionic rectifying valve now put the cryptic phrase "Rectifier inc." in their "literature."

This goes a long way to clear up matters, but, unfortunately, those manufacturers who employ metal rectifiers in their sets are moaning because, so they argue, a set calling itself a "five-valve set (rectifier inc.)" is far more likely to attract a buyer than an instrument employing an equal number of "working" valves, which is debarred from calling itself a five-valve set, because, to quote their own words, "it employs a metal instead of a thermionic rectifier." Ye gods and little fishes! If the *thermionic* people can get away with this stunt, can't they do the same, for surely a metal rectifier is just as much a valve as a thermionic rectifier?

Radio in the Restaurant.

RADIO enthusiasts are apt to indulge their hobby in strange places, but none more so I think than in an all-night restaurant where I chanced to be a few nights ago. I had, unfortunately, just missed my last train home, and was about to repair to an hotel when I found that I had only eighteenpence in my pocket. My predicament was rather awkward as I obviously had insufficient for an hotel, and to arrive at Rowton House in a taxi would, I felt, be rather incongruous and might lead to my being regarded with some suspicion. I had resigned myself to perambulating the streets until the first train in the morning, when I suddenly remembered that for a few pence I could purchase a magazine and spend the night in the comfort and warmth of an all-night café for the price of a cup of coffee.

I lost no time in converting my thoughts into deeds, and was soon ensconced in a comfortable corner. I had been reading for upwards of an hour, heedless of the clamour around me, when my attention was attracted by the doings of a few youths at a neighbouring table. On each of their heads a pair of headphones was firmly clamped, and on their table was an all-mains short-wave set which they had plugged into a handy lamp-holder. Speedily edging myself into their circle, I borrowed a spare pair of 'phones, of which there were upwards of half a dozen. It was now about 3 a.m., and American stations simply rolled in as the tuning dials were twirled under the obviously practised hands of one of the members of the party who appeared to be in charge. By and by other night-birds in the restaurant joined us, and we made quite a merry party.



We made a merry party.

Curiously enough, a couple of tables away I noticed a well-known announcer busily engaged in wolfing bacon and eggs; he had congenial company with him, and so made no attempt to join us. I must confess that I was quite sorry when 6 a.m. arrived, and I left to catch my train. It strikes me that the proprietors of these all-night establishments are losing a golden opportunity of increasing the popularity of their cafés by not immediately installing a short-wave receiver under the control of a competent operator to help their patrons while away the weary hours between the last and first trains.

Winning Faces.

AS a matter of interest I have during the past few months been keeping a record of the number of times which the photographs of various individuals have appeared in periodicals of the wireless Press, and I see from my tabulated data that one person figured no fewer than sixteen times in one issue of a certain periodical. Another set designer runs him a close second, however, and, in fact, these two are racing neck-and-neck, although the "field" is not very far behind. I am anxious to see who will win the championship for the whole of the year, and suggest that the Editor of *The Wireless World*, as the only disinterested party, should award a cup.

A "Certain" Official.

I SEE that a Post Office official has been on his hind legs again to a Sunday newspaper concerning the subject of wireless pirates. According to him, one of the sources of information is the "thousands of anonymous letters giving details of defaulting listeners. . . ." Surely the proper place for anonymous letters is in the wastepaper basket, where all sensible people consign them. This method of obtaining information, too, is open to grave abuses, as any person having a private grudge against another individual who has not yet joined the ranks of listeners can vent his spite by giving false information to the Post Office.

What particularly arouses my wrath, however, is the official's further statement: "When it is definitely known that a house is making use of a wireless set and the inspector who calls is informed that no such set is in use, the inspector, under the Wireless Telegrams (*sic*) Act, has power to obtain a search warrant. But, of course, such a warrant is not obtained unless the inspector is certain." If it is "definitely known," and the inspector is "certain," what on earth does he want to search for. Why not issue a summons straightaway?

Taffy's Pick-up.

EVER since the days of the War, Welshmen have commanded my highest admiration, and this feeling on my part has been greatly intensified by the latest feat on the part of one of the sons of the Principality. The gentleman in question had had the misfortune to forget that a licence is a necessary preliminary to the installation of a wireless receiver, and as a consequence found himself before the local bench of magistrates. The apparatus, explained the defendant, did not

When the inspector is "certain."

work satisfactorily, but did this daunt him? Not a bit of it; he had simply taken the whole outfit and, with the technical ingenuity worthy of his great race, had converted it into a gramophone pick-up. But greater marvels were yet to come, for when the inspector called, this gramophone pick-up—for, remember, it was nothing more now—was actually receiving a programme! And the reward of ingenuity and labour? Ten shillings. Shameful!

How To Tune In.

Short Cuts to Calibration.

By

R. W. HALLOWS, M.A.

THE publication of the admirable tuning chart in *The Wireless World* of October 7th has stimulated a great deal of interest in the calibration of receiving sets. There are, though, still many people who are frightened by the very mention of the word "calibration," since they think that it refers to a long, complicated, and laborious process. Actually, the preparation of a detailed tuning chart is both a simple and interesting business, and if one sets about it in the proper way most, if not all, of the work can be done in a single evening. In this article I am going to describe a method by which a selective superheterodyne receiving set was accurately calibrated recently in a matter of just over two hours. The same principles are applicable with equally good results to almost any receiving set.

One of the first difficulties that crops up when calibrating a set is to discover the *exact* reading of any station that is tuned in. The ear is not wholly to be depended upon, particularly in the case of strongly received stations. Even with highly selective sets these are frequently to be heard with large volume over the best part of a whole division of the condenser scale, and it becomes a matter of impossibility to decide by listening to the signal whether the precise setting is, say, 35¼, 35½, or 35¾.

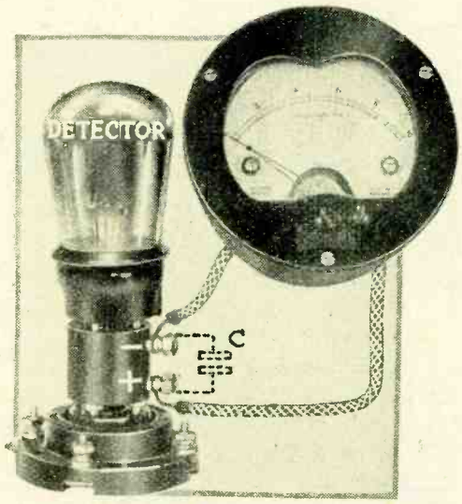
Visual Tuning.

Any reader who cares to make the experiment will find that if he tunes in his local station, or one of the big Continental transmitters, such as the Poste Parisien, Leipzig, Langenberg, or Prague, half a dozen times, without looking at the dial until he is satisfied that resonance has been reached, he will obtain a variety of readings differing from one another by a considerable fraction of a scale division. The true reading might be taken as the average of those obtained, but the process is in any case a slow one, and there is no guarantee that the average reading is accurate.

Happily, there is a way out of the difficulty of which anyone may avail himself who owns a milliammeter. The illustration explains how the milliammeter is connected into the plate circuit of the detector valve of a "straight" set or the second detector of a superheterodyne by means of a Bulgin split-anode adaptor plug. It is advisable to use screened leads to the meter. The condenser C will be needed only in those cases where it is found that the introduction of the measuring instrument gives rise to instability. Its purpose is to provide a shunt path for oscillating current.

If a detector is of the anode-bend type the plate current rises to its maximum when resonance is reached; a gridleak-and-condenser detector, on the other hand, shows a minimum reading of plate current at exact resonance. In either case the milliammeter provides a definite indication, and eliminates guesswork.

The instrument should, ideally, have a maximum reading only a little in excess of the greatest amount of plate current passed by the detector valve: a range of



The use of a "split-anode" adaptor to bring a milliammeter into operation for calibration purposes. The condenser C will, in most cases, not be required.

from 0–2 milliamperes is thus most suitable for most anode-bend and leaky-grid detectors, and one of from 0–10 milliamperes for power grid detectors. But even if the only milliammeter available is one with a range of 0–20 or 0–25 milliamperes, it will be found to be of the greatest assistance.

When a milliammeter is used in the way suggested, the exact condenser scale reading for any station is instantly obtainable. The tuning knob is simply turned slowly backwards and forwards until the maximum deflection of the needle occurs, and very accurate records of settings become possible.

Now for a quick means of picking up and identifying stations. In the course of the evening to which reference was made in the first paragraph of this article, forty-seven were tuned in and definitely identified in little more than an hour and a half. Here is the way in which similar results may be obtained with any set, though the actual number of stations must, of course, depend upon the sensitiveness of the apparatus as well as to some extent upon local and general conditions.

Making a Start.

The first thing to do when handling an unknown receiving set is to find the local station, or both of them, if the local transmitter is a high-power twin. There is no difficulty about doing this. One has merely to start with the dial, or dials, at zero and to work fairly rapidly upwards for the local to be found in a matter of moments owing to its great field strength. In up-to-date superheterodynes, such as those designs published in *The Wireless World*, there is only one tuning dial and only one setting at which the local station is received at maximum strength. There are, though, superheterodynes containing one tuning control for the high-frequency circuits and a separate control for the oscillator. In such cases it is essential to find out, as soon as the local station has been tuned in, whether it is the first or the second channel that is being received. For calibration purposes one channel or the other must be used throughout, and it is generally most convenient to employ the first—that is, the one with the lowest reading on the oscillator dial.

The local station comes in strongly with the two condensers in certain positions: upon which channel are we hearing it? First obtain the maximum deflection of the milliammeter by moving the high-frequency tuning control and adjusting the oscillator condenser. Then move the oscillator dial fairly rapidly downwards over about twenty divisions. If the local station is heard again at equal strength at a lower reading of the oscillator dial, then the original setting was that of the second channel, and the lower reading should be used for calibration purposes. On the other hand, if the local station comes in again at a higher reading of the oscillator dial, *that* is the second channel, and the first reading is the one required.

We will suppose that the local station is Brookmans Park, as was the case when the calibration under description was made. If the local station is a twin, both transmissions should be found and recorded in the way outlined. Their scale readings are then plotted upon the chart against their wavelengths. Each

How to Tune In.—

station in succession is then used as a jumping-off point.

Whether calibration is being done in wavelengths or in frequencies; whether the condensers are straight-line wavelength, straight-line frequency, or log-midline, the settings for the North National, a station fairly easy to receive in most places, will lie approximately half-way between those of the London Regional and London National.

Having plotted the North National's setting upon the chart, the work can now go forward fairly rapidly. Reference to the list shows that there are two strongly received stations on wavelengths just below —Hilversum and the Scottish National. The simplest method is to tune downwards (speaking in wavelengths) until a station is found which is transmitting the same programme as the North National. This *must* be the Scottish National, and a powerful station found between the two *must* be Hilversum.

We return to the setting of the North National, and then move upwards to a point roughly half-way between this and the settings of the London Regional. Here we are certain to encounter, after a small movement of the control knob, a transmission of considerable strength, for we are bound to be in the group consisting of Gothenburg, Breslau, the Poste Parisien and Milan. Which of these stations are we hearing? Each member of the group can be tuned in fairly rapidly, and one of them is sure to make an announcement before long which renders identification certain if the items in progress cannot be traced from the published programmes, as in most cases they can. During announcements Breslau can be "nailed down" by the occurrence of the words "Breslau und Gleiwitz"; Milan by the words "Milano, Torino, Genova, and Firenze," and so on. As soon as one of these stations has been identified, its neighbours on either side can be put down with certainty.

Filling in the Gaps.

There remains now the small gap between this group of stations and the London Regional. Stepping stones heard are Brussels No. 2 and Strasbourg. Having received these, there is no difficulty (provided, of course, that the set is capable of the feat) in finding Brno, which lies just between them.

The rest of the calibration proceeds in the same way. Between the London National and the Scottish National, Turin and Heilsberg are the key stations, whilst below the London National Budapest No. 2, Fécamp, and Nürnberg are waiting to help.

Above the London Regional the Midland Regional and North Regional are easily found, and once this has been done Leipzig, Stockholm, Rome, Beromunster, and Langenberg follow quickly. The calibration of the top end of the medium waveband is soon completed by means of Prague, Brussels No. 1, and Budapest, for with their help intermediate stations such as Florence, Vienna, and Munich are readily found.

The last process is to fill up as many gaps as possible by finding the weaker stations, and this is always done by searching for them between two known readings. When, for instance, those for the Midland Regional and Stockholm are known, Katowice, Dublin, and Belgrade can be picked up without much trouble, whilst if a station is heard between the Midland Regional and Katowice, this must be Sottens, since there is no other possible station in the intervening space.

ON THE SPOT.

Visits to Foreign Broadcast Stations.

III.—RADIO ROMA (680 kc. 441 m. 50 kW.).

STATION IRO, Radio Roma, is only one of Rome's broadcasting stations. The Eternal City contains two important short-wave stations, those of the Vatican and the Italian Government, but to the ordinary listener Rome means Radio Roma.

When I visited the new studio building of the EIAR, the *Ente Italiano per le Audizioni Radiofoniche*, the decorations were not quite complete. The building, which is some way from the centre of the city, has seven studios and a ridiculously small control room. In the basement there is a special television studio. The studio decorations, which follow the new Italian style, compel admiration, and I consider that they can stand comparison with the new B.B.C. studios in London.

The new broadcasting building in Rome. It includes eight studios, one of which is used exclusively for television.

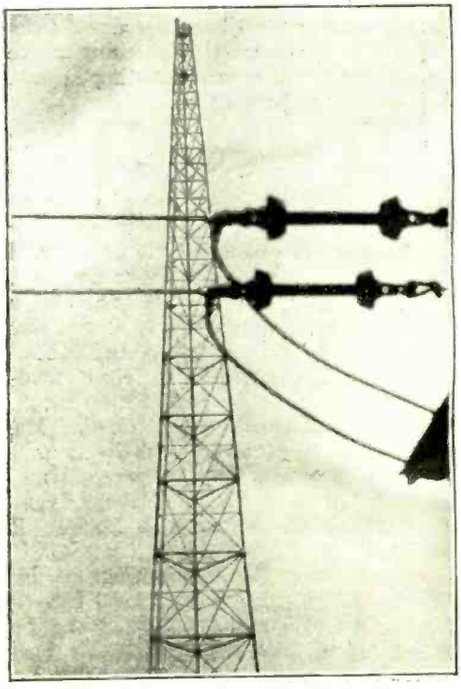
An autumn view of St. Peter's at Rome.

The actual IRO transmitter is situated some twenty miles to the south of Rome at Santa Palomba. It was here, strangely enough, that I saw a modern American transmitter, built by R.C.A., for the first time. What fascinated me at Santa Palomba was an oscillograph permanently coupled to the last transmitter stage, enabling one to see the modulation applied and observe any distortion.

Santa Palomba is situated at a considerable height, with a clear view for miles around, which may explain why Radio Roma has such an excellent range.

The announcers include Signorina Corsini, whose accents are always associated with "Radio Roma," and Gastone Ciuffo, a former London bank clerk.

WANDERING WAVE.



A glimpse of one of the "Radio Roma" aerial masts at Santa Palomba, 20 miles from the city.

NEWS of the WEEK.

What About It, B.B.C.?

ACCORDING to Egyptian radio journals, the best heard European stations out there are Budapest, Bucharest and Warsaw.

Radio-conscious.

BOURNEMOUTH maintains its leadership as the most "radio-minded" town in Britain. Out of 22,459 homes on the register, 21,039 have wireless sets.

Surprises Run Riot.

RADIO-TOULOUSE, racking its brains for new "surprises," asked for suggestions. A listener at once wrote suggesting that it would be a splendid surprise if the station transmitted a programme "totally different from that announced."

Permanent "Mike" Enclosure.

AT the Hohenwarte sports ground, Vienna, a permanent home has been found for the running commentator's microphone. It takes the form of a telephone box with a double glass screen raised some feet above the level of the watching crowds.

New Loud Speaker Rule.

"LOUD speakers and gramophones must only be installed in residences and must not give out more sound than a piano," is the decree issued by the Mayor of Montlucon, France.

Listeners are now asking whether the Mayor has any preferences in pianos; in other words, whether their receivers may make as much noise as a concert grand or not exceed that of a cottage "upright."

German Reorganisation.

GERMANY'S reorganisation of broadcasting appears to be complete with the publication of new rules and regulations according to which the broadcasting companies become public utility and limited liability companies as from January 1st next. The new rules seem to savour of red tape; for instance, every programme will have to be submitted to the State Radio Commissioner and also to the Federal Radio Commissioner before being broadcast.

Programme Advisory Boards are to be set up all over the country, Bavaria alone remaining outside the system.

Jewellery Barred by Ultra Shorts?

RECENTLY an engineer working on the 2-kW. 7-metre television transmitter on top of the Empire State building in New York began to feel his finger getting unbearably hot. Investigation showed that the ring he was wearing was picking up enough energy to generate eddy currents.

This occurrence suggests that the use of the ultra shorts may mean that engineers and others will have to divest themselves of all jewellery before approaching ultra short wave transmitters. Perhaps even all small metal objects will have to be put on one side, and, if so, what will happen to the fellow with metal fillings in his teeth? It will, as our New York correspondent remarks, be a tough break for our familiar friend of the golden smile.

Current Events in Brief Review.

Only a JOAK?

JAPANESE dictionaries may soon be in demand if there is truth in the report that the German Rundfunk organisation is considering the relaying of programmes from Japan. Short-wave links would be employed.

Lille Leads.

LILLE will be the first town in France to possess a "Broadcasting House." The municipality has just voted the sum of £8,600 for the purchase of a private mansion in the Boulevard de la Liberté to be converted into a sumptuous radio house for the offices and studios of "La Radiophonie du Nord."

RINGING THE CHANGES.—The Rev. Isa Rees-Jones, vicar of Yardley Wood, Birmingham, has constructed this 50-watt amplifier in his study for the reproduction of chimes on three loud speakers mounted in the church tower, 500 yards away.

Enlightened Lisbon.

THE Lisbon Municipal Council has passed a resolution that electric signs within the city area will only be licensed if provided with suitable filters to prevent interference with radio reception.

We hear that the Portuguese Radio Club is endeavouring to get the order extended to cover all forms of man-made static.

IN NEXT WEEK'S ISSUE

A special booklet giving technical details of the 1932/1933 season's wireless receivers and radio-gramophones will be included as a supplement.

Italy's Low Licence Figures.

ALTHOUGH Italy's broadcasting prestige in Europe stands deservedly high, the country possesses only 239,000 licensed listeners. Milan leads the cities with 31,157 licences; Turin being second with 30,647. Rome can boast only 19,362.

A Wireless Paradise.

JAVA appears to be the transmitters' treasure island, for it contains no fewer than twelve amateur stations, of which seven are endowed with more than 40 kilowatts power. All transmissions and, indeed, all reception on the island, is carried out on short waves, Java being described as "one of the most favourable spots in the world for radio reception."

Secret Publicity.

PUBLICITY broadcasting stations are growing increasingly common on the Continent, but in Holland there are a number of stations which, while seeking publicity for their clients, aim at secrecy themselves. Illicit stations are reported to be making themselves heard in various populous regions. One station is sufficiently brazen to send out a nightly "good luck" message to the police who are trying to trace it. Another makes the announcement "Hier de clandestine zender Gouda."

The Prince's Example.

MOTOR car wireless promises to become increasingly popular following the royal example set by the Prince of Wales, whose latest car is equipped with a built-in radio set designed for reception while the car is in motion. By means of the "transitone" system of volume control weak signals are automatically boosted up and strong ones toned down to compensate for varying reception conditions when passing in and out of screened areas.

On taking delivery of the car His Royal Highness ordered a second speaker for the driver's compartment, so that his chauffeur can enjoy concerts while waiting.

Broadcasting Interference.

MR. R. A. WATSON WATT and Mr. O. F. Brown, in their fifth broadcast talk in "The Ordinary Listener and His Set" series, to be broadcast on the National wavelength at 7.5 p.m. to-morrow (Saturday), will give listeners advice on electrical interference and how to identify it. Actual "man-made static," as recorded by gramophone, will be broadcast to help listeners to diagnose their own interference troubles before seeking official assistance.

A broadcast of this nature is long overdue. Actually demonstrating on the ether the sounds which a listener is likely to hear if his set is being interfered with is likely to be far more effective than any spoken explanation.

Towards the Six Millionth.

BY the end of October more than 10,000 persons had followed the example of the now famous Mr. Fox, the holder of the five-millionth wireless licence. On October 31st the total was 5,010,234, compared with 4,866,000 at the end of September. At the end of October, 1931, the figure was 4,100,000.

Loud Speaker Curves *and their* Interpretation.

Assessing the Relative Importance of Resonance Peaks and Troughs.

By P. G. A. H. VOIGT, B.Sc., A.M.I.E.E.

(*Concluded from page 476 of the previous issue.*)

IN the first part of this article the author discussed the choice of appropriate frequency and response scales for the presentation of characteristics. The concluding instalment deals with the information which may be gleaned from response curves in estimating quality of reproduction.

WHEN taking characteristic curves with actual sound measurement there is a complication of considerable importance. That is, that a loud speaker will generally radiate low notes in all directions, but the higher notes tend to be concentrated more and more in a beam forwards.

To get full information about a speaker, therefore, several curves should be taken at various angles off the axis. In an ideal speaker the change in characteristics should not be very great, but with some of

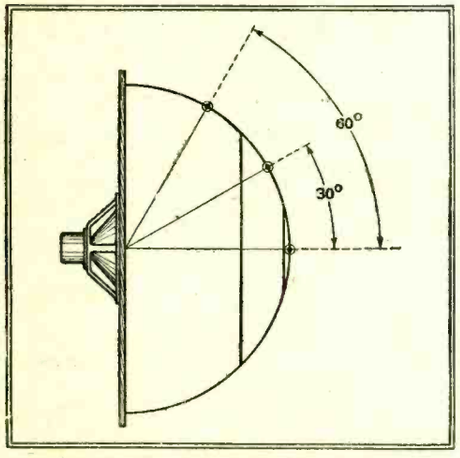


Fig. 4.—When estimating the average forward output from a loud speaker, curves are taken with the microphone in the three positions indicated. The areas of the sound belts represented are (from left to right) approximately in the ratio: $2\frac{3}{4} : 1 : 1/7\frac{1}{2}$.

the sharp-angle moving-coil cones there is actually a very considerable concentration of high notes, and consequently a curve taken with the mike on the axis may show a serious excess of top when the actual forward radiation of the speaker may really contain an excess of bass. For most purposes three curves—one on the axis, one at 30 deg. and one 60 deg. off the axis, will give all the information required. To calculate the mean forward radiation from these three curves the axial curve is divided by $7\frac{1}{2}$, the 60 deg. curve multiplied by $2\frac{3}{4}$, and all three added together.

Ideal Microphone Position.

It may well be said that, since most listening is done on the axis, the axial curve is the one which matters most, but it should be remembered that few people listen under the same conditions as those which occur during calibration. They will almost invariably hear a mixture of direct axial radiation and reflected radiations which are primarily non-axial. In fact, I rather think that the ideal way of calibrating a speaker is to measure it in the place for which it is intended, and with the microphone in the position where the listener's head would be.

In the case of ordinary microphones a similar effect takes place. For sounds reaching the microphone diaphragm squarely the mike has a certain curve, but for sounds, such as reflected sounds, etc., coming from the sides and back, the curve will be different. This is obviously undesirable, even if, on the average, the curve is about right. The best thing is to produce a microphone the curves of which are the same independent of the direction from which the sound comes, and this ideal is now being approached.

It will now be interesting to discuss the curves shown in Fig. 5, and to deduce from their appearance what faults the imaginary loud speaker has. The principal fault with this speaker is a serious resonance at 500 cycles. It may be argued that the trough near 500 cycles will, on the average, largely neutralise the effect of this peak, especially as, on the decibel scale, they both look equal in size. This is, however, not by any means the case. Assume that we are dealing with two equal pure tones occurring simultaneously—one at 512 (on the peak) and one at 384 (in the trough). Then the 512-cycle note will be reproduced at three times its proper strength, while the 384 note is reproduced at one-third its proper strength. The total strength for the two notes is three and one-third instead of the correct amount, which obviously cannot be more than two.

Stationary Waves.

While on the question of peaks and troughs we must consider another peculiarity of listening. This is that practically all listening is done in places which have marked reflections. This means that a sound wave coming from any source is liable to be reflected, and as the reflected wave is often of practically the same strength as the incident wave, a marked "stationary" wave is set up. This means

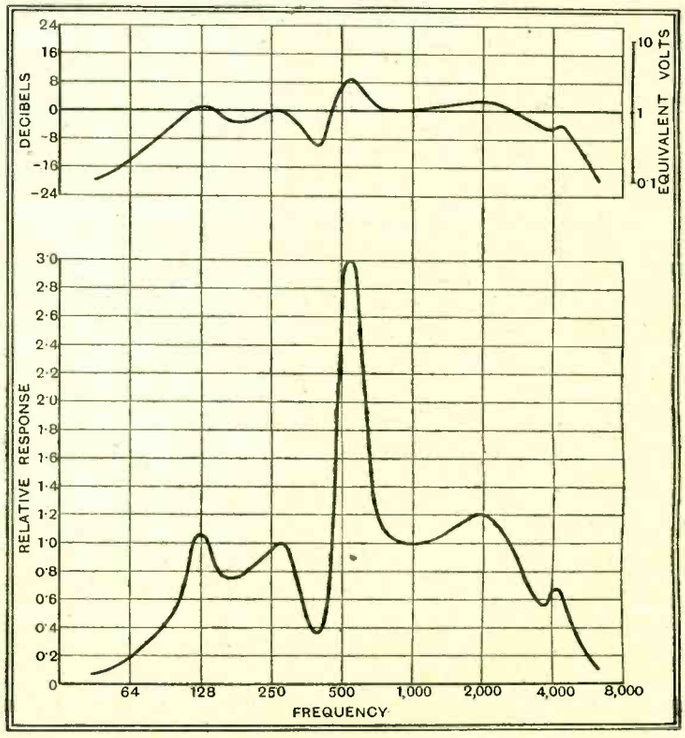


Fig. 5.—Response curves of an imaginary loud speaker. The relative importance of the peaks and troughs is discussed in the text.

Loud Speaker Curves and Their Interpretation.—that there are places where the reflected wave neutralises more or less completely the incident wave, and others where it helps it. Normally, therefore, the ear listens in a space the characteristic of which for sustained notes is all peaks and troughs. To prove this it is only necessary to listen to the B.B.C. tuning note with one ear stopped up while moving the head about in all directions. It will be noticed at once that the strength of the note varies from one spot to the next, there being a maximum and minimum about every seven inches. With a different sustained note the stationary waves are completely altered, and in a spot on which one note was weak the other may be loud.

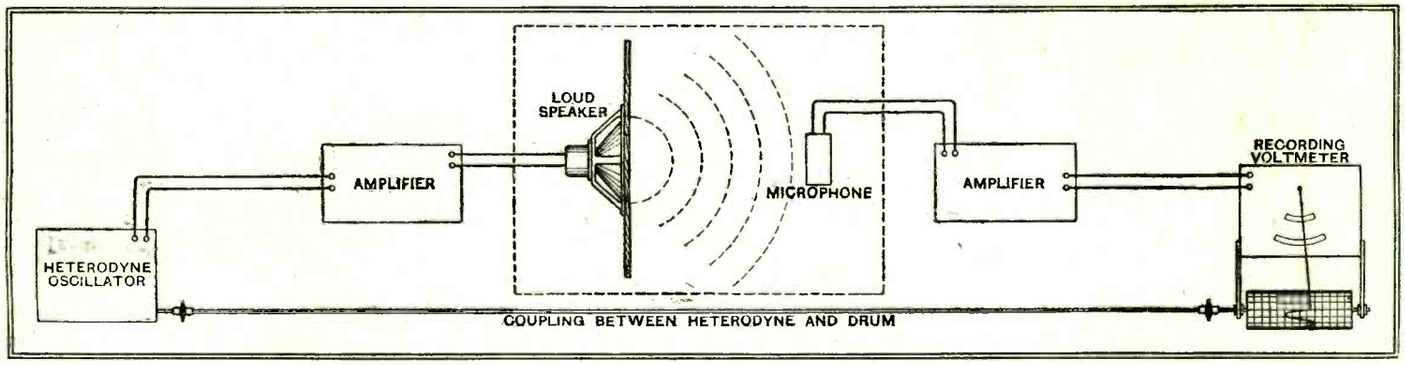


Fig. 6.—Schematic diagram of a typical layout for measuring loud speaker response curves.

Tone Colouration.

Naturally, if the ear is always listening in places the natural acoustics of which are all peaks and troughs, a few small peaks and troughs in the loud speaker will not be noticed. This is quite true as regards the troughs, but does not apply to the peaks to anything like the same extent. When a loud speaker has a peak it is generally due to resonance of some kind; that is to say, some part has a natural period and therefore responds more violently to a certain note and exaggerates it. This form of exaggeration is quite different in its results from that due to stationary sound waves, because when a loud speaker contains a resonant part practically all the transients, clicks, etc., will have a tendency to set that particular part resonating at its natural note. They will therefore sound differently because of such resonance. This is often called a "colouration" of the tone. Transients, in any case, are not periodic, and therefore do not set up stationary waves. Another difference between peaks due to stationaries and to resonance is that peaks due to resonance occur in definite fixed parts of the scale depending on the loud speaker, but peaks and troughs due to stationary waves occur over the whole scale, and are different for every different note and every different part of the room, so that what the right ear hears is actually different from that which the left ear hears.

To sum up, we may say that a trough is likely to escape notice because the ear is normally listening in a space which puts in peaks and troughs all over the scale, but a peak is almost certain to be noticed because the resonance which causes it, quite apart from accentuating that particular note, will give a characteristic tone to transients. It is easy to judge the probable performance of a pick-up, for instance, by listening to the tone of the surface noise as reproduced through it, and to tell before the music starts whether it will be high or low pitched.

Now for the relative effects of the various parts of the scale. The region 1,000-2,500 cycles determines the amount of top, and a speaker which is good up to 2,500 will sound as if it had plenty of top but it will lack definition and clarity, unless the region above this is also reproduced. A speaker which goes up to 3,500 and then tails away to about one-tenth response (20 decibels less) at 6,500 cycles will give good results. Naturally, a speaker which goes up higher still without dropping will be more natural; that is to say, to the listener it will seem even more as if the original sound were coming through the loud speaker.

At the low end of the scale, if the efficiency begins to tail away at about 200, results will be quite fair, but the undertones, such as the accompanying double bass, will not be noticed very much. The addition of an octave, so that it starts tailing away at about 100 cycles, will bring in most of these sounds, but the reproduction will still be deficient in such sounds as the fundamentals of drum notes, and the lowest notes of the organ will not be quite up to strength. The addition of another octave down to about 50 cycles will put this right, but will often reveal a serious 50 cycles hum on mains-operated amplifiers.

Harmonic Distortion.

Before concluding this article on characteristic curves, I must sound a note of warning. The characteristic curve tells much about a speaker, but it does not tell everything. For example, a speaker may buzz badly, due to a loose joint in the diaphragm; such buzz will, as a rule, not affect the curve sufficiently to be noticed. Further, there may be considerable hysteresis distortion, causing overtones in a moving-iron unit. This, likewise, will not show. The same applies to very low notes on a moving-coil unit, in which the surround is free over a certain distance, and then pulls up tight. This will introduce an overtone not present in the original, and may show as a considerable response instead of practically none at all. I even have doubts whether two speakers, having practically identical curves, will sound alike—at any rate, on transients—if their construction is such that one is aperiodic, so that it radiates sound instantly on receiving the corresponding currents, while the other is resonant and has to get its vibrating surfaces going properly before the sound is thrown off.

An Outstanding Receiver.

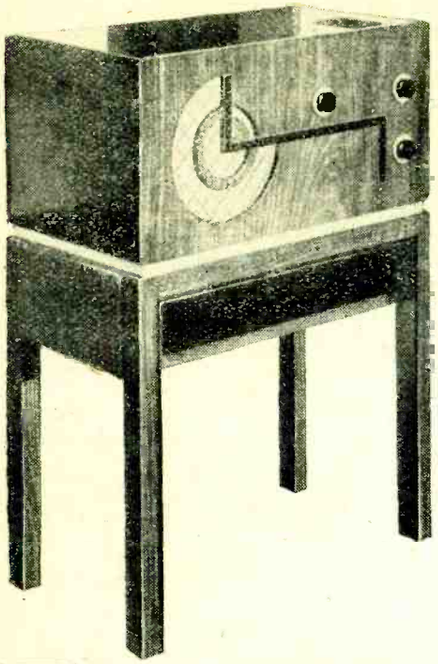
A PRELIMINARY test on the Climax A.C. mains three-valve receiver recently submitted for test has proved so outstanding that, although a full report will appear in a later issue, it is thought that readers will like to have some early information.

The circuit consists of a screen-grid H.F. stage preceded by a band-pass filter, and coupled by a further tuned circuit to the detector. A pentode output valve is fitted, and an energised type of moving-coil loud speaker, while valve rectification is used for the H.T. supply. The volume control takes the form of a series aerial condenser, and this perhaps represents the sole point of adverse criticism, for its range of control is hardly sufficient for a powerful local station.

The sensitivity is high, and a number of foreign programmes are available with the mains aerial, while literally dozens are obtainable with an outdoor aerial. The selectivity is higher than that of any other three-valve set we have yet tested, and is comparable with that of many four-circuit receivers. At a short distance from Brookmans Park it proved possible to receive the Scottish Regional without interference, and with careful handling some half a dozen distant stations were obtainable between the two locals.

Mains hum is completely absent, even when using the mains aerial and without an earth, and the quality of reproduction is definitely above the average. The base is clean and free from boominess, and the high musical frequencies are well represented in the output; there is no trace of shrillness, however, and speech is particularly good.

The mechanical construction is sound and clean, and the mains equipment is designed on very generous lines. Altogether, the receiver sets a very high standard, and at its price of 16 guineas represents excellent value.



Murphy A8.

SUPERHETERODYNE RECEIVER.

A Selective Long-range Set of Advanced Design.

THIS receiver has been designed (quoting the makers' own words) "to obtain, at full room strength, every station on the medium and long wavebands which, at the point of reception, is sufficiently strong, compared with the prevailing noise level, to be of entertainment value."

Some idea of the range may be gathered from the fact that on the first day of test fifteen foreign stations were received at good programme strength on medium waves at 10 o'clock in the morning. After dark practically any station in *The Wireless World* list could be chosen at random and tuned-in. The enthusiast would probably succeed in logging seventy or eighty stations during the course of an evening, while those in search of entertainment value would find twenty or thirty programmes comparable in strength and quality with their local station.

The selectivity, too, is of a very high order. On a good outdoor aerial, at a distance of only five miles from London Regional, when listening to the Stuttgart (Mühlacker) programme at full strength, the only evidence of the existence of the local station was an occasional side-band "splash" during deeply modulated passages. It would be difficult to find a more searching test of selectivity, for the field strength of the unwanted station under these conditions is approximately 100 times that of the wanted station, and the frequency separation is only 11 kc.

Automatic Volume Control.

The only factor which is likely to limit the value of a station from the programme point of view is background noise. The set itself, even when giving its maximum amplification, is remarkably quiet having regard to the number of valves employed, while the mains hum is lower than the majority of A.C. sets so far tested, regardless of type. Heterodyning between stations which are off their proper wavelength is sometimes rather noticeable, but a tone-control switch at the back of the set mitigates this trouble at the expense of curtailed high-note response.

From the foregoing it is evident that the Murphy A8 can hold its own, from the point of view of sheer performance, with most receivers in its class. In the smooth and effortless manner in which it achieves this performance, however, it can fairly claim to be unique. The wise adoption of automatic volume control has entirely removed the fierceness which might otherwise be associated with a set providing such high overall amplification. Having adjusted the general level to a volume suited to the room, the tuning scale can be explored without any fear of disruptive noises through coming unexpectedly upon a high-powered station. Fading is automatically compensated, and the list of useful stations from the programme point of view is thereby considerably extended. Unmodulated carriers which in an ordinary set betray their presence by a faint breathing noise produced the opposite effect in the A8. Between stations a faint hiss indicates that the set is operating with full amplification; on passing through a carrier the background subsides completely and reappears again on the other side. Another interesting effect is to be observed when tuning through long-wave stations which appear to occupy an exceptionally wide band with absolutely uniform strength and quality. Some idea of the range of the control may be gained from the fact that the outdoor aerial can be detached, leaving a few feet of the lead-in attached to the aerial, without altering the volume in the least. The only change, if the station happens to be a distant one, is a rise in the background noise; but for this one might question the necessity of an outdoor aerial.

FEATURES.

General.—*Eight-valve superheterodyne receiver for operation on outside aerial from A.C. mains. Automatic volume control. Moving-coil loud speaker. Provision for gramophone pick-up.*

Circuit.—*Signal-frequency H.F., band-pass coupled to first detector (oscillator coupled in cathode lead). Two I.F. stages. Double diode second detector with automatic bias control to all preceding stages. Screen-grid first L.F. stage, with post-detector manual volume control, resistance-capacity coupled to power pentode output valve. Full-wave valve rectifier.*

Controls.—*(1) Single-knob tuning with illuminated and calibrated drum scale. (2) Auxiliary manual volume control. (3) Wave-range, gramophone and on-off switch. (4) Tone control switch.*

Price.—*£24.*

Makers.—*Murphy Radio Ltd., Welwyn Garden City, Herts.*

In the space at our disposal we can draw attention only to a few of the many interesting features of the circuits. Unquestionably, the most intriguing is the employment of a full-wave diode detector, which, in addition to giving freedom from distortion, is also to a large extent responsible for the success of the automatic volume control. The control bias voltages are developed across a potential divider connected between the centre tap of the tuned input circuit and earth. The signal-frequency amplifier, the first detector, and the first I.F. amplifier receive a greater degree of control than the I.F. stage immediately preceding the detector. The arguments underlying the design of the circuit are very ably presented in a booklet obtainable on application to the makers.

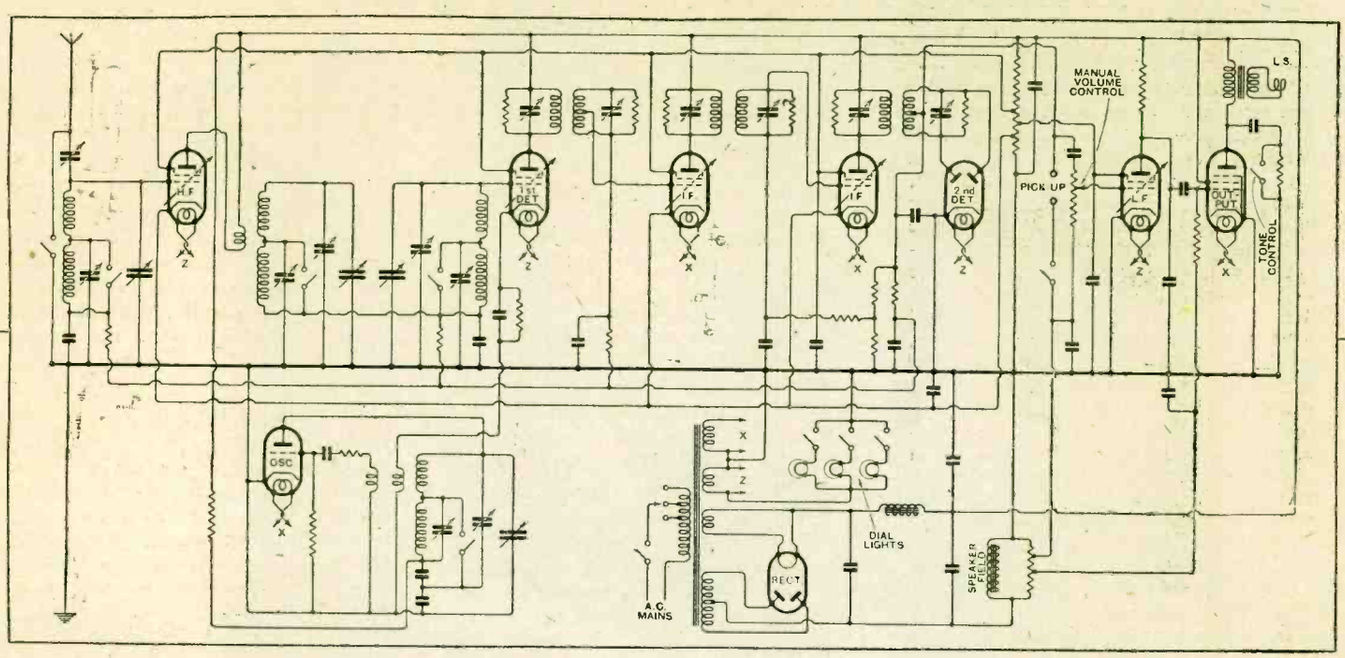
Cabinet Design.

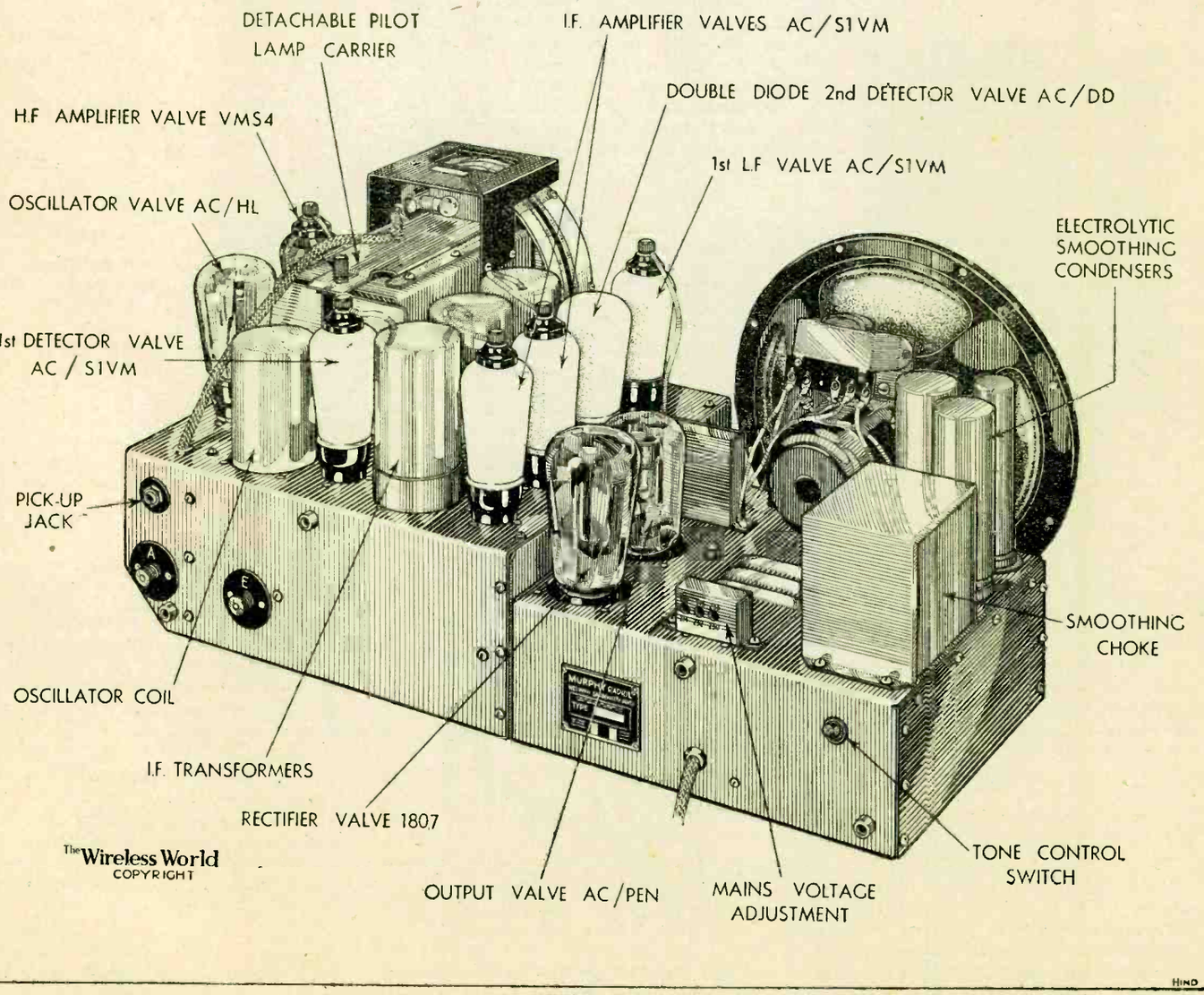
The cabinet follows modern conventions in decoration, but is sound in design from the functional point of view. Standing in front of the cabinet, the controls fall naturally to the hands—the tuning to the right and the manual volume control to the left—while the calibrated drum dial is viewed downwards through a glass window let into the top of the cabinet. The wave-range switch carries contacts controlling pilot lamps which illuminate the appropriate wavelength scale or the panel showing that the set is switched for gramophone reproduction. (A jack is provided at the back of the set for the connection of a pick-up.)

The loud speaker is on the same level as the controls and is at just the right height for a listener seated in an armchair. It is capable of delivering an ample reserve of power for the average room, but showed signs of developing a bass resonance at full power in the particular example tested. At moderate room strength, however, the balance was entirely satisfactory and the general effect well up to the standard demanded in a modern mains receiver.

The feature which leaves the most outstanding impression after more than a week's experience with the set is the flawless functioning of the automatic volume control under the most searching reception conditions. The performance in this respect is really much better than the maker's own figures would lead one to suppose. Add to this the exceptionally high selectivity and range, good quality, and sound engineering construction, and it cannot be denied that the Murphy A8 at its new price is a bargain.

DOUBLE DIODE DETECTOR AND AUTOMATIC VOLUME CONTROL.





Circuit diagram and chassis layout of the Murphy A8 Superheterodyne receiver. The metal back-plate carrying a ventilation scoop for the rectifier and output valves is not shown.

LABORATORY TESTS.

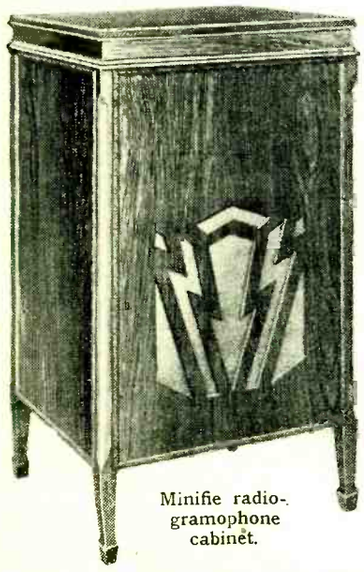
INEXPENSIVE RADIO-GRAM CABINET.

A WELL-MADE radio-gramophone cabinet with generously proportioned compartments is now obtainable at the very reasonable price of £4 4s. from Minifie and Co., 1, Hampshire Street, Brecknock Road, London, N.W.5. It measures 39in. high, 32½in. wide, and 19in. deep overall, thus providing ample space for the accommodation of any of the more recent *Wireless World* receivers.

When ordering the cabinet the overall height of the receiver chassis should be given, for the shelf which accommodates this part of the set can be fixed to provide a head room of between 7in. and 13in.

The loud speaker, power pack or batteries, as the case may be, are housed in the lower part, which is exceptionally roomy, measuring 18in. × 15¾in., while the minimum height available is 12in.

Stout plywood is used for the construction of the cabinet, while the workmanship is of that standard which, as a rule, characterises more expensive models. Minifie cabinets are supplied finished either in polished walnut or in mahogany, the price being the same in each case.



Minifie radio-gramophone cabinet.

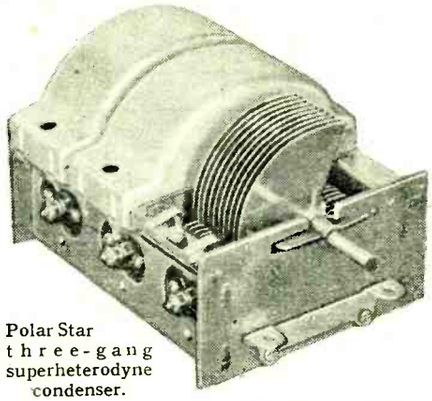
POLAR SUPER-HET CONDENSER.

THIS condenser is built on the same general lines as the new Star series, but is made as a three-gang model only. It includes two sections, fully screened, each of 0.0005 mfd. capacity at maximum, while the third section is fitted with specially shaped stator vanes to give accurate tracking of the oscillator with the pre-selector circuits when a 110 kc. intermediate frequency amplifier is employed.

The condenser is designed for use with coils of 157 mH. inductance for the normal tuning circuits, and one of 126.5 mH. for the oscillator coil on the medium wave band. The respective long wave coils should be of 1,900 mH. and 925 mH., and in addition a condenser of 0.00175 mfd. is required in series with the oscillator section. A 0.002 mfd. compression-type condenser can be used, and the wave-band switching arranged to bring it into circuit on the long waves.

Tracking of the oscillator circuit was found to be sensibly accurate over the whole range, and such slight deviations from the required 110 kc. frequency difference that could be determined were well within the usual tolerances permissible in a modern superheterodyne receiver.

NEW RADIO PRODUCTS REVIEWED.



Polar Star three-gang superheterodyne condenser.

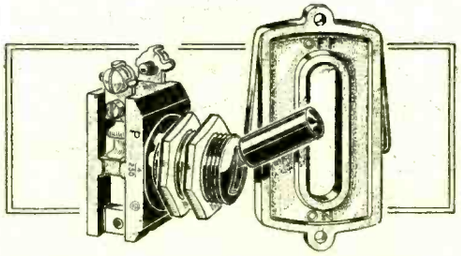
The two 0.0005 mfd. sections are exceedingly well matched, for although the makers state that these are correct to within one-half of 1 per cent. plus or minus one micro-microfarad, our specimen showed a much closer agreement than this at all parts of the scale.

Each section is fitted with a small trimmer giving a variation in capacity of 40 mmfds. With the trimmers adjusted to their lowest value the minimum capacity of the 0.0005 mfd. section was 26 mmfds. in each case.

Robust construction combined with sound engineering practice account largely for the exceedingly good accuracy of the various members in this condenser. It is assembled in a U-shaped steel frame with the rotors supported in phosphor-bronze bearings of generous size which are spring-controlled to preclude end play. Detachable feet are fitted to enable the condenser to be mounted either on its base or on its side. All trimmers are readily accessible. The price is 27s. 6d. The makers are Wingrove and Rogers, Ltd., Arundel Chambers, 188-189, Strand, London, W.C.2.

BECKER KITSWITCH.

MADE by Geo. Becker, Ltd., Ampere Works, Wembley Park, Middlesex, the Kitswitch is a new model designed especially for use in receivers built on a metal chassis, and is rated to handle 4 amps. at normal supply voltages. The body consists of a



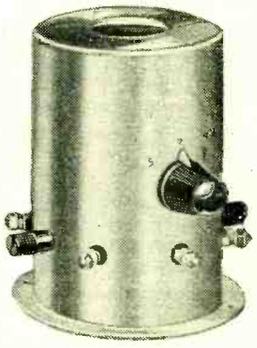
Becker Kitswitch with long operating lever and intended for chassis mounting.

bakelite moulding with all contacts fully insulated. It operates with a snap action, is fitted with self-cleaning contacts, and is in every respect suitable for use as a mains switch.

A long operating lever is provided, also a small bakelite escutcheon plate for the panel or front of the cabinet, this being clearly marked to indicate the on and the off positions. The price is 2s. 6d.

CORDO I.F. TRANSFORMERS.

IN the Cordo superheterodyne I.F. transformers the two coils comprising the primary and secondary circuits are fixed in relation to each other, and the coupling is varied by a small swivelling metal disc mounted midway between the two coils. When the plane of the disc is in line with the axes of coils maximum coupling results, and under these conditions the peak separation is approximately 7 kc. With the disc rotated through an angle of 90 degrees conditions simulating optimum coupling are obtained; one peak only can be determined, and the highest degree of selectivity is achieved. Thus any order of peak separation, or band-pass condition, is possible of attainment by the simple expedient of varying the position of the small metal disc.



Cordo superheterodyne band-pass I.F. transformer.

Simple though this arrangement is, it is nevertheless quite satisfactory in practice, as we have verified by some recent tests made with these coils. The small losses introduced by the proximity of the metal disc to the two coils does not seem to be of any real consequence, so that Cordo I.F. transformers could be employed as alternatives to band-pass superheterodyne transformers.

Each circuit is tuned separately by a small condenser, the adjusting knobs for which are readily accessible, and these afford adequate latitude to enable the transformer to be tuned to 110 kc.

Another interesting feature is the provision of a tapping on the primary windings, which being slightly off centre gives the choice of two step-up ratios. By including a portion of the coil only in the anode circuit of the valve the makers claim that the performance of the transformer is definitely improved.

The makers are Cordo Electrical Products, Ltd., 68, Victoria Street, Westminster, London, S.W.1, and the price is 9s. 6d.

o o o o

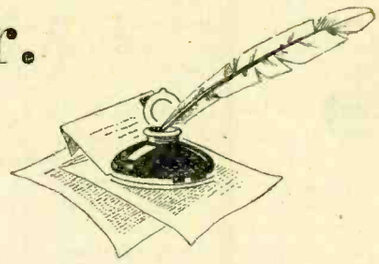
Catalogues.

Rich & Bundy, Ltd., New Road, Ponders End, Middlesex.—Twenty-three-page illustrated catalogue dealing with mains transformers and L.F. chokes.

Lumen Electric Co., 9, Scarisbrick Avenue, Litherland, Seaforth, Lancs.—Sixteen-page booklet describing "Lumen" mains transformer material consisting of moulded bobbins, stampings and end clamps.

The British Radiophone, Ltd., Aldwych House, Aldwych, London, W.C.2.—Illustrated leaflets describing a new drum drive, Q.M.B. switches, gramophone pick-up, wire-wound volume controls and potentiometers.

Letters to the Editor.



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.

American Broadcast Reception.

ON the morning of November 8th I arrived home about 4.30 a.m. (from work), and tuned in six American stations. They were broadcasting a political talk for Mr. Roosevelt, and a telegram was read out which had been sent by him.

The set used is the "Power Radio Gram" plus the Ferranti band-pass H.F. kit.

The strength of one station was loud enough to hear upstairs.

Chesterfield. J. HUTCHINSON.

Waveband Allocation.

MEMORIES are proverbially short, and a search through the files not always reliable, but had "15 kcs," who writes in your issue of November 11th on the "International Waveband," looked in the February numbers of *The Wireless World* in 1929 he would have found a letter from me suggesting the same idea. My suggestion was honoured by favourable comment in your Editorial of February 27th, 1929. The criticism then was the possibility of having to alter some sets in countries where the agreed waveband was unsuitable, but surely this would not be difficult, or even very likely; and the second and more formidable difficulty was the inevitable squabble over who was to have the best widths of waveband.

If, however, some of the biggest nations have managed to agree on the subject of Contract Bridge I am not in despair over the possibility of an agreement which would give each country control over a certain width of waveband, and so confine interference in each country to the amount it decided to put up with.

Chester. K. YOUNGHUSBAND.

The Modern Straight Five.

I SHOULD like to emphasise the good quality obtained on the Modern Straight Five set without the sacrifice of an undue amount of selectivity, which is adequate for the reception of nearly all stations having consistently good musical value as distinct from interesting reception. J. C. S.

Tuffley, Gloucester.

TO TELL THE WORLD. This new sound-amplifying van of the British Thomson-Houston Company carries two 20-watt undistorted all-mains amplifiers and twelve RK moving-coil loud speakers. Radio or gramophone music can be diffused over a wide area. Note the unobtrusive loud speaker grilles.

How Many Valves?

I HAVE been interested in your Leader relative to the designation of valves used with an all-mains set, but surely the rectifier valve should be left out of the calculation?

Personally, I have always regarded this valve as part of the power-supply unit, which is replaced in other all-mains sets by a metal rectifier.

Again, the rectifier valve does not enter into the actual circuit of the set, either as an H.F. or L.F. amplifier, or as a detector. Yet again, to regard the rectifier valve as one of the total valves in any set is to mislead a would-be purchaser, who always regards a set from an efficiency point of view from the number of valves fitted to it.

I am certain that if I were to design a set for a client, and include the rectifier valve as making one of the total number, I should be guilty of misleading my client.

Let all in the radio industry get this matter straight once and for all, and thus avoid ambiguity on the point, that the rectifier valve is part of the mains supply, and is not a radio valve in the proper sense of the word at all, as many other types of rectifier valves are used in the electrical world, solely for the purpose of rectifying A.C. supplies in supply stations and for battery-charging equipments.

HUBERT W. HAYDON,
Technical Director.
Radia Electric Co. (Gloucester), Ltd.,
Gloucester.

B.B.C. Frequency Tests.

THE correspondence which has appeared in *The Wireless World* and other journals from listeners whose appetite for frequency tests has been whetted by the recent broadcast by Mr. Watson Watt will, it is hoped, have the desired effect on the B.B.C. It is difficult to imagine any reason why the Corporation should not devote a few minutes per week to a test transmission, which would be of immense value in raising the standard of reception; an object in which the B.B.C. is by its own account vitally interested. The broadcast already carried out is proof that there is no objection in principle.

It is satisfactory to presume that, if such tests become a regular feature, technical objections will act to prevent these transmissions from being superimposed on the more important musical programmes, seeing that æsthetic considerations alone have no weight, as in the case of the time signals.

There are two points in connection with measurements based on broadcast frequency tests that may be of interest. If through excessive strength of reception, or imperfect apparatus (particularly of the selective tone-corrected type), the lower frequencies are distorted, the harmonics thus produced would give a fictitious reading. Suppose the receiver is a bad one, reducing 50 cycle notes by 10 db. as compared with the frequency of a 30 per cent. harmonic produced. The curve instead of falling to the extent of 10 db. at the low end would show only a 4 db. drop, the reading being boosted by the harmonic to an extent out of proportion to its actual intensity.

The other effect was observed by listening to the B.B.C. test on a receiver giving good reception up to 10,000 cycles. As the test modulation rose to its highest point, a *descending* note of considerable strength was heard, being the beat note between the London sideband and the adjacent carrier wave. This would, of course, tend to vitiate the high-note readings.

M. G. SCROGGIE.

London, S.E.19.

One Licence—How Many Sets?

I HAVE recently purchased your Diary and Note Book for 1933, and notice that on page 4 you give a Summary of Regulations Controlling Receiving Licences. In this short article you say that a single receiving licence will cover the installation of more than one set, provided that the sets are in the same house.

In *The Times*, November 23rd, the following paragraph appeared:—

WIRELESS LICENCES.

In the course of the hearing at the Stratford Police Court yesterday of a number of summonses against residents of Romford and Ilford for having a wireless set without a licence it was explained that one owner had two sets, and his explanation was that he thought one licence covered both if they were in the same house. Mr. F. H. Plummer (prosecuting).—There must be a licence for each set. Mr. Godlee (Chairman).—If there is an extension from one room to another? Mr. Plummer.—One licence is sufficient for an extension, but a separate licence must be obtained for each set. The defendants were fined 40s. each.

From this it would appear that one licence covers only one receiver in a house, and one portable, under certain conditions, according to the G.P.O. licence.

I own a commercial three-valve set, and a home-made superhet., which I have always understood were covered by one licence.

Thanking you in advance for your kindness in assisting a regular reader of your excellent paper. F. W. G.

Grange Park, N.

[We have always understood the position with regard to more than one set to be that the Postmaster-General approves of two or more sets or loud speakers being made use of under one licence, provided the sets or speakers are used under the same ownership. If a set is installed in a house, speakers can be run to different rooms in the house, but

Letters to the Editor.—

if any of these rooms are let off, whether the house is divided or not, then each separate occupier is required to have a separate licence. This position has been made clear, we believe, on more than one occasion by the Postmaster-General, and we are glad to be able to confirm that no change in the regulations has taken place.

The Times subsequently published a statement from the Post Office that sufficient detail of the prosecution had not been given as the two receiving sets in the house in question belonged to different people.—ED.]

Tuning Scales.

AS an enthusiastic wireless amateur, I have sometimes wondered that there has been no references in your columns to the present practice on the part of manufacturers in the method of marking the scales on the dials of their sets.

I have taken a rough survey, with results as follows:—

1. Dials marked only at the 50 or 100 divisions, of which one had the lines so thick that I should say at least three stations come in on one line.

2. A type with a sort of logarithmic scale, where at one end 50 is divided in three and at the other in five!

3. With the names of stations only, but no sign of an indicating pointer to show which of the many names visible through the aperture is the one in tune.

4. Divided into the normal 100 or 180 divisions.

Of these, No. 1 is the commonest, and No. 4, which I consider the best, is presumably old-fashioned, as few sets have it.

As, with modern sensitivity in sets, stations come in at every degree of a fully graduated dial why all this ridiculous marking?

C. GUSTAVE DUHL.

London, W.11.

CLUB NEWS.

Fog Has No Terrors.

MR. F. H. HAYNES gave an excellent talk and demonstration on the subject of superheterodyne operation at a recent meeting of the Tottenham Wireless Society. The Haynes A.C. Super brought in practically every broadcasting station in Europe, and this, according to the official report, "despite the very dense fog outside."

Hon. Secretary: Mr. W. B. Bodemeaid, 29, Pendennis Road, Tottenham, N.17.

Spotting the Errors.

A NEW idea was tried out at a recent meeting of Slade Radio (Birmingham). After a circuit had been drawn on the board members were asked to point out the mistakes it contained. The majority of the eighteen errors were soon discovered, but the remainder were not so easily located as, in some cases, they entailed an alteration in values. A most profitable discussion ensued.

Full particulars of the Society can be obtained on application to the Hon. Secretary, 110, Hillaries Road, Gravelly Hill, Birmingham.

Cossor Set Described.

AN interesting lecture-demonstration of Cossor A.C. mains receivers was given by Mr. Hartshorn (of Messrs. A. C. Cossor, Ltd.) at a recent meeting of the Smethwick Wireless Society, held in the Clubroom, Crown Hotel, High Street, Smethwick.

Mr. Hartshorn discussed the circuit diagram of the Cossor four-valve A.C. receiver, and showed how the problems of selectivity and cross-modulation had been met by the Cossor variable-mu S.G. valve. He also showed the refinements incorporated in this set, which contributed to purity and volume of reproduction.

Intending members should apply for particulars to the hon. secretary, Mr. E. Fisher, M.A., 33, Freeth Street, Oldbury, near Birmingham.

Ratepayers and Radio.

THE radio section of the New Eltham Ratepayers' Association holds fortnightly meetings. Recently an interesting talk on condensers was given by Mr. Gwynne, of the Telegraph Condenser Co., Ltd. Membership of the radio section is open free to all members of "N.E.R.A." Hon. secretary, A. E. Gillborn, 87, Montbelle Road, S.E.9.

The Argument for Tone Control.

IT was with the closest attention that members of the North Middlesex Radio Society listened at their last meeting to an authority on sound reproduction giving his views on this important matter of tone control. This was Dr. Hughes, who was lecturing by the courtesy of Multitone Electric Co., Ltd.

Dr. Hughes dealt in detail with the various factors involved. Some European broadcasting authorities, he said, put the higher notes out at a higher level than the rest, on the grounds that the majority of receivers failed to reproduce them properly. Others decided that the receiving sets as a whole required more bass, and so on. Hence the need for individual tone control. Then there was the question of the loud speaker response. Dr. Hughes showed, by means of polar diagrams and response curves, that the position and direction of this instrument had a profound influence on the character of the sound waves reaching the ear. On the whole, he considered that, in view of the number of variables in the reproducing chain, some form of adjustable tone control was desirable.

Two views showing the receiver alone and combinedwith gramophone reproducer and record cabinet.

A demonstration was given of a receiver which incorporated a "Multitone" transformer, and a description of its construction and theory followed.

A film was shown, demonstrating exactly how the response curve varied as the control knob was turned.

An attractive programme of lectures, demonstrations, etc., for the winter session has now been prepared, and a copy will be gladly sent to anyone interested on the receipt of a postcard by the hon. secretary, Mr. E. H. Laister, Windflowers, Church Hill, N.21.

The H.M.V. Film.

THE Gramophone Company's film on "Record Manufacture" was presented to the Bristol and District Radio and Television Society at their meeting at the University on Friday, November 11th. At the same time one of the latest H.M.V. radiograms was demonstrated. Hon. secretary, Mr. G. E. Benskin, 12 Maurice Road, St. Andrew's Park, Bristol, 6.

For Worksop Enthusiasts.

THE Worksop Radio Society is now holding regular meetings in the County Technical College, Blyth Road. Full particulars can be obtained from the hon. secretary, Mr. A. Cuckson, 226, Kilton Road, Worksop.

Tone Control.

BEFORE an audience of over fifty, Dr. Hughes recently lectured at a meeting of the Battersea and district Radio Society, on the subject of "Tone Control," explaining the Multitone transformer and the service it can render in securing a pleasing balance of tone. Hon. secretary, Mr. S. F. Harris (G5SH), 43, Southcott Road, S.W.11.

A Nine-year-old Belfast Club.

FOUNDED in 1923, the City of Belfast Y.M.C.A. Radio Club has continued without a break ever since. At the opening meeting of the new session Mr. W. Graham gave a "Chat on Valves," dealing with impedance, mutual conductance, and amplification factor.

The club holds fortnightly meetings at the Y.C.M.A. Headquarters, Wellington Place, Belfast. Morse practice can be carried out every night, an oscillator being used for the purpose.

Hon. secretary, Mr. John J. Cowley, 4, St. Paul's Street, York Street, Belfast.

Coming Events.

FORTHCOMING events in the programme of the Golders Green and Hendon Radio Society include lectures on "Recent Development in Radio Design" (Mr. E. Gardiner, B.Sc.), "Direct Coupled Amplifiers" (Mr. J. C. Emerson, B.Sc.), "How to Test a Superheterodyne Receiver" (Mr. R. M. Barnard, B.Sc.), and "Uses of the Oscillograph to Amateurs" (Mr. Maurice Child).

All communications should be addressed to 60, Pattison Road, London, N.W.2.

A NEW IDEA IN CABINET DESIGN.

WE have in the past rather criticised some British manufacturers for showing lack of originality in cabinet designs for their receivers. There has been rather too strong a tendency to copy whatever designs American manufacturers standardise. It is refreshing, therefore, to come across a design by a British firm which is certainly original and has many points of special appeal.

The arrangement which is illustrated shows that a receiver of this type, which is produced by Radio Furniture and Fittings, Ltd., of 106, Victoria Street, S.W.1, can be purchased in units. The larger illustration shows the wireless receiver proper with electric clock, lamps, and a convenient drawer in which to keep the current issue of *The Wireless World*. The smaller picture shows the same type of receiver, but mounted on a sectional pedestal; the first section is the turntable and pick-up to convert the receiver into a radiogram, and the section below is designed to house gramophone records. It is not necessary to buy the complete installation at once; it can be added to from time to time.

Listening to the receiver in a room darkened except for the lamps on either side of the loud speaker has a pronounced effect in inducing concentration on the items broadcast.

BROADCAST BREVITIES.

By Our Special Correspondent.

The B.B.C.'s Foreign Audience.

WHEN critics of the B.B.C. become unusually vitriolic, the Corporation can always point to the eagerness with which foreign broadcasting organisations relay the British programmes. Since the beginning of September some twenty-five B.B.C. programmes have been radiated from aerials in America, Germany, France, Switzerland, Holland, Austria, and the Irish Free State.

America, Too.

British military band music is especially popular in Germany. France, it seems, has a weakness for our symphony concerts, while Switzerland and Austria like those of the popular variety.

Naturally, the talks are at a discount so far as the Continent is concerned, but in America they are all the rage, especially when the B.B.C. is offering such "scoops" as Mr. Ramsay MacDonald, Mr. John Buchan, and Mr. J. B. Priestley. The Columbia network makes a feature of such events.

War Debt Suggestion.

In this connection may I repeat my former suggestion (which was subsequently quoted in Continental papers) that transatlantic broadcasts might be used to liquidate war debts?

Let America forgo the gold and have—what is surely far more acceptable—a service of continuous tip-top programmes supplied by the B.B.C. We would gladly pay for orchestral performances in the small hours of the morning.

Percy Pitt.

I SAW the late Mr. Percy Pitt at Broadcasting House a few days ago, and was impressed by his vigorous and healthy appearance. No one would have guessed that death was to claim this much-beloved conductor so soon.

Mr. Pitt's musical career went back to the late 'eighties, and perhaps it was because of this that he never seemed quite aware of the limitations of the modern broadcast microphone. In his artistic ardour he sometimes forgot that the music was primarily for the little suspended disc and not the audience on the spot.

A Key to Character.

In other respects he was an ideal choice as the B.B.C.'s first Director of Music. His knowledge of music and musicians was enormous; the walls of his room at Savoy Hill were covered with autographed portraits of such eminent artistes as Melba, Albani, Sims Reeves, and the de Reskes. About these autographed pictures there was something that could be counted as more than coincidence: in nearly every case the wording ran: "To my very dear friend."

My Italics.

I am sorry that the B.C.C. has resurrected that rather fulsome eulogy of itself which was appended to a symphony concert programme of February, 1930. "Without his (Percy Pitt's) vision," said the writer, ". . . the music of the B.B.C. could never have won *its foremost place in the world's art.*" Bow wow!

How to Broadcast Music.

LECTURES of exceptional interest to knowledgeable wireless users are to be given by Dr. Adrian Boult before the Royal Institution on Saturdays, December 3rd, 10th, and 17th. The B.B.C.'s Director of Music is to make public for the first time some of the technical considerations which govern the broadcasting of various types of music, from vocal and instrumental solos to the singing of large choirs.

Secrets of Control.

The Balance and Control Section are to demonstrate how the different transmissions must be handled in their passage between studio and transmitter, and Dr. Boult will also have the assistance of Mr. Hely Hutchinson, the conductor and pianist, Mr. Stuart Robertson, vocalist, and the Wireless Singers. The Blattnerphone may also be demonstrated.

The fee for the course of three lectures is half a guinea, and tickets are obtainable from the Institution, 21, Albemarle Street, London, W.1. The lectures begin at 3 p.m.

Lookers and Listeners.

PERHAPS you are a "looker" and do not know it. I hear that Mr. Baird, in consultation with the B.B.C., has decided that "looker" is the best television equivalent to "listener."

Now we want a word for the man who looks and listens at the same time.

Christmas "Proms."

THE usual famine of good music at Christmas time is checked at last with the new series of Queen's Hall Christmas "Proms," which opens on New Year's Eve under the leadership of Sir Henry Wood. All the concerts—thirteen in number—are to be broadcast.

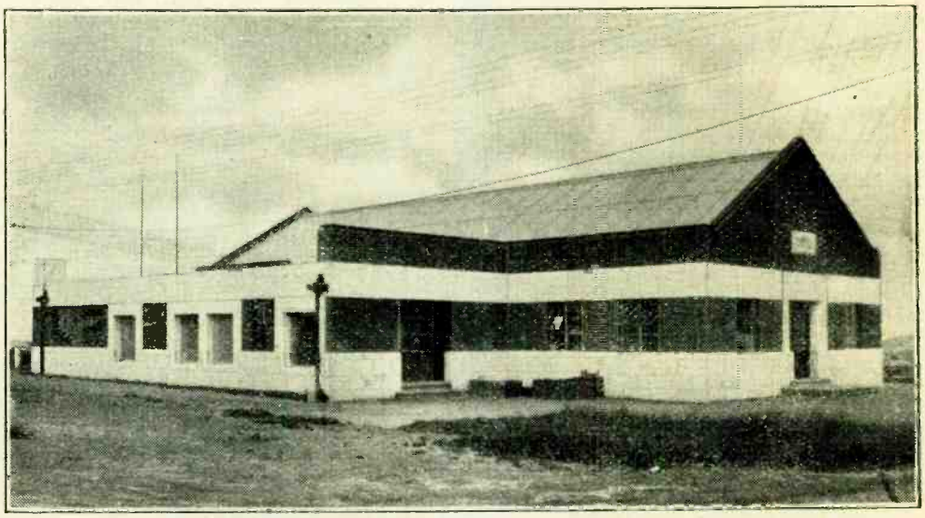
Handel Night.

During the fortnight the programmes will follow a plan not unlike that of the summer "Proms." There will be two Wagner Mondays, two Beethoven Fridays, a Russian concert (January 3rd), a Delius concert (January 5th), a Bach concert with a second half devoted to Haydn (January 11th), and popular miscellaneous programmes on the first and last nights.

January 7th will be devoted entirely to the works of Handel.

Nottingham Studio for East Midlands?

THE long-existent feeling among the listeners in the East Midlands that they have been left out in the cold in broadcasting organisation led Major Gladstone Murray to hold out hopes the other day that the Nottingham studio might soon be revived.



HUB OF THE EMPIRE SERVICE. The new building at Daventry housing the B.B.C. Empire short-wave transmitters. Regular programmes will begin on December 19th. Six days later the Christmas message of H.M. the King will be radiated throughout the Empire.

Artistes Out of Pocket.

The Nottingham relay station was closed down in October, 1928, when a vague promise was given that the studio might be retained for regional use. Nothing has been done for four years, and artistes from Nottinghamshire, Lincolnshire, and Leicestershire have had to travel all the way to Birmingham to broadcast. In some cases they have complained that their fees were insufficient to meet their travelling expenses.

Satisfied Enquirer.

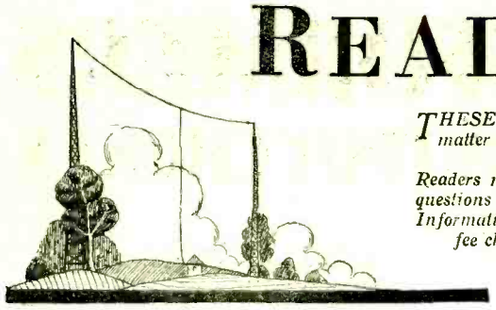
I LIKE the story now going the rounds of the French Radio Press concerning the very popular announcer with whose voice numerous lady listeners were reported to be in love. A few evenings ago a gentleman turned up at the station and insisted on seeing the vocal Adonis. The interview was short.

"Are you really Mr. X?"

"I am veritably he."

"Thanks, that is all I wanted to know," and the visitor departed radiant. Outside he told a friend in confidence: "My wife is in love with his voice: this has made me very uneasy, but now that I have *seen* him I can sleep peacefully."

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.

Variable-mu Valves: Bias Values.

IN order to obtain the full range of volume control desirable with variable-mu valves in the immediate vicinity of a powerful station, it is desirable to make provision for the application of a negative bias voltage of quite a high value. When dealing with battery-fed valves, a 16½-volt bias battery is none too large, and so voltages of this order are often specified for use with the new valves.

But this cannot be taken as a hard and fast rule. It is really a matter of geography, and is further bound up with the overall sensitivity of the set. When no signals of abnormal strength are to be expected, the de-sensitising effect of, say, a maximum bias of 9 volts is likely to be ample—at any rate for a set with one H.F. stage.

This matter is raised by a correspondent who is using in his H.F.-det.-L.F. three-valve receiver a pentode output valve, for which a 9-volt bias battery would be enough; he asks whether, in order to provide ample voltage for a variable-mu valve, he should change over to a battery of higher voltage.

As our querist lives, wirelessly speaking, in the wilds, we feel quite certain that the maximum bias of 9 volts will be ample for the variable-mu valve that he proposes to fit.

Switching Procedure.

THERE seems to be still some uncertainty as to the correct procedure to follow in switching on and off a set with battery valves, which is fed with anode current from A.C. mains through an eliminator.

The subject is, perhaps, not of very great importance, but it is as well to play for safety, and carry out the operations of switching L.T. battery and H.T. eliminator in the correct sequence. By doing so, the risk of an undue rise in H.T. voltage and consequent damage to condensers or other components is minimised. The rule is:—

Switching on.—Low-tension battery circuit first, then the eliminator. By doing this, it is ensured that the valves will begin to draw current from the eliminator as soon as voltage from it is applied to them.

Switching off.—Procedure should be reversed, the eliminator being switched off before the filaments.

With D.C. mains eliminators, the sequence is of hardly any importance, as the H.T. voltage cannot rise to a value greater than that of the supply system. At the risk of making the subject rather more complex than it really is, it may be stated that there is something to be said for reversing the "A.C." procedure, as by doing so, the production of surge currents is likely to be minimised.

A Short-wave Converter.

AS he already has a broadcast receiver of which the L.F. stage closely follows that included in the "Short-Wave Two" (November 4th), a reader asks whether it would be practicable to build the detector portion only of the short-wave set, and then to devise a scheme for connecting it at will to the L.F. amplifier of his existing receiver.

This is a good plan, and one that has often been put into satisfactory operation. Further, it is not strictly essential that the L.F. end of the set to be adapted in this way should have precisely the same L.F. amplifier as that of the "Short-Wave Two."

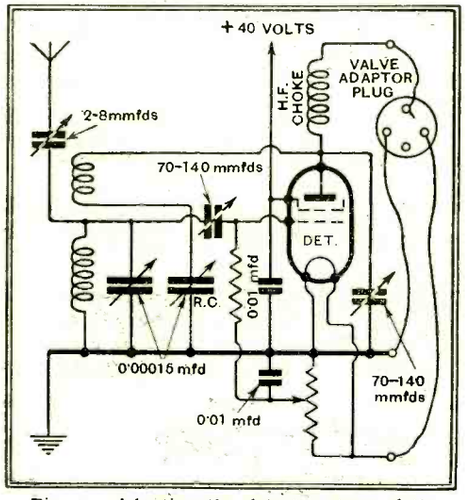


Fig. 1.—Adapting the detector stage of the "Short-Wave Two" for use with an existing L.F. amplifier.

It will generally be best to make the conversion on the lines suggested in Fig. 1. This will be recognised as the detector portion of the "Short-Wave Two" connected to an adaptor plug, which is intended to be inserted in the detector valve-holder of an existing set—of course, after having removed the original valve.

Due to the fact that a screen-grid detector is employed, it will also be necessary to make provision for the supply of about 40 volts H.T. to the screening grid. The short-wave unit may be permanently "earthed," but the aerial lead must be transferred. All other connections are made automatically through the adaptor plug.

Dual Loud Speakers.

AS has already been pointed out, it is quite possible to fit dual-matched loud speakers to the "Modern Straight Five." The only departure from the standard circuit arrangement that need be made in such cases is to replace the 2,500-ohm voltage-reducing resistance by the field winding of the second loud speaker; this winding should, of course, have the same ohmic value as the resistance which it displaces.

With the standard "Monodial A.C. Super," the use of dual speakers is not quite so straightforward. In this set, as it stands, there is no surplus H.T. wattage for energising the field of a second loud speaker; accordingly, this instrument should include its own current supply system, or, alternatively, should be of the permanent-magnet type. At least one manufacturer of matched loud speakers is willing to supply pairs, consisting of an energised and a permanent-magnet model.

There is still another possibility; the power unit of the "Modern Straight Five" may be constructed and connected to the dual speakers as suggested above. It may then be operated in conjunction with the "Monodial Super" in the manner described in the constructional article.

What the Milliammeter Shows.

THE user of a short-range "quality" set, fitted with two resistance-coupled L.F. stages, has noticed a definite falling-off in reproduction; this is particularly noticeable when volume is increased to a fairly high level.

A milliammeter has been inserted in the output valve anode circuit; its needle remains reasonably steady, and, as current is normal, it is rightly concluded that this stage is probably in order.

But on transferring the meter to the anode circuit of the penultimate valve, violent and almost continuous "kicks" of the needle are observed. Our queriest knows that the meter should indicate a steady current, and so he assumes that overloading is taking place; he asks what may be deduced from the fact that all the "kicks" are in a downward direction.

Provided that the set is properly designed (our present concern is merely that the penultimate valve should be capable of fully loading the output stage without itself being overloaded), fluctuating *reductions* in current would indicate a flow of grid current, due to insufficient negative bias.

If our correspondent is sure that the bias arrangements are in order he should transfer his attention to the coupling condenser in the grid circuit of the valve which is giving the trouble. Any leakage current from the source of H.T. which may pass through this condenser will tend to reduce the effective bias voltage.

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.

The Wireless World

THE PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 693. FRIDAY, DECEMBER 9TH, 1932. VOL. XXXI. No. 23.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

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 8846 (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: 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.

CONTENTS.

EDITORIAL COMMENT.

Christmas Notes.

Make This a Wireless Season.

EARLY information indicates that this year Christmas will be celebrated more actively through the medium of broadcasting than ever before; our own stations are organising special programmes to meet the occasion, whilst all over the Continent impressive efforts will be made to ensure that the programmes shall make a special appeal at the festive season, and in many cases we shall be given a vivid impression, through the broadcasts from abroad, of how Christmas is celebrated in different localities and languages throughout Europe. Listeners should make a special point of studying the Christmas programmes from abroad and entertaining their friends by passing from one station to another and picking out the best of the items.

We would like to feel that all our readers will do what they can to make this Christmas a truly wireless one. There can be no better way of stimulating good fellowship and understanding, not only at home but between nations abroad, than through the medium of broadcasting.

Choice of Gifts.

In the matter of the choice of gifts for our friends at Christmas time, wireless provides, too, an exceptional opportunity for selecting presents to suit every pocket; presents which we can give with complete confidence that they will be acceptable, not only to individuals in the home, but to every member of the household. Those who have not already got wireless may want to build a set for themselves, or start with a complete receiver, whilst those who already have sets will certainly be in need of some extra or replacement which will be a welcome gift.

Receiver Booklet.

Those who contemplate complete sets as presents will welcome the booklet issued as a supplement with this issue, as it provides a guide to British receivers of all types. This reference booklet appears at an opportune time, because this is certainly the buying season and, in the rush of Christmas shopping, this descriptive guide will save much time and worry in making a choice.

In this issue we include the constructional details for building the D.C. version of the famous Monodial Super, and for those especially who take a keen interest in foreign station reception, there can be no better choice of a receiver to build.

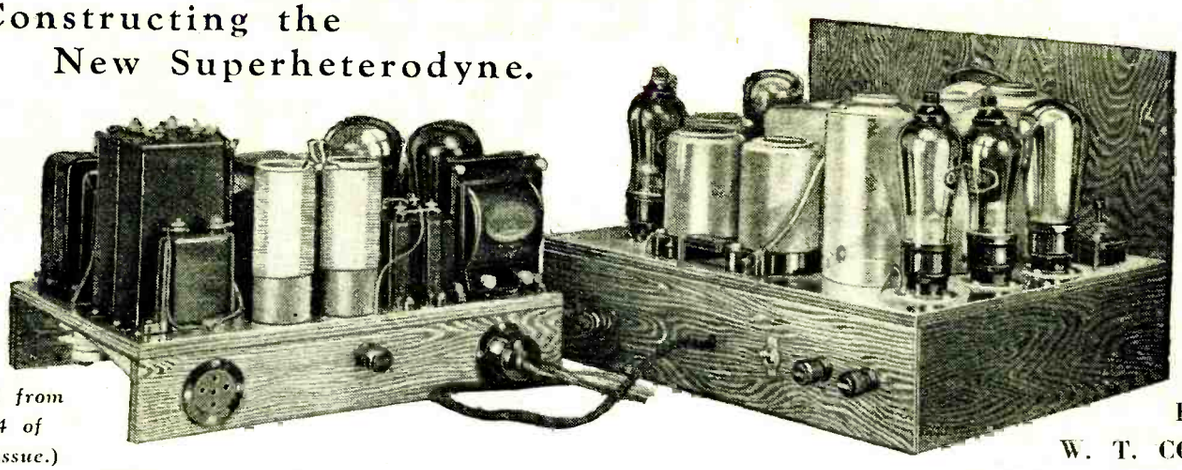
We also announce in this issue a straightforward three-valve receiver which will be described next week. This set has been designed to give the best performance which can be attained from a three-valve set, taking into account extreme simplicity of construction, cheapness and reliability. The parts for this receiver will make an ideal Christmas gift.

We take this opportunity of extending our sincere good wishes to all our readers at this season, including those in the remotest parts of the Empire, with whom we hope a closer link will soon be formed through the medium of the Empire Broadcasting Station.

In the inauguration of this station we feel that we have more than an ordinary interest; it is now many years since we came forward with the proposal that an Empire Broadcasting Station should be set up, and although progress has been slow till now, yet we look forward to rapid developments in the future.

MONODIAL D.C. SUPER.

Constructing the New Superheterodyne.



(*Concluded from page 494 of previous issue.*)

By W. T. COCKING.

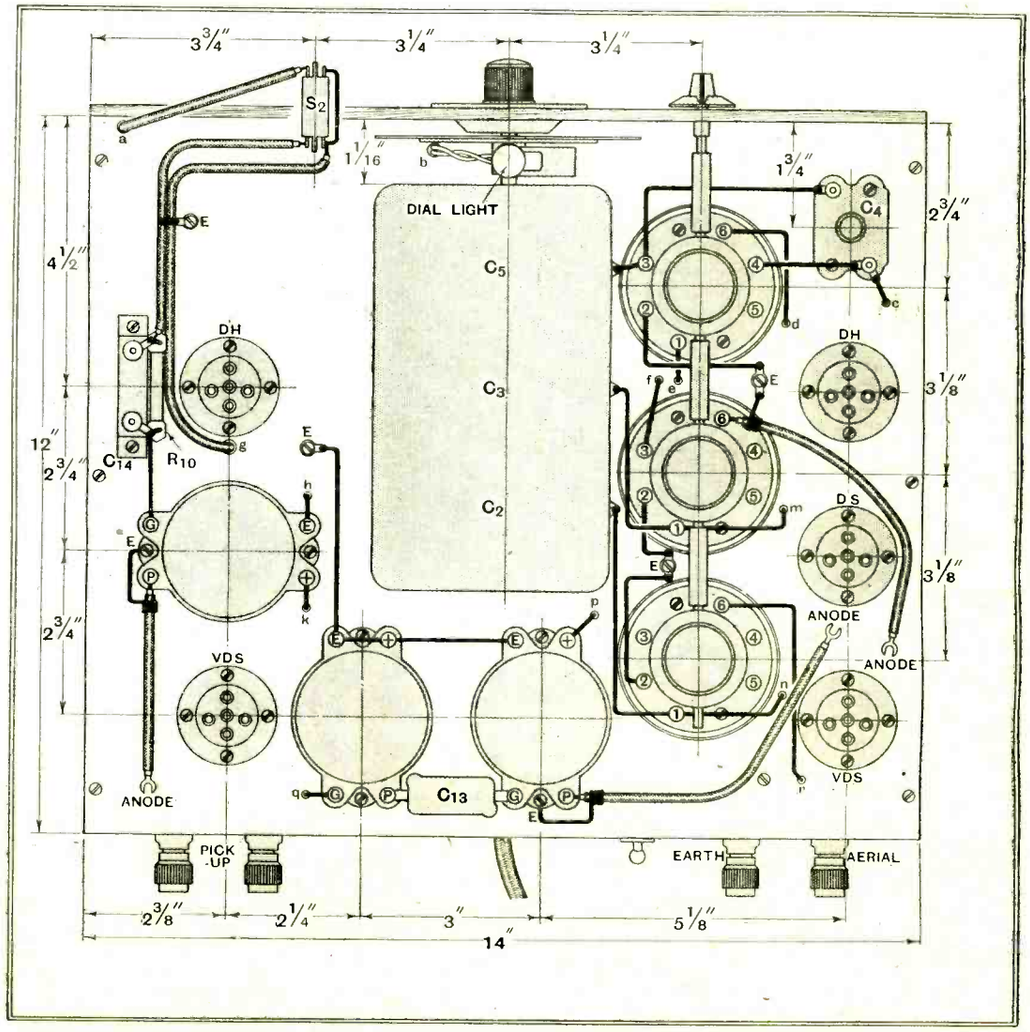
Effective Nine-kilocycle Selectivity and High Sensitivity.

FOLLOWING the practice adopted for earlier receivers, a two-unit construction has been adhered to, and this offers many practical advantages. The baseboards are aluminium covered, and may be obtained ready drilled; it should be noted that the fixing screws for the three-gang condenser are rather short, and it is necessary to countersink deeply the underside of the base. Care should be taken not to deviate from the specification, not only in regard to the layout, but also in the manner in which the various connecting leads are run. This is highly important, since alterations to such normally uncritical leads as the heater connections may have unlooked-for results.

As far as possible, it is wise to test the components before including them in the set, and the connection of wires renders such testing difficult. Coils and I.F. transformer windings should be tested for continuity, while condensers should be tested for their insulation. When all components are screwed down, and before wiring is commenced, it is advised that the insulation of all components, other than the frame of the gang condenser and the coil screens, from the chassis be checked.

The actual adjustment of the receiver is quite simple. Even with all circuits badly out of tune, it should be possible to receive at least one station; it should be noted that if no results at all can be obtained the mains plug probably requires reversing in its socket. Having found a station, the trimmers on the I.F. transformers should be roughly adjusted for optimum strength, and the coils then coupled as loosely as possible while keeping the signal still just audible; in the case of a local station it will be necessary to turn down the volume control considerably.

Each trimmer should then be accurately adjusted for the maximum response. The coils in the third transformer, the I.F.—second detector coupling, should then be coupled to give optimum signal strength, or slightly tighter. The coils in the first I.F. transformer are next adjusted for optimum signal strength. The second transformer comes next, and here the precise adjustment will depend largely upon the loud speaker used. The setting should



The layout and wiring of components situated on top of baseboard. Principal dimensions for drilling are given.

Monodial D.C. Super.—

be for the best quality, and with a speaker giving a good high-note response this will usually coincide with the adjustment for maximum sensitivity.

The two trimmers on the signal-frequency circuits should next be nearly fully unscrewed, and the oscillator trimmers set at about one-half of its capacity. A station on as low a wavelength as possible should now be tuned in, and the two trimmers on C_2 and C_3 adjusted for maximum response. If any difficulty be experienced in finding a very low wavelength station, a rough adjustment should be made on about 250/300 metres, after which a station on about 220 metres should be obtainable.

A station on about 500/550 metres should next be found, and the oscillator trimmer adjusted while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings be obtained. A return should then be made to the low wavelength station, and the two pre-selector trimmers readjusted. The ganging should then hold over the whole of the medium waveband, and the sensitivity and selectivity should be up to standard.

A LARGE number of requests have been received for a D.C. mains version of the Monodial A.C. Super which has gained such high praise for remarkable all-round performance. Constructional details and hints on operation are given in the accompanying article, which forms the second instalment.

Ganging on the Long Waves.

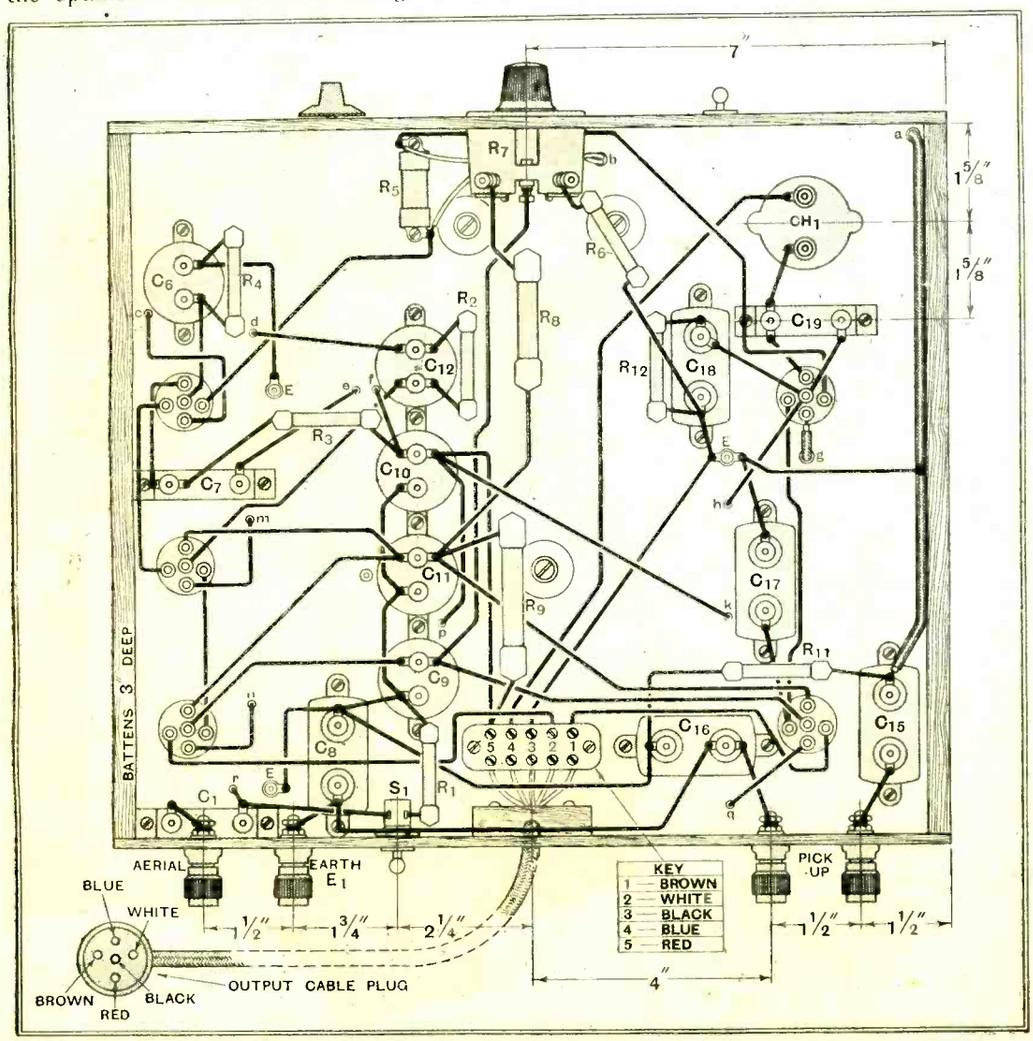
On the long waveband only one adjustment is necessary. A station on a high wavelength, such as Radio-Paris, should be tuned in and the padding condenser C_4 adjusted while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings be found. Needless to say, while all ganging adjustments are being carried out the "Local-Distance" switch should be set for distance, and if the ear be relied upon as an indicator of signal strength the volume control should be kept such that the signal is only weak.

Adjusting for Quality.

Some attention should now be given to the question of the exact setting of the I.F. coils, for upon this depends the selectivity and quality. The looser the coupling the greater will be the selectivity, but an excessively loose coupling will result in a loss of the high musical frequencies. Some compromise may be advisable, therefore, but in general the best all-round results will be obtained by making the adjustment for the best quality while listening to a programme which is itself of good quality and well balanced.

A B.B.C. or German local programme, not a relay which may itself be distorted, should be chosen, and the programme should be of a well-balanced type. Thus, it is obviously out of the question to attempt to adjust the set for quality when the item broadcast consists chiefly of low notes, and the endeavour to obtain high frequencies which are not present in the studio performance will lead to excessively tight coupling of the coils and poor selectivity. Similarly, if the adjustment be carried out on a programme which is itself lacking in bass, the couplings will be made too loose.

Dance music is one of the best programmes for the quality adjustment of a receiver, since the volume remains at a fairly constant level, and both low and high notes are normally continuously present. Moreover, this type of programme is rich in transients which require a good high-note response for their proper reproduction.



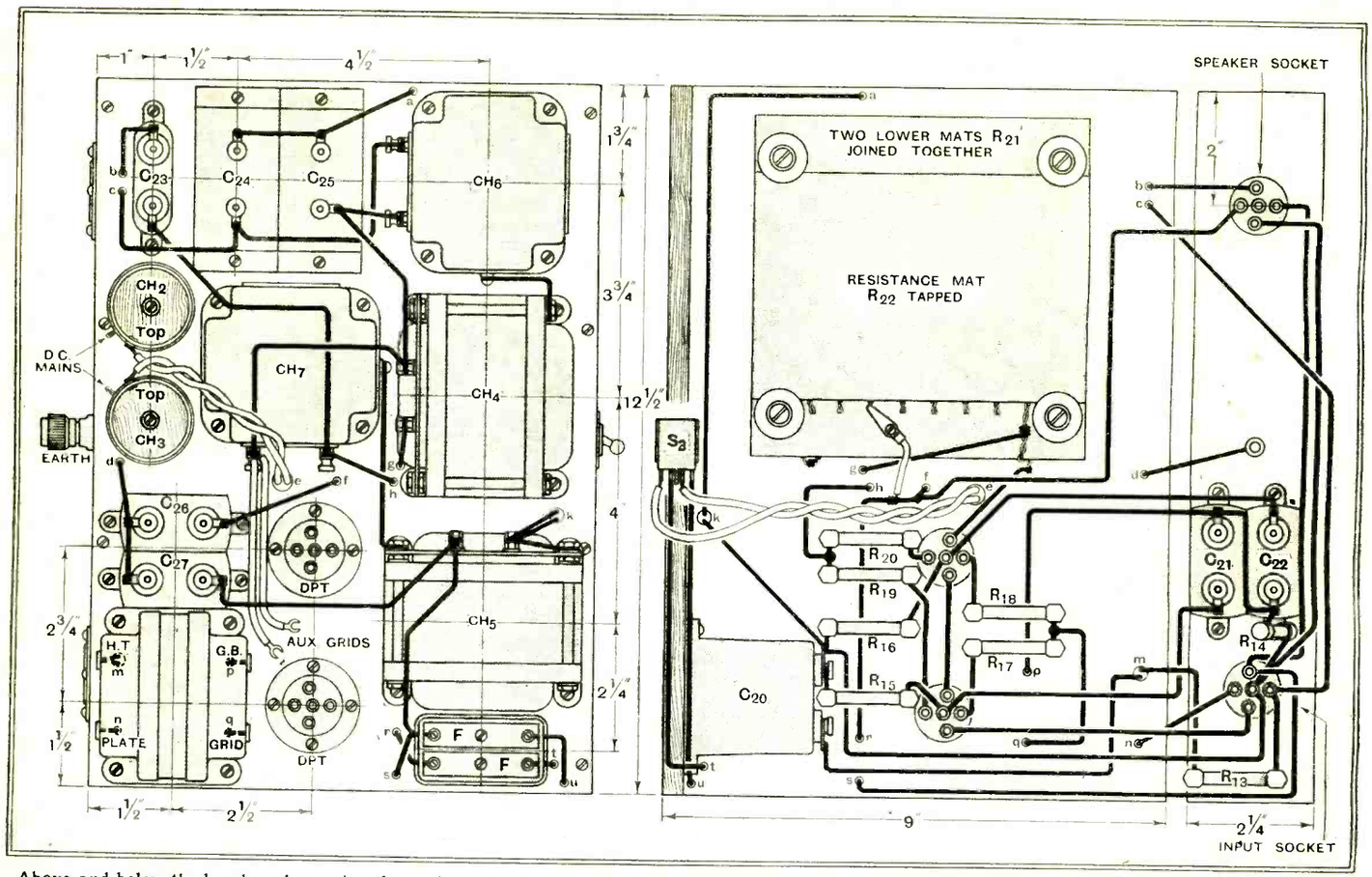
The bulk of the wiring connections are made on the underside of the baseboard, where most of the small components are housed.

Alternative Earths.

It will have been noted from the circuit diagram and the constructional drawings that two earth terminals are provided. It is not intended that an earth shall be connected to each of these, only to the one terminal which is found experimentally to give the best results. In some cases the normal connection to terminal E_1 will be found the best, but in others the mid-point connection to E_2 will be greatly superior; in some locations, however, it may be found desirable to dispense with a local earth connection entirely. After changing the earth connection in any way one should not forget to readjust the trimmer on C_2.

It must not be forgotten that in a D.C. set all components are in direct connection with the supply mains, and as a result, if the positive of the mains be earthed, metal parts should on no account be handled while the set is switched on. In any case, it is wise to use an insulated screwdriver for adjusting the trimmers on the gang condensers, and a thin strip of wood or ebonite for moving the levers on the I.F. transformers.

Since a wooden panel is employed, the metal escutcheon is insulated, and the construction of the "Radio-Gram" and "Local-Distance" switches is such that



Above and below the baseboard carrying the equipment of the power unit. Complete wiring and dimensional details are given.

their knobs are not in connection with any circuit. Care should be taken to see that the grub screws in the tuning and volume control knobs are well countersunk, however.

Performance.

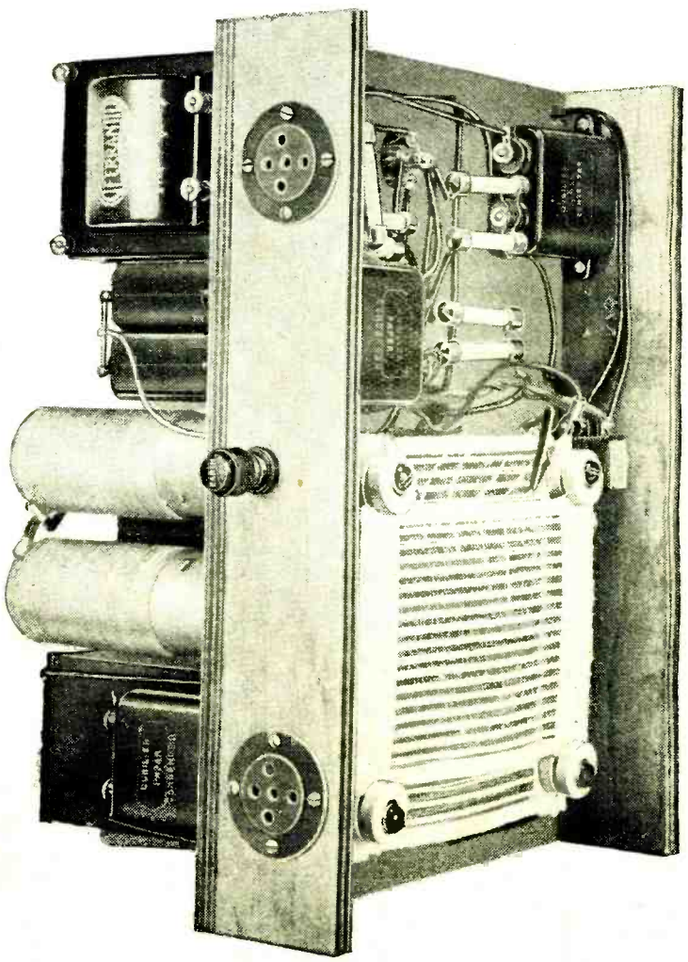
The receiver has been tested at about 12 miles from Brookmans Park, and it was found to give a performance strictly comparable with that of the earlier A.C. model. The quality of reproduction, both from the local and from distant stations, reached a high standard, and this with a degree of selectivity sufficient to permit reception on practically every channel. Stations spaced by 9 kc. could be received clear of one another, and in some cases more closely spaced stations could be received without serious interference. Muhlacker was found to be free from intelligible interference from the London Regional, but was at times subject to sideband heterodyning.

On the long waveband the usual stations are available, and Koenigswusterhausen is clear of its immediate neighbours. The sensitivity is adequate for the reception of the weakest stations, and the limit to range is set rather by atmospheric conditions than by any lack of power in the receiver.

For the convenience of readers constructing the Monodial D.C. Super, full sized blue prints of the complete layout and wiring diagrams of the receiver and power amplifier are available from the publishers at 1s. 6d. post free.

The volume obtainable is adequate for all normal purposes, but is dependent to some extent upon the loud speaker used. The more sensitive the speaker the greater will be the undistorted volume obtainable, and it is recommended, therefore, that a mains energised type of moving-coil speaker be employed. The field winding should be rated for 200/250 volts, and be connected to the mains via the output plug, for then the single switch on the power unit will control not only the set, but also the field current.

A receiver of this nature is well adapted for use as a radio-gramophone, and the two-unit construction lends itself admirably to this. In the case of cabinets such as the Camco "West-



The resistance mats are mounted on the underside of the power unit by means of insulated washers.

Monodial D.C. Super.—

minster" or the Kabilock "Beaufort," it is advised that the receiver unit be placed on one shelf, with the power unit behind the loud speaker on another. To avoid hum, pick-up leads external to the set should, of course, be run in earthed screened sleeving, and be kept as far as possible from all mains leads. On the mains used for testing, hum was inaudible, and, except for the usual two points of second channel interference from the two locals, whistles were marked by their absence.

Since the pentodes are compensated on radio by the side-band cutting of the I.F. circuits, and this is absent on gramophone, it will probably be found that the reproduction from records is too high-pitched. Some form of compensation, therefore, must be inserted on gramophone only. This may be done by employing a lower value than usual for the potentiometer which will be connected across the pick-up. The exact value required, however, will depend upon both the pick-up and the loud speaker used. It is convenient, therefore, to employ the usual value of 250,000 ohms for the gramophone volume control, and to adjust the tone by shunting a suitable resistance across the pick-up. In the general case this will have a value of some 50,000 ohms or even lower.

VOLTAGES AND CURRENTS.

With Volume Control at Maximum.

Valve.	Anode Volts.	Anode Current.	Screen Grid Volts.	Grid Bias.
Pentode 1	160	20.0 mA.	160	6.5
Pentode 2	160	26.0 „	160	7.2
2nd Det.	60*	2.0 „	—	—
I.F.	160	6.8 „	82	3.0
1st Det.	160	0.7 „	82	6.0
Osc.	100	2.2 „	—	2.2*
H.F.	160	6.1 „	82	3.0

Total current from mains 335 mA.
Power consumption about 67 watts for 200 volts mains.
„ „ „ 74 „ „ 220 „ „
„ „ „ 77 „ „ 240 „ „

* Corrected for load imposed by meter. The actual reading will be less by an amount depending upon the meter resistance.

A model of this receiver is available for inspection by readers at the editorial showrooms at 116, Fleet Street, E.C.4.

DISTORTIONLESS L.F. VOLUME CONTROL.

The Case of the Parallel-fed Transformer.

THERE are three obvious positions for the gain control in a resistance-capacity-coupled transformer stage: (1) a variable resistance across the transformer primary, (2) a potentiometer across the secondary with the sliding contact connected to the grid of the subsequent valve, and (3) a variable anode resistance.

Frequency Response.

All three methods possess certain drawbacks as follows: (1) The impedance of the primary winding with the resistance in shunt becomes very small for low values of the gain, and, since this impedance is in series with that of the coupling condenser, which becomes large at low frequencies, the latter are attenuated more than the higher frequencies, so that as the gain is reduced the response characteristic of the amplifier becomes distorted.

In case (2) it is well known that most transformers are designed to work into "open circuit," and that shunting the secondary winding accentuates the effect of the leakage inductance in attenuating the highest frequencies. In the third method, variations of the anode resistance do not upset the amplifier characteristic, but they involve changes of the steady anode voltage, and so shift the operating point of the valve.

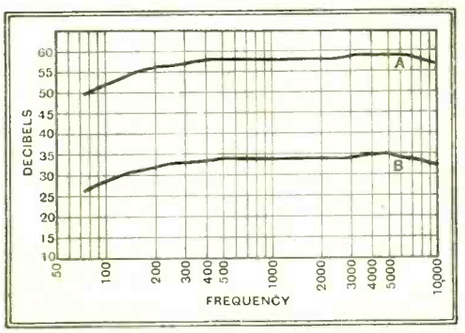


Fig. 2.—Curve A shows maximum volume response, whilst curve B represents the effect of a drop of 24 db.

All these difficulties are obviated in the scheme shown in Fig. 1. It will be seen that, as the gain is reduced, resistance is introduced in series with the condenser, tending to swamp variations of its reactance with frequency.

Fig. 2 shows two gain curves of a small three-stage amplifier using this system of gain control. Curve A was plotted with the full gain; in curve B the gain has been reduced about 24 db. The differences are too small to be worth worrying about.

A convenient value for the resistance of the potentiometer is in most cases about 50,000 to 100,000 ohms.

W. BAGGALLY.

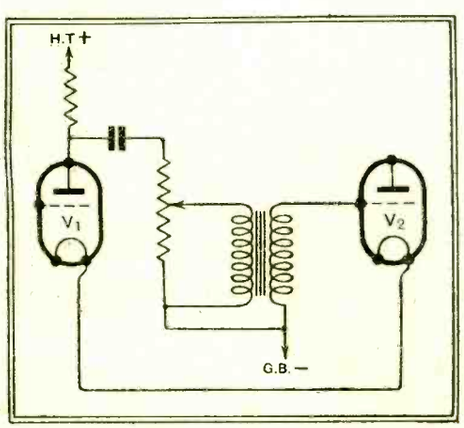


Fig. 1.—A distortionless potentiometer control of volume advocated for parallel-fed transformer coupling.

THE WIRELESS CALIBRATOR.

MUCH ingenuity has been given to the devising of so-called station finders, by means of which the appropriate condenser setting for any wavelength may be ascertained. Alternatively, these indicators may be used to identify an unknown station of which the transmission has been already tuned in.

All successful devices of this type depend basically on the principle employed in preparing a wavelength calibration curve; the settings for a few known stations are observed, and a graph in which wavelength is plotted against condenser readings is drawn.

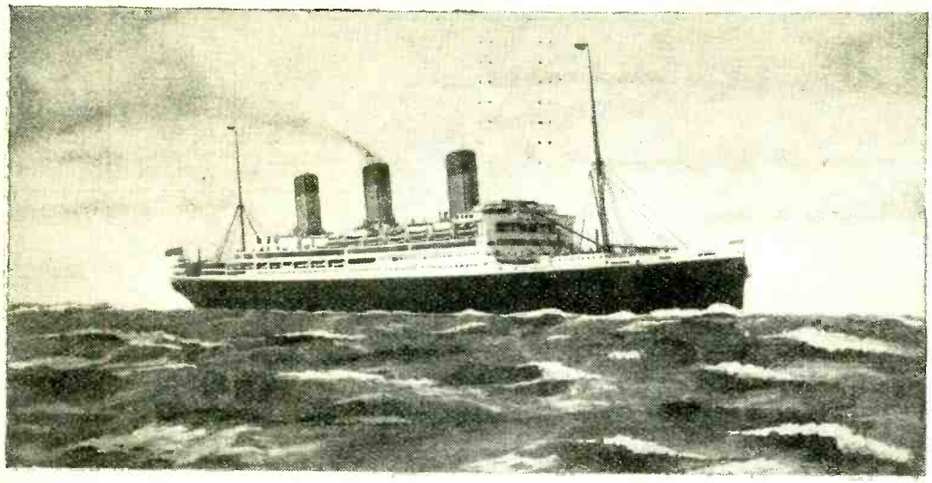
The station indicator published by Wireless Calibrator, of 11, St. Bride's Avenue, Fleet Street, London, E.C.4, consists of printed lists of stations, from each of which correctly spaced converging lines are drawn. These charts are bound between book covers, and a loose semi-circular scale, marked in 0-100 and 0-180 degree scales, is supplied. When a few "key" stations have been located, the dial is set to register on the appropriate lines, when the adjustment corresponding to any other station may be read off at a glance.

The Wireless Calibrator, which costs only a shilling, is both accurate and easy to operate.

Speech from Ship to Shore.

The Public Telephone Service for Ocean Travellers.

By T. W. BENNINGTON.



The White Star liner "Majestic," which has operated a public telephone service since 1930.

TELEPHONE subscribers can now call up their friends in mid-ocean and, atmospheric conditions permitting, can converse with as little difficulty as if the distant speaker were on the inland telephone service.

Here is a simple description of the way in which the two-way circuit is established. The reliability of the service is such that 85 per cent. of the calls applied for are successfully effected.

UNTIL the beginning of 1930 all regular radio communication between ships at sea and the land was confined to messages in Morse. Radiotelephony had not been utilised to any extent, mainly because it was considered that a transmitter capable of giving sufficiently high-grade telephony to permit of connection to the land telephone system was too complicated and expensive a piece of apparatus for ship-board use. Early in 1930, however, the science of marine radio communication was advanced another stage by the inauguration of the first ship-to-shore telephone service, which was opened between Great Britain and the White Star liners "Majestic" and "Olympic," voyaging between Southampton and New York. Preliminary tests being successful, the service was soon put on a regular commercial basis and extended to other large liners, and to other European countries. At the present time it is being further extended to include several smaller passenger vessels.

Advantages of the 'Phone.

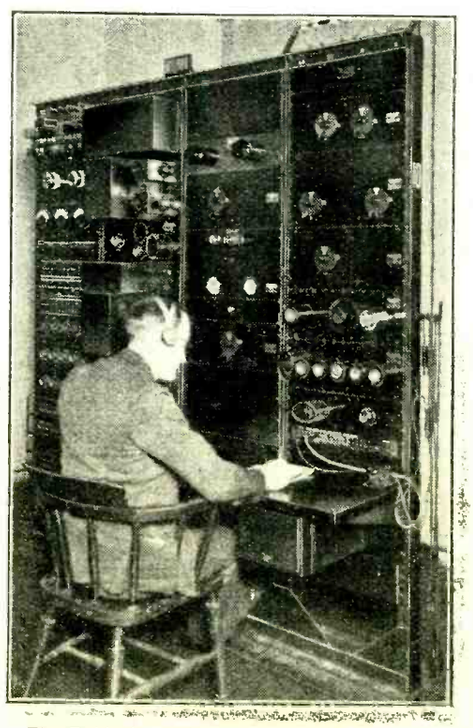
The radiotelephone service has special advantages for certain classes of messages. Two-way communication is effected, personal contact given, a great saving of time may result in the case of urgent messages, and the ships are placed within easy call of practically any telephone in Europe.

The shore end of the service is handled through the stations of the General Post Office, the transmitter and receiver stations being at Rugby and Baldock respectively, and the land wire terminal at the General Post Office, London. The ship installations are controlled by the various marine wireless companies, and differ somewhat in detail, although the same general requirements are fulfilled in all cases.

The radio part of the circuit is established on the short wavelengths, various definite frequencies between 17 and 4 megacycles being utilised, determined by the distance of the ship from the land station, the time of day, and the season of the year.

Reference to Fig. 1 will show how the circuit is established. Actually, two one-way circuits are used between the ship and the London Terminal, two separate frequencies being used for the radio channel, and two one-way land-line circuits between the shore transmitter and receiver stations and London. Here the one-way circuits are combined, so as to make the circuit suitable for further extension over the ordinary telephone system of Great Britain or by undersea telephone cables to other European countries.

On the ships the transmitter input and receiver output lines are combined in a similar way, so as to permit of extension to telephone booths in the passenger accommodation.



The Baldock receiver covers a wide range of frequencies. It can be rapidly switched from one antenna system to another, as required.

A brief glance at the "Majestic's" radiotelephone installation will give an idea of the equipment necessary to maintain a telephone service during the whole of the vessel's voyage between Southampton and New York. This installation is of the type fitted by the International Marine Radio Company.

The transmitter and receiver are housed in the same room in the after part of the ship, the transmitting antenna being immediately above the radio room, while the receiving antenna is suspended about 600 feet farther forward, and connected to the receiver by screened transmission lines. The antennæ, transmitting and receiving, are of the half-wave doublet type.

The transmitter itself employs a master oscillator with crystal control to maintain frequency stability, two frequency doublers being used to obtain the correct transmitting frequency. Push-pull amplifiers bring the power up to 500 watts, and modulation by the Heising method takes place in this stage, the modulators being two 250-watt valves in parallel, two stages of speech amplification having been previously effected. A push-pull stage of water-cooled amplifiers brings the carrier power up to about 3 kW., the peak power of the modulated wave being, of course, dependent on the percentage modulation. Voltage for the transmitter is supplied by three motor generator sets, which obtain their power from the ship's mains, and a motor pump circulates the cooling water through water-cooling radiators and around the valve electrodes.

The receiver is of superheterodyne type, H.F. amplification being carried out in a separate unit. Plug-in coils are used to cover the wave band employed, and each circuit is separately tuned by its variable condenser. An oscillator of special type

Speech from Ship to Shore.—

is used, with an anode bend first detector, followed by several stages of I.F. amplification, an anode bend second detector, and one stage of L.F. amplification. A milliammeter in the plate circuit of the second detector gives visual indication of the received carrier strength, and automatic gain control is employed between the second and first detectors to reduce the effects of fading.

"Combination" of the transmitter input and receiver output lines is effected by means of an apparatus similar to that used at the shore terminal, to be described later. This extends the connection to various booths, to the captain's room, etc.; and enables the technical operator to talk on the circuit, control the input to the transmitter, and to switch any particular telephone into the radio circuit.

Similar equipment, differing according to the different operating companies' designs, is used on all ships where the aim is to maintain long-distance service, whilst recently ships with very much lower powered equipments have participated in the service for a certain distance (up to about 1,000 miles) from Great Britain.

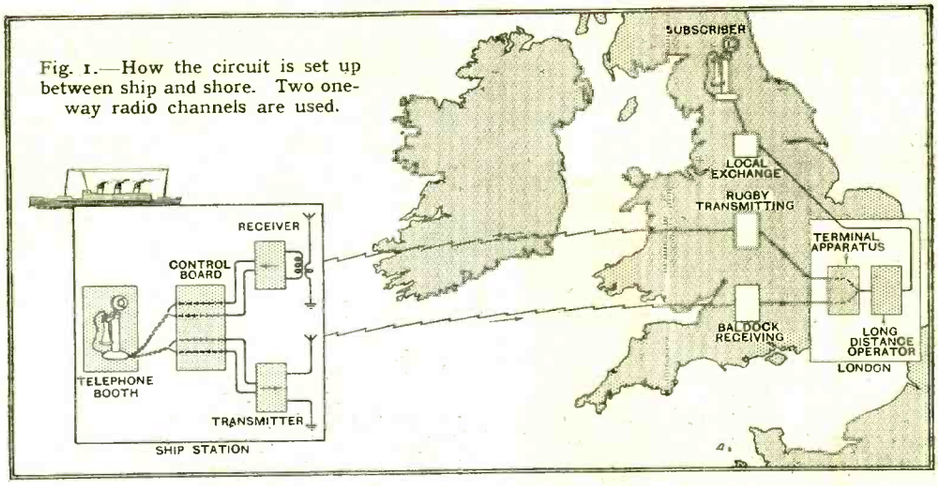


Fig. 1.—How the circuit is set up between ship and shore. Two one-way radio channels are used.

Reducing Atmospheric Noises.

The Rugby transmitter is of a similar type to that used on the "Majestic," the addition of extra water-cooled amplifiers bringing the carrier power up to about 18 kW. Special Post Office directive antenna systems, known as "arrays," are employed to concentrate the transmitted energy in the direction of the North Atlantic steamship lanes. Different arrays are used for the various frequencies, each array being orientated so as to cover the area in which its particular frequency can be relied upon to give best results.

Directive antenna systems are also employed at the receiver station. Besides giving a large gain in signal strength in the required direction, these have the important advantage over non-directive systems of reducing the received noise level, atmospheric disturbances only being received from a direction in which the gain of the systems are operative, and they are practically unaffected by disturbances originating in the opposite direction. The Baldock receiver is of a special type, arranged to cover a wide range of frequencies and provided with switching arrangements to permit of connection to the various antenna systems.

We have seen, then, that the circuit between ship and shore is established by means of two one-way radio channels, and that between the shore transmitting and receiving stations and London by means of two one-way wire circuits. It is at this point that some rather complicated apparatus is necessary in order to "combine" these two circuits for extension over the ordinary telephone system.

A schematic diagram of a typical "combining," or terminal, apparatus, is given in Fig. 3. Very briefly, the action of this apparatus is as follows. Speech currents arriving at the terminal from the shore subscriber divide in the hybrid set, part being dissipated in the output of the receiving repeater, and part being amplified by the transmitting repeater and sent over the land wire to the transmitter. The technical operator at the terminal is enabled to adjust the volume level to compensate for losses on the land wires or for a weak voice. Echoes arising from delay effects on long telephone circuits are suppressed. Similarly, speech currents arriving from the receiver are amplified by the receiving repeater, adjusted to the correct volume level, and, dividing in the hybrid set, part is dissipated in the network, and the useful part is sent on over the ordinary telephone circuit to the shore subscriber.

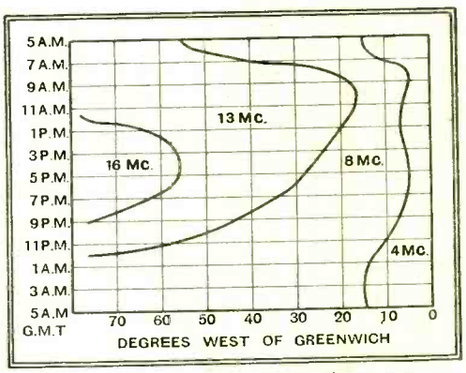
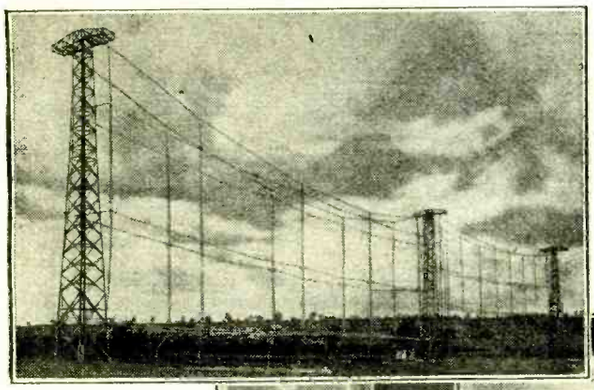
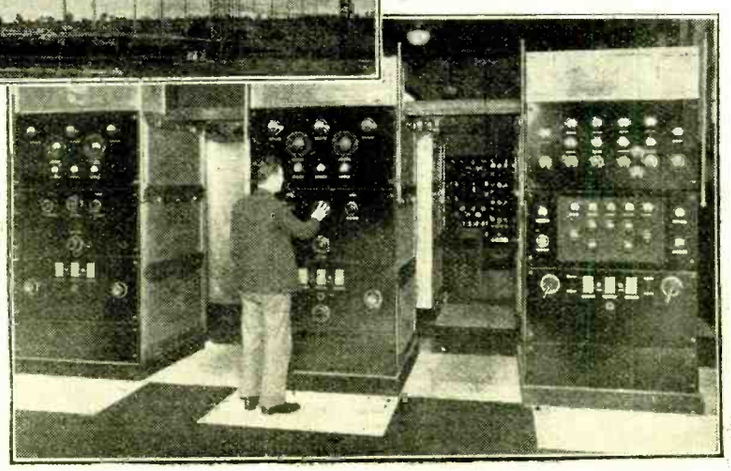


Fig. 2.—Frequency chart for the summer months, showing the optimum frequency for any position on the North Atlantic at any time of day.

Under certain conditions there is a danger of some part of the received currents being returned *via* the hybrid set to the transmitter leg of the circuit, and finding their way to the transmitter. This would cause "singing" round the entire circuit. Again, under certain conditions a "singing" path can occur between the shore transmitter and the shore receiver. To prevent these effects it is desirable to keep the receiving leg of the circuit blocked while the shore subscriber is speaking, and to short circuit the transmitting leg whilst he is listening, thus blocking all "singing" paths, whether from shore transmitter to shore receiver or around the entire circuit. To accomplish this a voice-operated device known as the "Vodas" is used. From Fig. 3 this will be seen to consist of transmitting and

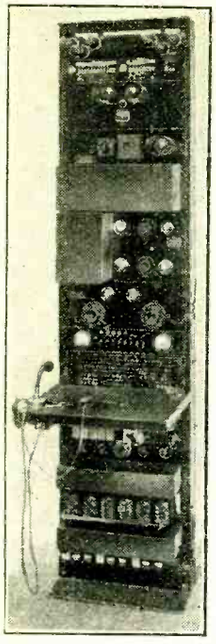


One of the special Post Office "arrays" at the Rugby transmitting station for concentrating the transmitted energy in the direction of the North Atlantic steamship routes.



The Rugby transmitter, which is similar to that used on the "Majestic," but having a carrier power of about 18 kW.

Speech from Ship to Shore.—receiving delay circuits, transmitting and receiving detectors, and certain relays, and is shown in the condition when no speech is being transmitted. Relay A keeps the transmitting path blocked, and relay B permits received speech to pass. When the shore subscriber speaks voice currents go into the transmitting detector and delay circuits, and provided relay C has not already been operated by currents from the receiving detector, operate relays A and B. Operation of relay A opens the transmitting circuit, and operation of relay B blocks the receiving path, and prevents currents from that circuit from reaching the transmitter. When the talker on the ship speaks, relay C operates and so prevents relays A and B being operated by echoes of received speech. When both subscribers stop talking the relays return to normal. Terminal apparatus used on the ships is of a similar nature.



Ship terminal equipment.

The actual choice of a suitable frequency on which to establish the circuit is not such a complicated matter as one might suppose. Field strength data for the whole area covered by the service has been obtained by the engineers for different times of day and for the different seasons of the year. From this data frequency charts have been plotted for the various seasons, showing the optimum frequency for any position at any time of day. A typical chart for the summer months is shown in Fig. 2, the frequencies being given in megacycles. A frequency of approximately 17 megacycles (not shown on the summer chart) is brought into use for long distance work at certain seasons of the year. The operators are, of course, aware of the exact frequencies, both transmitting and receiving, to which the frequencies, in megacycles, refer. The shore operator is kept continually aware of the ship's position, and knowing this, the operators on both ships and shore, by referring to the chart, can see at a glance on what frequency to work.

In general, as is well known, the lower frequencies are best at night time and the higher frequencies during daylight, and the period covered by the lower frequencies increases and that by the higher decreases as the seasons change from summer to winter. Some idea of the skip distances on the different frequency bands, and their diurnal and seasonal variation in point of utility, is given in the table below:—

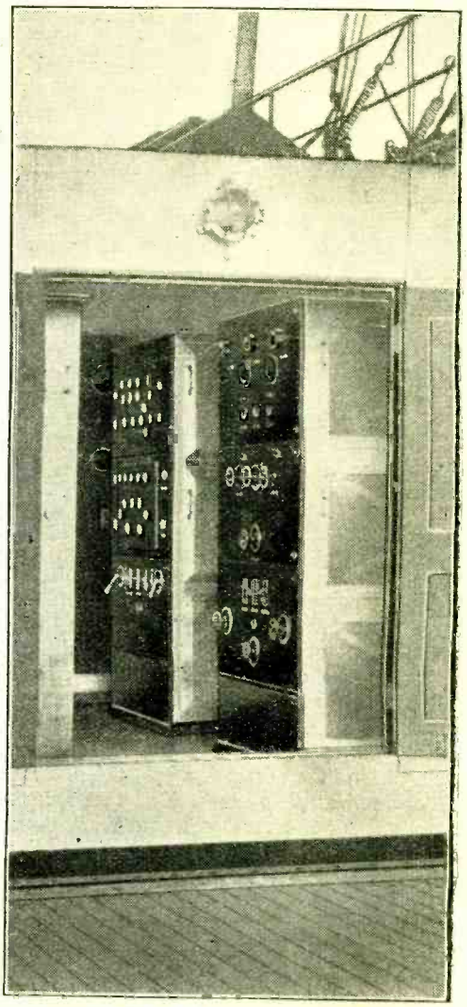
SKIP DISTANCES.

	Approx. Frequency in Megacycles.	Approx. Distance Range in Miles	
		Day.	Night.
Summer	4	0– 250	0– 700
	8	250– 700	700–2,500
	12	700–1,600	2,500–3,000
	17	1,600–3,000	—
Winter	4	0– 300	0–2,500
	8	300– 800	2,500–3,000
	12	800–2,000	—
	17	2,000–3,000	—

"Magnetic storms," and other phenomena, which are the cause of disturbed radio conditions, are believed to have their origin in the sun. The effect of these solar disturbances on short-wave transmission is always to reduce the strength of the received signal, and North Atlantic transmission paths have been found to be more susceptible to their influence than those farther south.

Commercial circuits are obtained for about 85 per cent. of the time during which the service is opened.

Having now briefly reviewed the essentials of the circuit, let us see what happens when, say, Mr. Smith of Leeds picks up his telephone to speak to his business associate, Mr. Jones, travelling to New York on the "Majestic," at present 2,000 miles west of Land's End. Mr. Smith will have previously "booked" his call by telephone, and the long-distance operator will now announce, "Mr. Jones is on the line. Go ahead, please." On Mr. Smith saying "Hullo, Jones," low frequency impulses set up by his voice pass over the wire line to the Leeds exchange, and from there to the long distance switchboard in the General Post Office, London. From here they are sent to the radiotelephone terminal in the same building and, passing through the hybrid set, are amplified, and the volume level adjusted by the technical operator. Next, after having set up currents which operate a relay and "clear the circuit ahead," they pass over a wire line to Rugby, where they are once again amplified and used to modulate the high frequency carrier of the transmitter, by which means they are carried across the 2,000 miles of ocean to the "Majestic's" receiver. Here, after amplification, they are separated from the high frequency carrier, and after being adjusted to the correct level, are sent down to the telephone earpiece where Mr. Jones is listening, and reproduced as sound waves. A similar series of events take place on Mr. Jones replying—from his telephone to the "Majestic's" transmitter, thence to Baldock and the London terminal, through the hybrid set, long distance switchboard and local exchange, and, finally, to Mr. Smith's earpiece.



The transmitter room on the "Majestic." The power amplifier unit is nearest the camera. Beyond is the oscillator-modulator unit.

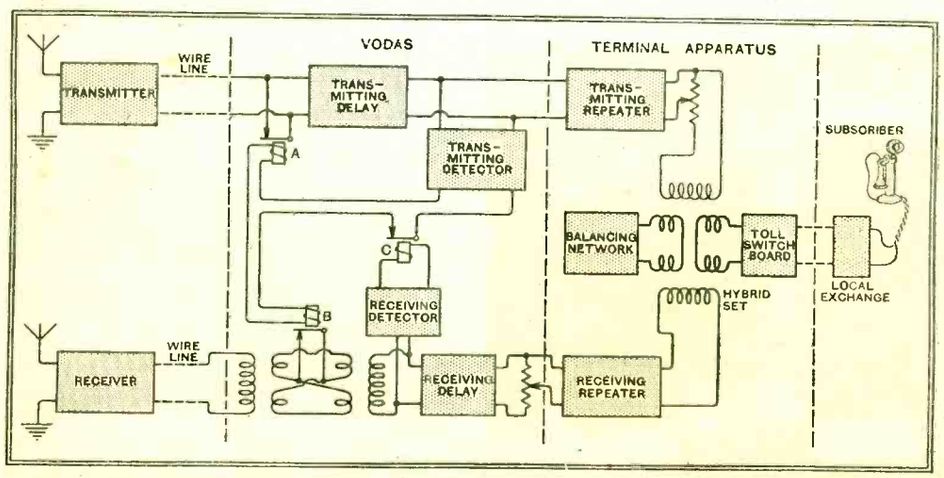


Fig. 3.—Shore terminal arrangements, showing how the two one-way circuits are combined.

NEWS of the WEEK.

Current Events in Brief Review.

Athlone Testing.

THE new Irish Free State 50-kW. transmitter at Athlone is now testing on Dublin's wavelength of 413 metres.

School for Announcers.

FLORENCE has opened the first radio elocution class in Italy. Although intended specially for announcers, the classes will be available to all microphone aspirants.

New Cape Town Transmitter.

WORK is proceeding at the Chelmsford works of the Marconi Company on a 10-kW. transmitter to replace the existing low-power station at Cape Town.

Super Station for Turkey.

THE Stamboul, or Constantinople, broadcasting station cannot be regarded as easy to pick up in this country. The Turkish Government is now, however, building "a super broadcasting station" near to the famous Mosque of St. Sophia, the minarets of which will be used as masts until permanent masts are erected.

Non-stop to the Cape.

WEATHER permitting, the postponed attempt at a non-stop flight from Cranwell to Cape Town will be made by the Air Ministry long-distance monoplane between to-day (Friday) and Thursday next, December 15th. The 'plane will transmit every two hours at even hours, commencing 0600 G.M.T. on a wavelength of 33.71 metres. The call sign is GEZAA. The reception of a distress call should be communicated to the Air Ministry immediately.

Marconi on Micro-waves.

MARCHESE MARCONI, lecturing before the Royal Institution on Friday last, discussed the new system of micro-wave transmission, describing experiments with waves of the order of 50 centimetres in length conducted between his yacht and a station near Rome. The most outstanding result was the successful establishment of communication over a distance of 168 statute miles on a wavelength of 57 centimetres.

"It was effectively demonstrated," said Marchese Marconi, "that these very short waves could overcome the supposed obstacle presented by the curvature of the earth."

He remarked that the use of these waves in broadcasting and television was under consideration.

P.O. "Chief" Retires.

COL. SIR THOMAS F. PURVES, M.I.E.E., who retired from the position of Engineer-in-Chief of the Post Office on November 30th, was the chief British delegate at the Washington International Radio Conference in 1927.

As a telephone engineer of the first rank, Sir Thomas Purves has taken a prominent part in the world-wide extension of international telephony services by wire and wireless. He was elected President of the Institution of Electrical Engineers in 1929. A year earlier he presided over the historic joint meeting of the British and American Electrical Engineering Institutions when the two assemblies were linked by radio telephony. He is succeeded as Engineer-in-Chief by Lieut.-Col. A. G. Lee, O.B.E., M.C.

Christmas Broadcast from Bethlehem?

WE understand that the German broadcasting authorities are arranging a special national broadcast from Bethlehem on Christmas Eve. In all probability the actual transmission will be from gramophone records made on the spot, the land lines from the Holy Land being considered "very doubtful."

The National Broadcasting Company of America are making arrangements for a similar broadcast.

A 7d. Idea.

NEW ideas are specially welcome at Christmas-time. A correspondent sends us an idea for "a very simple and entirely foolproof mechanism that can be introduced at the exceedingly low cost of 7d. each into any portable, transportable, or mains wireless set. The contrivance has the effect of setting up a continuous and loud howl on the actual day the monthly instalment on the set becomes due; it is impossible to stop this howling until payment has been made. I would suggest that the price for this device be fixed at two guineas per set."

"The Signal Through the Receiver."

THE eighth and concluding instalment of this series will appear in our issue of next week. The article will deal with the passage of the signal through the output stage until it emerges from the speaker "near enough to the original music to give acceptable entertainment."

Sophisticated China.

THE inauguration of the new 75-kW. broadcasting station at Nankin is a reminder that China lags very little behind Western civilisation in the matter of wireless. According to a correspondent, not only does every group of fighters possess a mobile wireless transmitter, but no self-respecting gang of Chinese bandits is content without "having a whack" at wireless.

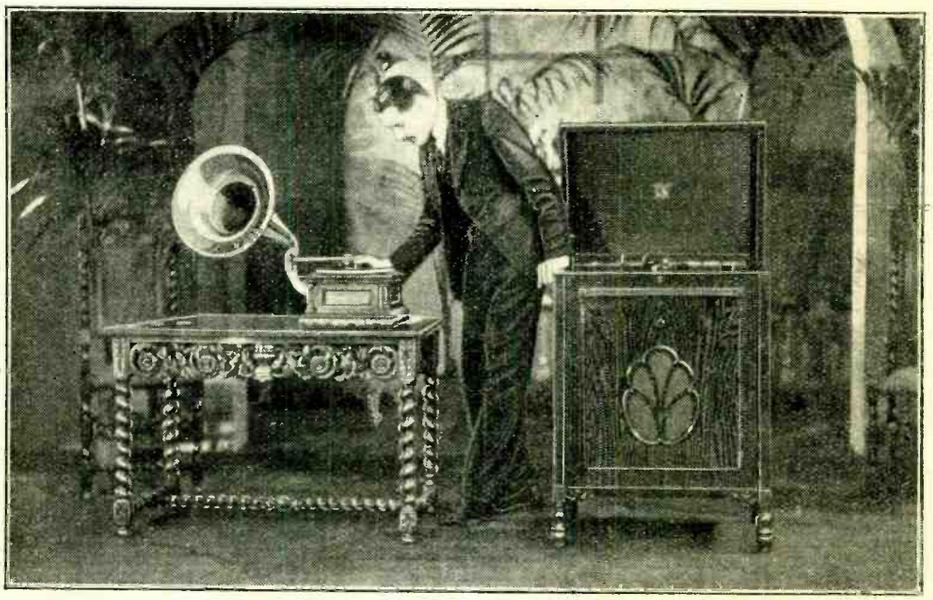
So the inauguration of a high-power broadcasting station at Nankin is not regarded as an awe-inspiring miracle.

French Listeners to Pay?

CRYSTAL users will have preference over owners of valve sets if the new French Wireless Bill becomes law. The projected listeners' tax is 15 francs per annum on crystal sets and 50 francs on valve sets.

There is a possibility that the arrangement may be opposed on the grounds that valve users would thereby pay a double tax as a result of the *ad valorem* tax on valves at the source of manufacture.

The future of the Bill, as indeed of all French Wireless Bills, is extremely uncertain.



CARUSO'S VOICE IN A TALKIE. A "still" from the forthcoming "Pathétone Weekly" film in which the processes involved in producing the new electrical recordings of Caruso's voice will be shown to the general public. The scene above shows a comparison between the original record as played on Caruso's own gramophone and the new electrical disc on the latest H.M.V. Superhet Ten Auto-radiogram.

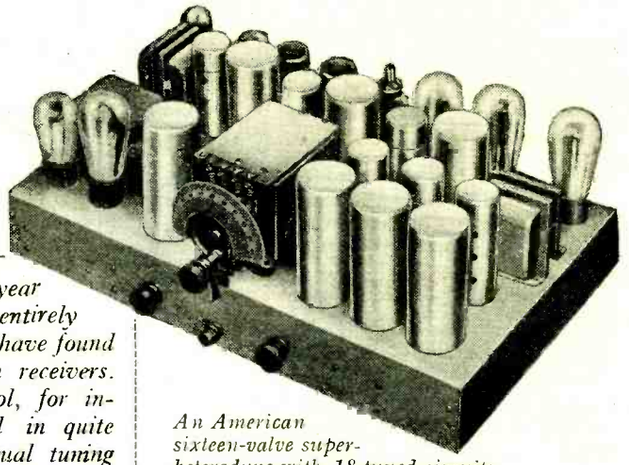
A Radio Ghoul.

A RADIO swindler of a new type has made his appearance in France. On arriving at the town which he intends to victimise he obtains a list of the day's funerals. Then, presenting himself to a bereaved family which seems to be well off, he displays the expensive six-valve radio set ordered, he declares, by the dear departed. After much expostulation, some keen bargainer among the relatives is quick to avail himself of the special offer which the seller makes "to settle this painful problem." Only when the seller is gone with the money is it discovered that the set is as dead as the man who was supposed to have ordered it.

New Ideas in American Sets.

Automatic Volume Control; Visual Tuning Indicators; Quiet Automatic Volume Control (QAVC); Acoustic Compensation.

By An American Correspondent.

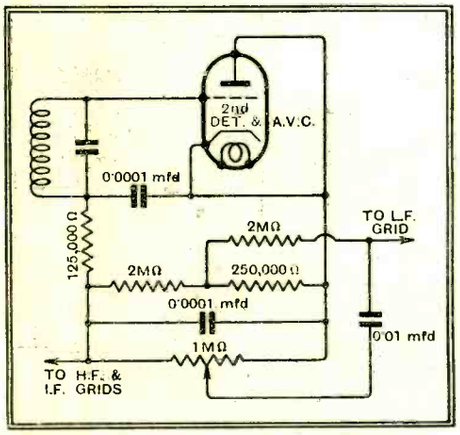


An American sixteen-valve superheterodyne with 18 tuned circuits.

IN the course of the last year or so a large number of entirely new circuit arrangements have found their way into American receivers. Automatic volume control, for instance, is now included in quite inexpensive sets, and visual tuning indicators are the rule. Another interesting scheme is an acoustically compensated volume control which makes up for the deficiencies of the human ear. These and other developments are discussed by a correspondent in U.S.A. who is in touch with modern American technique.

PURCHASERS of American radio receivers late in 1932 found themselves in possession of instruments of advanced design both as regards circuit and mechanical details. Circuits peculiar to radio were newly developed and exploited, new valves were being adapted to older circuits, and not content to use radio circuits, engineers went afield and borrowed from other arts, notably the illumination field.

Automatic volume control is already old, but it has never been found in such inexpensive sets as this year. A.V.C., as it is called, is now found in many receivers of the fifty-dollar class, or even cheaper, and as applied nowadays holds the loud-speaker output constant over very wide variations in input signal. In the majority of cases the A.V.C. control is applied to



The AVC system used in the Fada set. Automatic bias for the H.F. and I.F. valves is obtained from the 125,000-ohm resistor, whilst that for the L.F. valve is derived from the 2-megohm resistors.

the H.F. and I.F. stages only, but in the case of Fada, at least, it is applied to the L.F. system as well. The first L.F. valve in this receiver is a variable-mu type, and with A.V.C. applied to it, in addition to the other valves, a variation in input signal of 86 db. will cause a change in output level of only 8 db. (20,000 and 2.5).

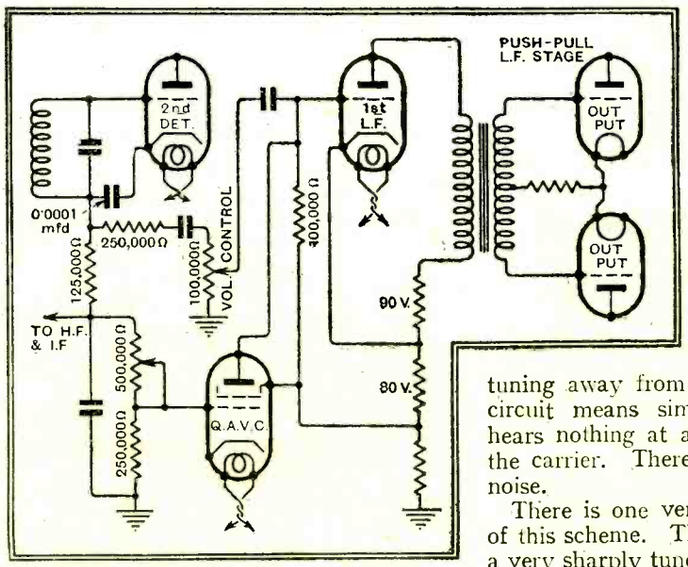
The vast majority of American receivers are superheterodynes in which the intermediate frequency is usually 175 kc., but other frequencies are used as well. The three-valve Philco superhet., for example, uses 450 kc. The number of intermediate frequency amplifiers varies from none at all to three. The second detector varies from a conventional triode to a diode, and from there to very complex arrangements. Many sets use two triodes as a push-pull diode detector, connecting together either the anode and cathode or the grid and anode. Others use a single valve in which there are two plates or grids and one cathode. These are called duo-diodes. Others use a still more complicated valve called a duplex diode triode. It is composed of a triode, together with a duo-diode all in the same envelope.

These complicated detectors not only separate the programme from the intermediate frequency carrier, but act as A.V.C. valves, and in some cases even as first L.F. stage as well. In the rectification process some D.C. voltage is generated. This voltage is used for various purposes, usually for operating the A.V.C. system.

Quiet Automatic Volume Control.

The receiver in which the output is constant regardless of the variations of input is not an unmixed blessing. When the set is tuned off the carrier its sensitivity increases by A.V.C. action. Any noise in the vicinity of the receiver, natural static or man-made, is brought in because of this excessive sensitivity. Tuning a receiver over the broadcast band is a business of going from a programme to noise to another programme to more noise.

Some recent receivers have a system of quiet A.V.C. called "Q.A.V.C.," which in effect is a method of shorting the L.F. system when the set is tuned into the between-carrier region. Such circuits require an additional valve. This valve is coupled to the A.V.C. system in such a manner that its bias is very low when the set is not tuned to a carrier. Therefore the valve has a high plate current, and across a resistor in its plate circuit appears a large voltage drop. This voltage is applied to the grid of the first L.F. valve in addition to its usual bias voltage. So great is the bias on this valve under these conditions that no plate current flows at all and therefore no amplification results. The valve does not pass any signals through to the loud speaker.



The QAVC system of Fada. When there is no detector input, the high anode current of the QAVC valve flows through the 100,000-ohm resistor and overbiases the 1st L.F. valve.

When, however, the listener tunes the receiver into a carrier wave, a strong bias is put on the Q.A.V.C. valve, its plate current decreases, which releases the bias on the first L.F. valve. The latter is thereby permitted to pass on to the power stage any programme that is on the carrier. Thus tuning away from a carrier with such a circuit means simply that the listener hears nothing at all until he is tuned to the carrier. There is no between-station noise.

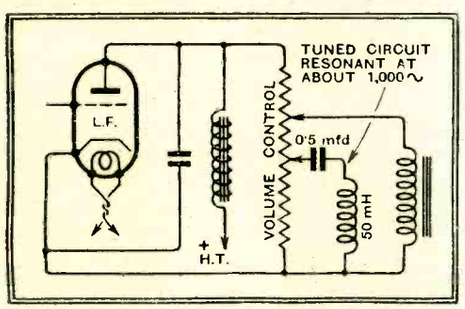
There is one very interesting variation of this scheme. The additional valve has a very sharply tuned input circuit coupled to the intermediate-frequency system. Its plate circuit has control of the first L.F. stage as before. But so sharply tuned is

New Ideas in American Sets.—this circuit that nothing at all is heard until the receiver is tuned within 1 kc. of the exact centre of the carrier. Therefore the listener gets all the programme or nothing. Distortion caused by incorrectly tuning a superheterodyne is avoided by this circuit.

Acoustically Compensated Volume Control.

Another refinement of technique is found in high-class receivers such as the R.C.A. Victor 78, the General Electric, and Zenith higher-priced sets. It is a method for compensating the low human ear sensitivity of the extreme ends of the audio-frequency scale at low sound levels. The method consists in raising the level of the very low and the very high notes when the volume control is turned down.

This compensation is achieved in the following manner. The volume control consists of a variable resistor between the detector and the first L.F. valve input. Across part of this resistance is a tuned circuit resonating to, say, 1,000 cycles. When the entire signal from the detector is impressed on the amplifier this tuned shunt circuit has little effect, but when the volume is turned down so that less of the resistance is in the circuit, this shunting impedance becomes important, and effects some attenuation to the middle register in favour of the lows and highs. In practice,



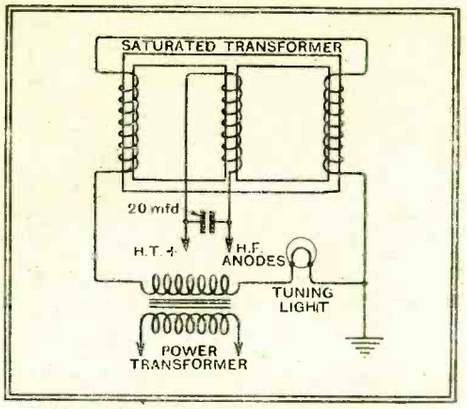
Acoustically compensated volume control. A circuit resonating at about 1,000 cycles is shunted across part of the volume control resistor. At low volume levels the middle register is depressed.

the very low notes are boosted more than the very high ones to take care of some of the loss in loud speaker and cabinet. Thus the balance of tone is preserved through all variations in volume level.

New L.F. Systems in America.

The average American gets but few of the higher notes out of his present-day receiver. This is due to the extreme selectivity of the multi-stage superheterodyne and to the desire to hear the programme free from noise generated outside or inside the set itself. Distortion in the detector, L.F. amplifier, or loud speaker is evident mostly in the high frequencies. Therefore many of the receivers are pretty dead at 5,000 cycles, and most of them are very inarticulate at 4,000 cycles.

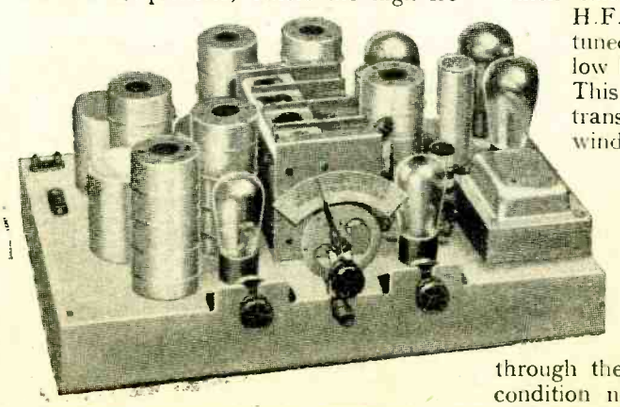
Thus the very small and inexpensive Philco superheterodyne, consisting of three valves and rectifier, has about the same (or even better) response at high frequencies as the best of the big sets. Due to its small box, the low frequencies are synthetic, of course. The more ambitious receivers, however, go down very far into the bass, considerable response at 40 cycles being not at all infrequent.



Dial lamp visual tuning indicator. The lamp is dimmed at resonance due to the action of anode current on a saturated transformer.

The majority of receivers use a push-pull output of pentodes capable of delivering several watts of power each. In a number of cases the input transformer is a step-down affair with very low secondary resistance. The grids are driven positive, but little distortion results because the grid current flowing through the secondary winding causes little voltage drop there. If the valves draw grid current the amplifier is called a class B circuit. The valves are the high-mu type which operate at zero bias.

Other manufacturers use the step-down transformer, but into pentode or triode with appreciable bias. The valves operate as a class A amplifier up to the point where the grids draw current, and then belong to class B. These receivers can deliver upwards of 10 watts to the loud speakers—usually two of them, sometimes three, and in a few cases four speakers. These speakers may be dissimilar in characteristics, one favouring the low frequencies, others the high frequencies. In other cases the speakers are only slightly different. A system of resonance at slightly differing low frequencies, say 70 and 80 cycles each, tends to prevent the other from booming.

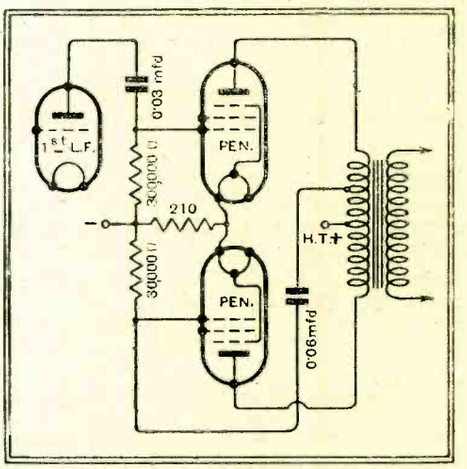


A typical American superheterodyne receiver with eleven valves (Midwest). The wave-band from 15 to 550 metres is covered and fully-automatic volume control is included.

About one-fourth of the season's models use some form of visual means of showing when the set is tuned. These tuning aids may take the form of the tuning meter whose needle indicates on a scale when the set is in resonance. Current for this meter comes from the detector plate circuit or some part of the A.V.C. circuit, anywhere, in fact, where the plate currents vary when a carrier is tuned in. Some of the other sets have neon valves which glow with their characteristic red colour as the set is tuned. The glow discharge requires about 150 volts to start, and as greater voltages are put across the valve from some part of the L.F. system the glow climbs higher and higher in the valve.

Visual Tuning Indicator.

Another and still more elegant method of indicating resonance is the incandescent lamp which dims as the station is properly tuned. In the circuit which



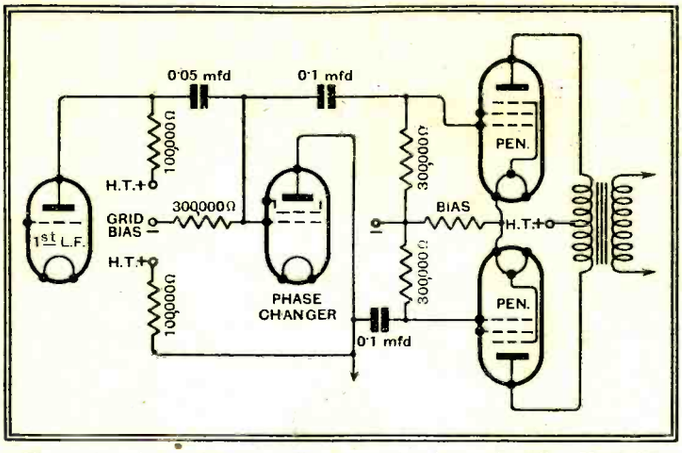
Capehart method of driving one of two pentodes in push-pull.

feeds this lamp from an A.C. transformer is another transformer. On a second leg of this accessory transformer is a winding which carries the plate current of the H.F. valves. When no signal is tuned in, the H.F. valves have low biases and large plate current. This current saturates the accessory transformer, and therefore the winding in series with the tuning lamp filament has little impedance. The lamp lights up brilliantly. Now when a signal is tuned in, the A.V.C. system reduces the plate current of the H.F. valves by increasing their bias, and therefore less current flows through the transformer. The saturated condition no longer holds, and there is sufficient impedance in the lamp circuit to reduce the current, and the lamp dims or casts a shadow on a scale.

Resistance-coupled Push-pull.

Two new circuits are found in the late models of the 1932 receivers. One is used in the Majestic and Columbia receivers

New Ideas in American Sets.—(made in the same factory), and is for the purpose of making certain that the proper phase and amplitude of energy is fed to two push-pull pentodes from a previous stage when coupled by resistance. The grid signals of these valves must be exactly 180 degrees out of phase and of the same amplitude. One grid is fed directly from the previous valve, through a capacity, the other is fed from the same point but through the intermediary of another valve.



Phase-changing valve preceding pentodes in push-pull. Used by Majestic and Columbia.

This additional valve reverses the phase 180 degrees, and by proper adjustment of the circuit delivers to the second pentode grid the same voltage signal as the other one gets directly.

In the Capehart push-pull amplifier one grid is fed directly as above, but the second is fed from a tap on the output transformer of the first valve. The circuits given clearly show the method of driving the second of the two push-pull pentodes. The point at which the transformer is tapped must be properly chosen so that the second grid is given the same amplitude signal and 180 degrees out of phase with that on the first pentode grid.

There are other circuit tricks employed in American receivers and still others are reported. All seem to complicate the circuit, but to the advantage of the listener. Much of the manual control is being taken from his hands and put into the set itself. Thus all A.V.C. systems are engineered so that the voltage to the detector is constant and is so chosen that least distortion results. As the same time that the Q.A.V.C. reduces noise, the A.V.C. keeps the loud speaker signal constant. Soon automatic tone controls will be available. At present the acoustically adjusted volume control (manual) is a popular feature, and with other new refinements makes the present models the last word in technical advance.

Distant Reception Notes.

CONDITIONS on the long waves have been generally good of late. The outstanding stations are Kalundborg, Huizen, and Radio-Paris. Oslo is good at times, when Russian transmitters are not causing interference. Motala is a little below the mark at times, and Zeesen, though usually well received, is sometimes rather weak. Both the Eiffel Tower and Warsaw provide excellent entertainment at any time when one of the pair is working and the other silent.

Munich's new 60-kilowatt transmitting plant appears now to have taken over the regular programme service. This station is very well received, as might be expected from the combination of a wavelength above 500 metres with high power. The 60-kilowatt Toulouse transmitter has been at work on many nights. The strength is, of course, enormous, and once the transmitter is in regular action we shall probably have no further cause to criticise Toulouse's quality.

There has been a certain amount of fading over most of the medium waveband, and this has been particularly annoying during attempts to receive transatlantic transmissions. It is one of the curiosities of wireless that if there is any fading the minimum of signal strength invariably occurs just as the announcer is giving the call-sign. So far as Continental reception is concerned, fading has not been bad enough to spoil reception.

Stations particularly worth attention at the moment are Fécamp, Turin, Heilsberg, Bratislava, Hilversum, Breslau, the Poste Parisien, Strasbourg, Leipzig, Katowice, Berlin Witzleben, Rome, Beromünster, Langenberg, Prague, the two Brussels stations, Vienna, and Budapest.

D. EXER.

In Next Week's Issue:—

The Wireless World STRAIGHT THREE.

The Most Reliable Modern Circuit. Simple Construction and Very Low Cost.

A RECEIVER with an H.F.-det.-L.F. three-valve circuit is generally (and rightly) regarded as a safe choice for the listener with average requirements as to range, selectivity, and volume. The present set has been produced with the object of satisfying these needs, and those features which merely improve performance in one direction, but which introduce corresponding loss elsewhere, have been rigorously avoided.

As the set is for battery operation economy in anode current has been studied, and, in planning the H.F. circuit arrangement, the variable-mu valve has been turned to good account.

To obtain ample selectivity to cope with difficult receiving conditions, a total of three tuned circuits—controlled, of course, by a ganged condenser—are included.

The frequency characteristic of the L.F. amplifier is arranged to give good quality of reproduction, even when full use is made of reaction for long-distance reception.

Ease of construction, simplicity, and, above all, low initial cost, have all been considered in the design.

LIST OF PARTS.

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

1 3-Gang condenser, 0.0005 mfd. **Ormond 7/R.490/S3**

1 Disc drive for condenser, with black knob, **Ormond R.362**
(Formo, J.B., Polar, Radiophone, Utility.)

1 Variable condenser, bakelite dielectric, 0.0003 mfd., with knob **Ormond**, R.508
(Burton, Graham Farish, Lotus, Telsen.)

1 Fixed condenser, 0.04 mfd., non-inductive **Dubilier, 9200**

2 Fixed condensers, 0.1 mfd. **T.C.C., Type 50**

1 Fixed condenser, 1 mfd. **T.C.C., Type 50**

2 Fixed condensers, 0.0002 mfd. **T.C.C., Type M**
(Formo, Graham Farish, Hellesens, Lissen, Peak, Telsen, Wego.)

1 Set of three shielded tuning coils, complete with wave-range switches, adjustable link, and switch-knob assembly **Telsen**
(British General, Colvern, Formo, Lissen, Tunewell, Varley, Wearite.)

1 L.F. transformer, 3:1 ratio **Igranic, T.24 B**
(Ferranti, Lissen, R.I., Slektun, Telsen, Varley.)

3 Valve holders **W.B., under-baseboard type**
(Benjamin, Bulgin, Burton, Clix, Eddystone.)

1 Potentiometer, 25,000 ohms, with ganged 3-point switch **Bulgin, V.S.9**
(Wearite.)

2 Resistors, 1,000 ohms, 1 watt **Erie**

1 Resistor, 2,000 ohms, 1 watt **Erie**

1 Resistor, 5,000 ohms, 1 watt **Erie**

1 Resistor, 50,000 ohms, 1 watt **Erie**

1 Resistor, 1 megohm, 1 watt **Erie**
(Dubilier, Loewe, Claude Lyons, Varley, Watmel.)

1 H.F. choke **Lewcos M.C.**
(British General, Bulgin, Burton, Goltone, Igranic, R.I., Varley, Wearite.)

2 Two-way terminal mounts **Junit**
(Belling-Lee, Goltone, Lissen, Telsen.)

4 Terminals, "Aerial," "Earth," "L.S.+" "L.S.−" **Belling-Lee, Type B.**
(Burton, Clix, Eelex, Igranic, Swain.)

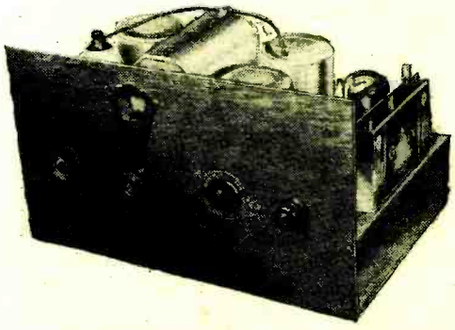
3 Wander plugs **Belling-Lee, Midget**
(Clix, Eelex, Goltone, Lissen.)

1 Battery cord, 5-way **Lewcos**
(Belling-Lee, Bulgin, Concord, Goltone, Harbros.)

1 Grid bias battery, 9 volts **Drydex**
(C.A.V., Ever Ready, Grosvenor, Hellesen, Lissen, Pertrix, Ripaults, Siemens, Smith.)

1 Pair G.B. Battery Clips **Bulgin No. 1**
(Burton, Gripso, Ormond.)

2 oz. No. 22 tinned copper wire, 4 lengths 1 mm. sleeving, wood panel 14 × 8, for baseboard.



The straightforward arrangement of the four controls is apparent in this view of the new set.

Screws: 7 ¼in. No. 4 C/sk., 7 ¼in. No. 4 R/hd., 6 ¾in. No. 4 R/hd., 6 ½in. No. 4 R/hd., 6 ¼in. No. 4 R/hd., 9 ¼in. No. 4 R/hd.

Cabinet: **Apollo Gramophone Co., Ltd.**

Valves: Marconi V.S.2, metallised; Cossor 210 DET, metallised; Mullard PM2A, or other valves with similar characteristics.

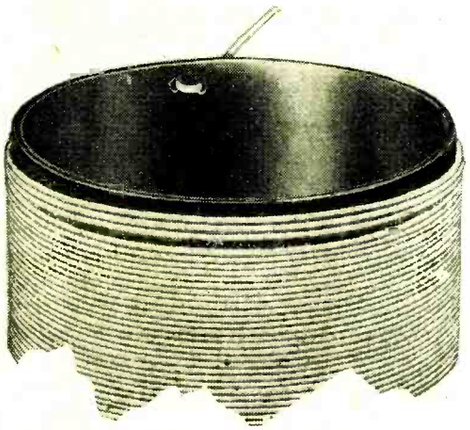
PRACTICAL HINTS AND TIPS

Simplified Aids to Better Reception.

IF a series of tuning coils be wound with precisely the same number of turns of similar wire on formers of the same diameter, it follows that the inductance value of each of them should be identical; the coils should therefore be suitable for inclusion in a gang-tuned receiver without further matching.

Final Matching Adjustments.

But in practice minor discrepancies, due perhaps to slight differences in the diameter of the former, or, more probably, to unequal closeness of winding, are likely to arise.



Minor discrepancies in inductance may be rectified by spreading the end turns.

These discrepancies may well be so slight that the somewhat brutal procedure of matching by the removal of complete turns should be quite unnecessary. Instead of doing this, it is usual to reduce the inductance of those coils which have a surplus by "spreading" a few of the turns at one end of the winding rather in the manner shown in the accompanying illustration. This adjustment is done by hand after the coils have been wound.

Some means must be found to ensure that adjustments made in this way shall remain constant, and that the loosened turns of wire will not change their position; with this object, it is usual to employ some form of insulating varnish or other adhesive to anchor the end-turns in position. For this purpose ordinary rubber solution has been found highly satisfactory, and to be entirely free from objectionable features. The solution should not be used indiscriminately; it is sufficient to smear it lightly over a small part of the upper surface of the former just before the coil is wound. Adjustments are preferably made while the solution is "tacky," but before it has finally set.

EVEN for those who are accustomed to mains-operated receivers it is almost an uncanny experience to handle a set of which the power plug may be connected at will either to an A.C. or a D.C. socket without any noticeable change in performance. Versatile receivers of this kind can now be produced without any great difficulty; perhaps the best-known type is that which makes use of the Ostar-Ganz valves, and which has already been described in these pages.

Universal A.C.-D.C. Sets.

The rectifier is usually the stumbling-block for those who are attempting to understand these "universal" circuits; their difficulty will mainly disappear if they appreciate the fact that the effective resistance of these devices is quite low in the "forward" direction, and that very little loss of voltage need be introduced by the rectifier, which remains in series—but as a passenger—when the set is worked from a D.C. source.

In addition to the high voltage indirectly heated valves already mentioned, it is also possible to devise universal sets to operate with Westinghouse metal rectifiers and ordinary D.C. valves with heaters connected in series. The basic circuit arrangement of such a receiver is indicated in Fig. 1, from which it will be gathered that the whole subject is far from complex; the circuit is essentially that of a D.C. receiver with a rectifier inserted.

Of course, smoothing must be generous, partly because half wave rectification is used, and so it will generally be best to employ high-capacity electrolytic condensers in conjunction with a very effective choke, or series of chokes.

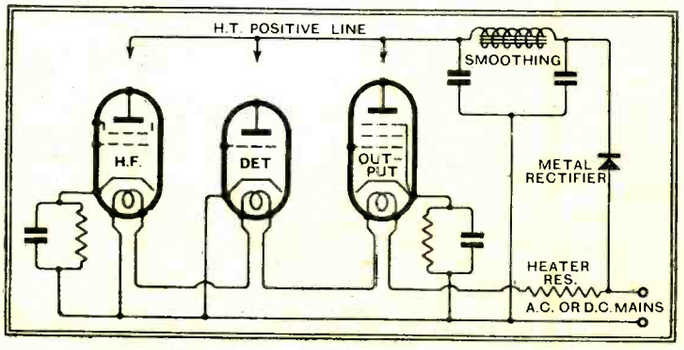


Fig. 1.—The basic circuit of a D.C.—A.C. set.

If the set is to be fully interchangeable between A.C. and D.C. supplies, without any alteration whatever, it is obviously highly desirable that the metal rectifier should be of low D.C. resistance in the "forward" direction; according to the Westinghouse Company, their most suitable model for this purpose is the H.T.10.

By interposing a simple 1:1 ratio transformer between the set and the mains when it is operated on A.C. supplies a circuit on the lines described could be made to comply fully with the various regulations.

AS soon as a new set, whether home- or factory-built, is finally installed and working satisfactorily it is an excellent plan to measure the individual anode currents of the valves, as well as the current passing in each screen-grid circuit, if a sufficiently sensitive meter be available. These measurements should be recorded on a piece of paper, which may be pasted inside the receiver, or, at any rate, stored somewhere where it is unlikely to be lost.

A Guide to Valve Condition.

Should a fault develop at any time in the future, it will then be possible to determine, with much less uncertainty than usual, whether it is due to the valves or the power supply equipment. Similarly, the inevitable gradual decline in valve emission may be watched, and it will be possible to know exactly which valve is due for replacement. A useful opinion can also be formed as to whether the power rectifier output has fallen off; in some cases the current of one valve will be found to have declined considerably, while that of all the others has actually increased during use. This is a certain indication that the valve which shows a low current reading is either defective or has excessive resistance in its anode circuit, and, further, that no suspicion need be attached to the anode-current supply system.

UNBIASED

Carols, 1932.

I HAVE just dismissed from my doorstep the fourteenth party of wretched children to disturb me in the midst of my wireless experiments. Back once more in my laboratory I find it difficult to proceed. My mind runs on an unfortunate experience last year when I was induced to join forces with the local choral society in the thankless task of singing carols in the interests of charity. My rôle was to cart round a receiver and pick up carols which were being broadcast from certain Continental stations, the idea being to relieve the singers while they were taking a breather.

To ensure success I used a superhet followed by a large power amplifier and an exponential horn of my own construction. H.T. was derived from a small motor generator driven from a car battery. As the whole apparatus was somewhat unwieldy I was compelled to employ a rather dilapidated perambulator which had been discarded by the last pair of little Grid Leaks many years previously and subsequently used by him as a receptacle for keeping pet rabbits. The set was a modern one not intended for a frame, and as it was necessary for the whole apparatus to be self-contained I hit upon the idea of using the metal ribs of a disused umbrella for this purpose, it being possible to fold it as we journeyed from one house to another. An earth connection was made to the metal chassis of the pram, the tyres having first been removed so that the wheels could make metallic contact with the actual earth.

A Forgotten Phenomenon.

I regret to say that our efforts were not appreciated by the inhabitants, several of whom caused their sets to oscillate violently on the wavelength on which we were receiving. The result was like Bedlam let loose, every whistle and howl being picked up and magnified by my amplifier to the intensity of a factory hooter, until at last in desperation I was forced to switch off.

Nothing daunted, our little band returned to their own vocal efforts but by this time the neighbourhood was thoroughly aroused and the singing was greeted by cat-calls and other offensive manifestations. It was then that the idea occurred to me of triumphing over all obstacles by fixing a microphone to the amplifier. By this means I proposed to raise the volume of the singers' voices to the level of a stentorian roar and so drown out all opposition while, of course, oscillation from neighbouring sets would have no effect on the apparatus.

Unfortunately, however I had quite forgotten the phenomenon of acoustic reaction, and no sooner had everything been connected up in readiness for a decisive onslaught on the enemy than an awe-inspiring bellow was built up by the interaction between the loud speaker and the microphone, and we were compelled to retire in confusion.

By FREE GRID.

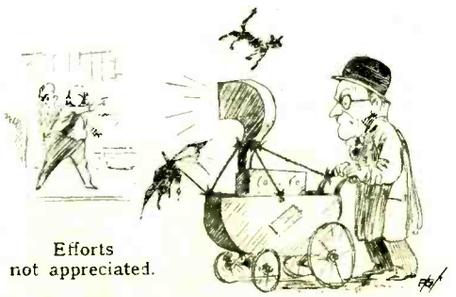
This year a fresh attempt is to be made, the first recital being given next Monday evening. All the necessary technical preparations have been made to prevent a repetition of last year's fiasco.

I have hired a large pantechnicon from a local firm of removal contractors, and have fitted it out myself. No attempt will be made to relay carols by wireless, but the singers, together with the necessary microphone and amplifier apparatus, will be accommodated inside the van.

A Thought for the Deaf.

Half a dozen public-address loud speakers, suitably mounted on camera tripods, have been prepared, and as soon as the van has taken up its stance six people, each in charge of a loud speaker, will jump down from the van and take their respective instruments to the front door of a house paying out the necessary extension leads as they go. In this manner six households at a time can be dealt with, contributions being received, of course, by the loud speaker attendants.

Volume will be at least twenty times as loud as would be the case if the singers were present on the doorstep in person, so that even the loudest of wireless sets inside the house will be drowned out and pleasure will thus be brought to those members of the household who have in



Efforts not appreciated.

past years been denied the joy of listening to first-rate carol singing owing to deafness.

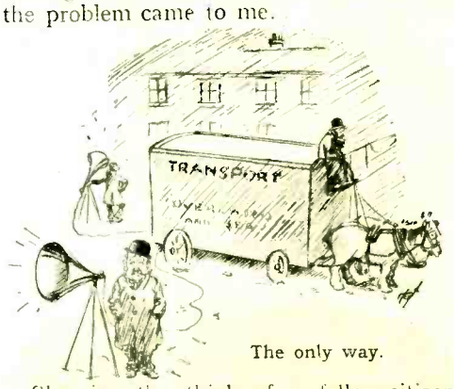
A Reminder.

WILL all those who intend to send me Christmas Cards this year kindly do their utmost to post as early as possible? Last year failure to do this resulted in several of them arriving almost too late for me to send them off once more on their missions of peace and goodwill.

The Little Light.

I HAPPENED to be strolling around one of our large emporiums the other day, doing a bit of Christmas shopping, when I noticed that among the many strings of decorative lamps that bestrewed the place one in particular was winking in and out in a highly irregular manner, and I was soon convinced that, for some inscrutable purpose, morse code signals were being sent out.

Now, I am good for twenty-five words a minute by ear any day, but, as anyone with knowledge of these matters knows, this does not mean that I can read from a lamp. I was, however, distinctly interested in the flashing lights and was wondering where I could rake up an acquaintance who could read their message when suddenly the solution of the problem came to me.



The only way.

Slapping the thigh of a fellow-citizen in mistake for my own, as the result of my excitement, I dived through the exit into a taxi and was speedily whisked away home. I worked in my laboratory until far into the night, and the next day re-entered the shop carrying a large suitcase, from which I drew out a pair of 'phones and a special "microphone" of my own devising. Donning the former and holding the latter up to the lamp I found that, to my delight, signals came clearly and strongly through the 'phones and were easily readable.

A System for Ships?

The messages were banal enough, being merely Christmas greetings from the management, and I wondered why they should waste time on such a device as probably less than one per cent. of the public could read the signals. My "microphone" was, of course, nothing more or less than a photoelectric cell, the suitcase carrying the necessary amplifier.

I am wondering whether this system could not be applied to ships at sea so that all morse-lamp signals could be received direct in the wireless room. This would then be truly ultra-short-wave wireless, the wavelength being about 0.0005 millimetres. The photoelectric cell would, of course, be mounted on the masthead, and in this manner could be used also to pick up the rays of distant lighthouses long before they were visible from the bridge, thus once again extending the scope of wireless as an aid to navigation as well as to signalling.

BROADCAST BREVITIES.

By Our Special Correspondent.

Opera v. Vaudeville ?

WAR is afoot—war which threatens the extinction of broadcast vaudeville as we know it to-day, and the substitution of "Opera for the Masses." This, at any rate, is how I read the signs and portents. There is a stormy petrel in the person of that popular producer, Mr. Gordon McConnel. Vaudeville knows him no longer.

In Low Favour.

Mr. McConnel has forsaken the tinsel trapping of musical comedy and revue for the more sober garments of studio opera, which, the B.B.C. will tell you, is being developed in order to prepare the way for broadcasting full-length operas in the theatre in conjunction with the Imperial League of Opera.

McConnel's transfer of allegiance is, of course, only an incident; but to whatever significance we may read into it must be added the fact that vaudeville is now in low favour among the mandarins of Broadcasting House.

Opera Making Headway.

Probably vaudeville has a friend in Mr. John Whitley, Chairman of the Governing Board, and a man of catholic outlook, but I doubt whether any other of the governors would raise a finger in support of the "cap and bells" type of programme.

On the other hand, opera is in such high favour at the present moment that not even the rumoured departure of its principal advocate, Lady Snowden, would be likely to spoil its chances of gaining a much larger proportion of the programme time in the near future.

Miniature Opera.

On December 16th "The Grand Duchess" (Offenbach), "The Rose of Persia" (Sullivan), and "The Gypsy Baron" (Strauss) will be presented in miniature studio versions and broadcast on the National wavelengths. On December 17th the programme will be repeated regionally.

Significant.

The fact that Dr. Adrian Boult will personally conduct the next group—on December 26th and 28th—is an indication of the importance which the B.B.C. attach to the new campaign. On those days the operas broadcast will be "Rigoletto" (Verdi), "Hansel und Gretel" (Humperdinck), and "Martha" (Flotow).

"Non-Stopera" ?

It looks as if Non-stop Variety is to be followed by Non-stop Opera.

Talkless Radio Play.

DALLAS BOWER, the well-known film personality, has written a radio play consisting of sound effects only. The title is "Working Day," and the play will last less than a quarter of an hour. I am told that it gives an impression of the passing hours.

What we want next is the talkless and soundless radio play. The B.B.C. would supply a background of complete silence, which the listener would fill with his own imagination.

How now, Mr. Gielgud?

Payment for Empire Broadcasting.

THE question whether the British broadcast listener must continue indefinitely to pay for the Empire service is not being allowed to rest, but I understand that the B.B.C. wishes to give the Dominions and Colonies at least six months of service before the financial side is discussed officially.

The Hungry Press.

A subsidiary, but highly important, service is the provision of forthcoming programmes to the Press of the Empire.

Some three hundred and fifty *daily* papers now receive a weekly budget of programme news from Broadcasting House. There are 120 in Australasia alone.

Zone 4 in Distress.

Several Empire listeners have written to me expressing their delight (it is not too strong a word) at the opening of the new service on December 19th, but an apprehensive note comes from the Gold Coast, W. Africa.

"Disaster."

"We in Zone 4," says the writer, "are threatened with disaster. . . . Had it fallen to my lot to select the least satisfactory wavelengths for this static-ridden spot, I should have unhesitatingly plumped for 48 metres—with 32 metres a fair second." (These are the wavelengths picked for Zone 4.)

Plea for Different Wavelength.

The writer goes on to plead for wavelengths around 25 metres, which experience has shown him to be least subject to the ills that ether waves are heir to in the tropics.

Probably the most encouraging message I can send to this reader is that the B.B.C. regard all the eight wavelengths for Empire broadcasting as purely tentative. Not until six months have elapsed, during which time reports from all over the Empire will have been collated and classified, will permanent plans be drawn up.

New Broadcasting Record.

SOMETHING like 1,000 broadcasting stations of all sorts and sizes will relay the King's speech on Christmas Day. His Majesty will undoubtedly create a new record in the magnitude of his audience.

Many millions of listeners will also hear the speech repeated on the Blattnerphone during the various Empire zone periods. Australasia, for example, will be given the speech between 9.30 and 11.30 on Boxing Day morning. India will pick up the speech direct, as it will be made during the normal Indian broadcasting period.

Goodwill Messages.

Even more spectacular than the broadcasting of the King's speech will be the subsequent world-wide relay of Christmas messages exchanged between different parts of the Empire. All these messages will be relayed by the B.B.C.

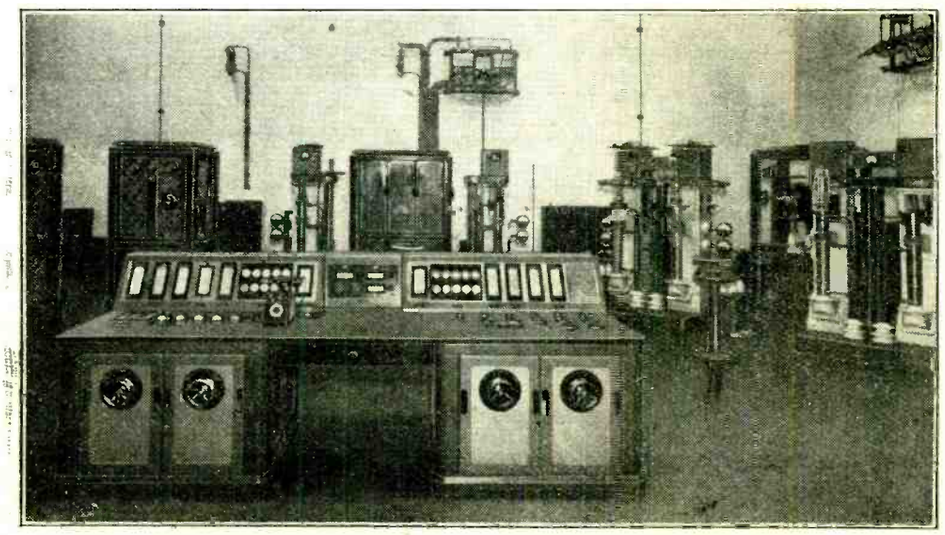
Henry Sets Germany Dancing.

HENRY HALL is happier these days, not only because criticism of the B.B.C. Dance Band has flopped very impressively since the hotter style of playing was introduced, but because of a sincere tribute from the Continent. The German stations recently sent a request for a special programme by Henry Hall and the Band, with the result that on Friday last "the boys" entertained Hamburg, Hanover, Bremen, Kiel and Salzburg in an exclusive transmission. No sound was heard by British listeners unless they picked up one or other of the stations mentioned.

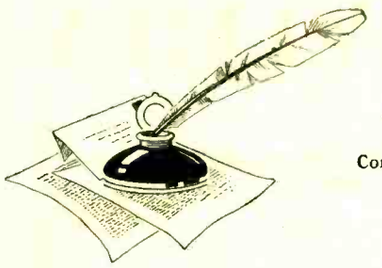
Marked Men.

THE B.B.C. staff turned out in their best Sunday clothes on Thursday, December 1st, for the mass photographing in the Concert studio. The pictures were taken to celebrate the tenth anniversary of broadcasting and to provide a visual record of the personnel.

Each section, or platoon, was photographed separately; no one escaped.



THROUGH THE CONTROL ENGINEER'S SPECTACLES. A general view of the transmitter room at Leipzig, which is now Germany's most powerful broadcasting station. Behind and to the right of the control desk can be seen the 150 kW. porcelain-mounted valves. The station is rated at 120 kW. in the aerial, and the wavelength is 389.6 metres.



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.

Dual Loud Speakers.

MR. TYERS' letter appearing in *The Wireless World* of September 30th, concerning his development of dual unit loud speakers in 1927, is very interesting. Perhaps some early development work by the Magnavox Company along these same lines might also be of interest to your readers.

As you know, Magnavox was building loud speakers as early as 1911; hence it is not surprising that the Magnavox organisation has pioneered a good many speaker developments.

In 1926 Magnavox was manufacturing moving coil cone speakers in rather large quantities, and early in 1927 started experiments for obtaining better response from the simultaneous use of two speakers. The first line of attack was similar to that of Mr. Tyers, namely, to use one speaker for low frequencies and another speaker for high frequencies, and to provide a filter to separate the energy from the amplifier into two parts accordingly. Excellent results were finally obtained, but enthusiasm was somewhat dampened when it was found possible to produce better results by spending more money on a single speaker. After considerable experimental work it was decided to attack the problem along different lines.

An attempt was made to obtain a satisfactory combination of speakers in which both units covered both high and low frequencies, but not in an identical manner. As a matter of fact, the best combination of dual speakers developed at this time was similar to our present dual-compensated units in theory, for speaker No. 1 responded particularly to medium high frequencies and speaker No. 2 to the extreme top, while the base resonances were quite low and slightly separated. It required a good deal of work before the best combinations were discovered. For instance, it was found that two speakers with widely separated resonances at the low end of the scale produced a very unnatural result, also that each speaker had to be designed to give separately greater efficiency on the top than would be necessary, or even desirable, were either speaker used alone. Very gratifying effects were eventually obtained, although these speakers were not sold commercially, both because of the apparent absence of market and also because the sudden demand for moving coil cone speakers of the single variety soon absorbed all our energies.

In 1928, I believe, the Splitdorf Radio Company used a pair of Magnavox moving coil speakers in a large set, with good results, although these speakers were really not a dual-compensated pair but separate standard speakers, certain compensations being made in the L.F. circuit by the manufacturers of the wireless set.

There is a popular belief that, although a speaker could be designed to respond well to low frequencies alone or high frequencies alone, it is not possible for the same speaker to respond efficiently to both ranges. This seems to be true in certain instances, but for very different reasons from those popularly conceived. It is generally assumed that an extremely light-weight cone must be used to radiate top efficiently, while experience has demonstrated again and again that stiffness and rigidity is a great deal more important than weight. This is apparently due to the fact that at high frequencies the diaphragm does not move as a unit, but little ripples are sent out from the centre of the cone and travel to the outside edge, and while the apparent mechanical reactance from the point of view of the coil is very much less than would be expected, the mechanical radiation resistance is surprisingly increased.

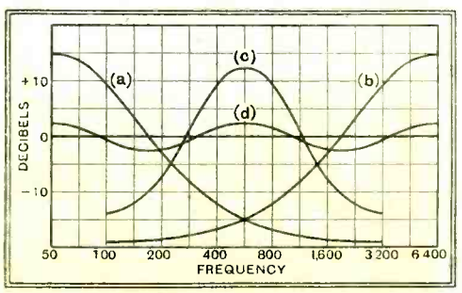
The present line of Magnavox dual-compensated speakers are the same in principle as the successful pairs developed in 1927, but, of course, more sensitive and having a more even frequency distribution. In this connection the English wireless public is fortunate in enjoying much better high-frequency response than American listeners, both because of the broadcast of wider sidebands and because of less sideband cutting and better audio characteristics in the receivers. The present line of Magnavox dual-compensated speakers were, of course, designed by the engineering department of the English company, to take advantage of the wide band of audio frequencies available in England.

EVERETT R. DEMPSTER.

London, W.C.2.

"Tone Correction."

WE have heard a great deal of late about the subject of "tone correction." Though it has only comparatively recently been proved that the tone correction feature can be made to compensate accurately for "sideband cutting," the general principle has been in use for goodness knows how long, *e.g.*, "loading" and "equalisation" of telephone lines.



Even in radio receivers the principle is perhaps older than some of us have hitherto suspected. Mention was made recently of a form of "natural" tone correction by making use of an uncorrected pentode in the last stage of a selective receiver.

This recalls to mind something in connection with the broadcast receiver of eight or ten years ago.

First, a reacting detector, with reaction almost invariably at oscillation point (to secure maximum volume, which even then was not much)—resulting frequency response curve (a) in the figure.

Secondly, a cheap and nasty L.F. transformer (primary inductance about ½ henry) following a comparatively high impedance valve—resulting frequency response curve (b).

Thirdly, an equally nasty (but not so cheap) loud speaker, with a frequency response curve as per (c).

The resulting quality was, of course, due to the combination of (a), (b) and (c), as shown by curve (d).

This, no doubt, explains why, even with the sets of those days, we *sometimes* got "good" quality.

C. C. WHITEHEAD.

Thornton Heath,
Surrey.

Our Manufacturers and the Empire Broadcasting Station.

IF a layman may comment on the activities of British wireless manufacturers, I should like to draw your attention to one omission in their manufacturing programmes.

That omission concerns the production of short-wave sets, an omission intensified by the imminent opening of the Empire Broadcasting Station. My knowledge of wireless technique is too slight to allow me to develop that aspect of the case, and neither is it necessary. The unfailing stream of new ideas emanating daily from the industry shows that British manufacturers require no tuition from anybody.

Where, however, my experience may be helpful is in connection with feeling in different parts of the Empire. There is a genuine and insistent demand for short-wave sets of British manufacture. At present, of course, such sets are almost entirely a foreign monopoly.

Recently I encountered three buyers from New Zealand who had made a British source of supply for such sets their foremost pursuit while in this country. They had to return empty-handed and really were bitterly disappointed at failing in their quest. They said almost vehemently that New Zealanders would give anything for British sets.

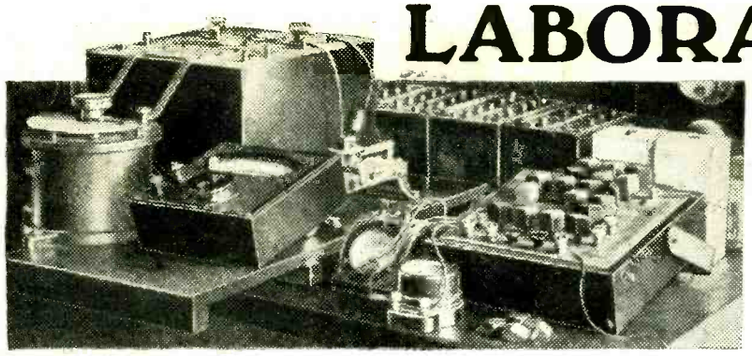
In Australia, as your readers are aware, the ban on complete sets has now been lifted. There is now a huge demand in that continent for complete British sets. The same truth applies to all parts of the Empire.

If British manufacturers will take a few soundings on the question of demand for British short-wave sets, they will find, as I have already found, a new era in production awaiting them.

I quite understand that existing manufacturers, especially those producing on a large scale, will be concerned with meeting the needs of the home market for some years to come. There are, however, many makers of first-class receivers who cannot hope to build up big business in the home trade, but who should be able to carve out a useful and profitable place for themselves in overseas—mainly Empire—countries.

"DOMINIONITE."

LABORATORY TESTS.



NEW RADIO PRODUCTS REVIEWED.

HEAYBERD MAINS TRANSFORMERS.

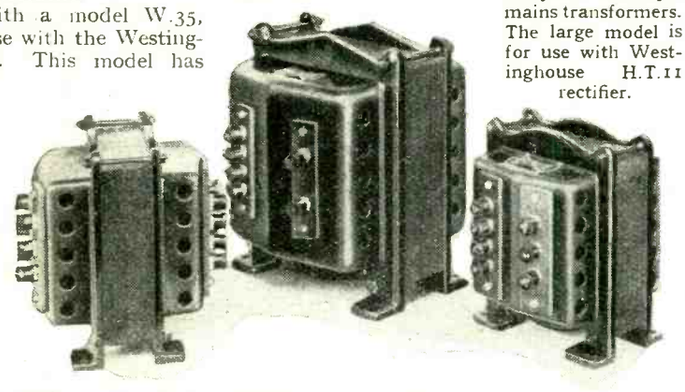
THE latest type of mains transformers made by F. C. Heayberd and Co., 10, Finsbury Street, London, E.C.2, are now fitted with cast aluminium end plates somewhat similar in design to those used on large power transformers. In addition to greatly enhancing the appearance of the component they afford complete protection for the windings and connecting leads. The safety measures are extended also to the external connecting points for insulated heads are fitted to all terminals, thereby minimising the risk of short-circuits should a lead come adrift by accident.

Tests were made with a model W.35, which is designed for use with the Westinghouse H.T.11 rectifier. This model has three secondary windings, one for the H.T. supply rated at 300 volts, 550 mA. and two L.T. windings giving 4 volts at 5 amps, and 4 volts at 2 amps. respectively. A voltage doubler circuit was employed and arranged as shown in the diagram on the graph. A smoothing choke of low D.C. resistance is advised to avoid unnecessary voltage loss, but this is not essential, for, as will be seen by the unsmoothed D.C. output curve, there is just a shade less than 500 volts available at full load.

The regulation of the 4-volt 5-amp. L.T. winding is quite satisfactory, for with a 1-amp. load only the output was 4.09 volts. With 5 amps. flowing this fell to 3.88 volts measured across the transformer terminals. The voltage given by the 2-amp. winding was found to be slightly high even under full load, but as a single pair of leads will be required to carry the full current in this case the voltage at the valve holder will not be much in excess of the normal value. If a dial lamp draws current also from this winding the additional load might quite well bring the voltage at the valve down to its correct value.

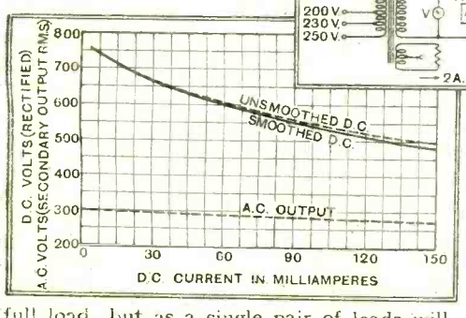
The price of this model is 65s. The workmanship in this, and in the two other models examined, is of a particularly high standard, and they are designed on thoroughly sound lines, and the prices are very reasonable, considering the exceptionally fine finish and general high quality of these components.

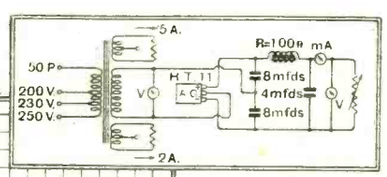
The model W.31, intended for use with a Westinghouse H.T.8 rectifier, costs 30s., while the type 803, which is intended to be used with a class A valve rectifier, costs 32s. 6d.



Heayberd new style mains transformers. The large model is for use with Westinghouse H.T.11 rectifier.

Regulation curves of Heayberd Model W.35 shrouded mains transformer using Westinghouse H.T.11 rectifier.





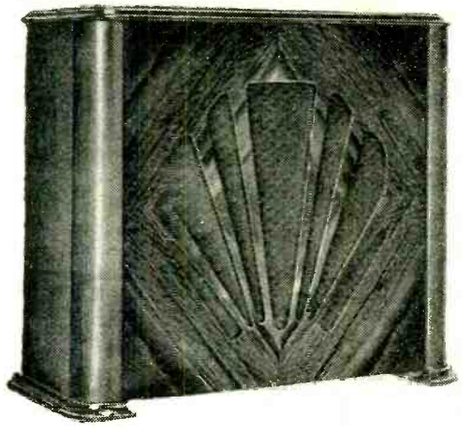
LOEWE "VARITONE" LOUD SPEAKER.

THE driving unit in this loud speaker is a balanced armature movement. The position of the armature in the air gap is adjustable by means of a large knurled knob at the back of the cabinet and enables the desired compromise between sensitivity and power-handling capacity to be obtained. The cone diaphragm is 12in. in diameter, and is of the so-called "free edge" type resting on a felt surround.

The speech coil is wound in two sections, and a three-way switch at the back of the cabinet gives the following alternative connections: (1) sections in series, (2) one section only, (3) sections in parallel. This arrangement not only enables the speaker to be matched to the output valve of the set, but also gives some control over quality. It also offers special advantages where the loud speaker is to be used in addition to the ordinary built-in speaker.

The sensitivity is better than that of the average medium-sized moving-coil unit, and the reproduction of both speech and music is pleasing. Tests revealed that the useful frequency range is from a little over 100 cycles to 4,500 cycles. Apart from a slight rise between 300 and 400 cycles and a definite resonance at 3,600 cycles the output is sensibly uniform over this range.

The cabinet is well finished and attractive in appearance, and the price is 39s. 6d. The makers are The Loewe Radio Co., Ltd., Fountayne Road, Tottenham, London, N.15.



Loewe "Varitone" balanced-armature loud speaker with adjustable speech-coil impedance.

SMITH'S ANODEX BATTERIES.

A NEW range of dry cell H.T. batteries known as the Anodex series has been introduced by S. Smith and Sons (Motor Accessories), Ltd., Cricklewood Works, Cricklewood, London, N.W.2. They are made in three capacities, known respectively as the Anodex, Anodex Extra Power, and the Anodex Triple Power. These are available in the usual standard sizes, and the prices are very competitive; for example, a 60-volt unit in the standard capacity class (Anodex) costs 5s. 6d., while a 108-volt Anodex Extra Power battery is priced at 14s.

There are two sizes of grid bias battery made, a 9-volt unit costing 1s., and one 16½-volt size, the price of which is 1s. 9d.

Smith's Anodex 120-volt dry-cell H.T. battery.

A specimen standard capacity Anodex battery is at present undergoing a life test, and when this has been completed we shall be in a position to give detailed information regarding the performance of these new models under working conditions.

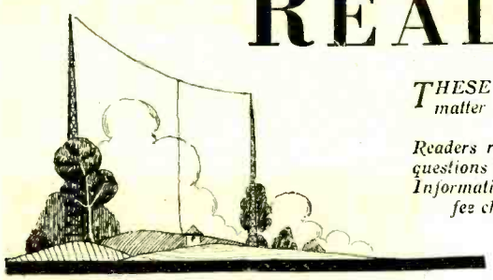
o o o o

CATALOGUES RECEIVED.

The Cressall Manufacturing Co., Eclipse Works, 31, 32, Tower Street, Birmingham, 19. Illustrated list No. 39 describing the Cressall range of heavy-duty sliding resistances and potentiometers.

Webb Condenser Co., Ltd., 42, Hatton Garden, London, E.C.1.—Illustrated catalogue containing the full range of Wavemaster variable condensers.

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.

Easily Fitted Volume Controls.

IT is something of a problem to devise a method of volume control that can be added easily to an existing receiver. At any rate, almost every method is open to criticism on the grounds that, although it may have the desired effect in reducing volume, it will at the same time introduce a more or less serious amount of distortion.

One of our correspondents, who has tried the expedient of inserting a rheostat of 30 ohms in series with the speech coil of his moving-coil loud speaker and the output transformer secondary, has found that this arrangement works quite well in practice, but when the volume level is decreased to a considerable extent by increasing the value of the series resistance, reproduction becomes high pitched. We are asked to suggest a better method, it being understood that any addition or alteration must be made to the loud speaker itself, and not to the receiver, of which the majority of components are inaccessible.

It is in accordance with theory that the admittedly somewhat crude arrangement described by our querist should result in attenuation of the lower frequencies, but, as he has found out, it has its uses, and is particularly easy to put into operation. The output transformer which serves to link the loud speaker with the last valve in the receiver is nearly always get-at-able, and so the extra resistance, of which the position is shown diagrammatically in Fig. 1 (a), may easily be added. A filament rheostat, with an ohmic volume of between 15 and 50 ohms (depending on the speech coil impedance) will generally be suitable.

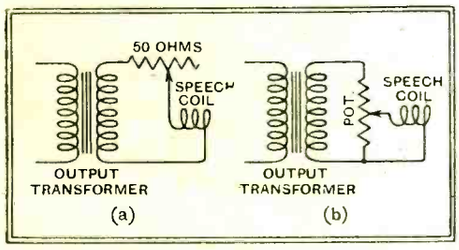


Fig. 1.—Two methods of fitting an external volume control to a moving-coil loud speaker.

We are rather at a loss to suggest any simple scheme which is likely to be a distinct improvement over that in question, but it would be worth while to try the use of a potentiometer connected as in Fig. 1 (b), with quite a low total resistance. The best value could be found by trial and error.

Long-wave Troubles.

AT first sight it might seem that when stability has been attained on the medium waveband in an H.F. amplifier, no trouble should be experienced on the long-wave side. The residual inter-electrode capacity of a modern screen-grid valve is extremely small, and therefore offers a very high reactance to the feed-back of energy between plate and grid circuits at long wavelengths.

To offset this, it is a fact that the dynamic resistance of the long-wave tuned circuits is very high indeed, even with small coils of average efficiency. Further, by-pass condensers used for decoupling, though they may be of more than sufficiently high capacity on the medium band, tend to become ineffective when wavelength is increased—and consequently frequency is lowered.

Either of the effects mentioned in the preceding paragraph may be responsible for the difficulties experienced by a correspondent, who has been unable to stabilise his set on the long waves, in spite of the fact that it works well on the medium band.

There is still another effect which may be causing the trouble; although the H.F. stage may be inherently stable, symptoms closely resembling those of instability are often traceable to imperfect filtering of H.F. energy in the detector anode circuit.

An H.F. stopper which is quite effective on the medium band may fail on the long waves, and we advise our correspondent to check this detail. As to whether the H.F. filter is really at fault may be ascertained very easily by connecting an abnormally large detector by-pass condenser—say of 0.005 mfd.—between anode and earth.

If this addition produces stability (it will in any case reduce high-note response) it may be assumed quite definitely that the filter is at fault.

The Padding Condenser.

IT is usual to adjust the trimming condensers of "ganged" circuits at a short wavelength; then, if the variable condensers are all accurately aligned, and if the tuning coils are properly matched, the adjustment thus made will hold good over the whole tuning range.

A reader, who is admittedly using a ganged condenser of somewhat out-of-date pattern, finds that an adjustment made in this manner does not hold accurately when the set is tuned to the upper end of the broadcast waveband (about 430 metres upwards). He is quite sure that the coils are all of the same inductance value. Only one of the three circuits in his set is affected, and it is found that, at the higher wavelengths, signal strength is improved by reducing the amount of trimming capacity. The remaining two circuits seem to be in proper alignment. Our advice is requested as to the best procedure to make good this defect.

Probably the best advice we can offer is that the condenser should be returned to its makers for overhaul, but, as it is an out-of-date pattern, it is far from certain that anything could be done to it. As a last resort, the inclusion of a padding condenser,

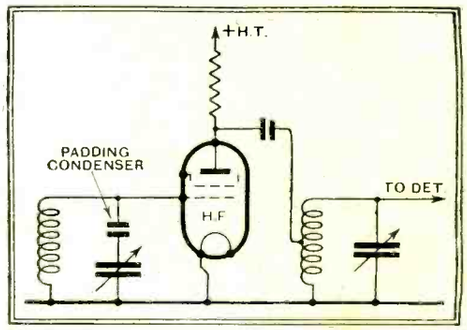


Fig. 2.—When one member of a ganged condenser is out of alignment, a padding condenser should be tried.

in series with the variable condenser which tunes the particular circuit running out of alignment, might be tried. For this purpose a capacity of about 0.02 mfd. might prove satisfactory, but a semi-variable condenser, in combination, if necessary, with fixed capacities, would be preferable.

The padding condenser should be connected as shown in Fig. 2.

Grid Circuit By-pass Condensers.

A CORRESPONDENT, who has been re-reading the issue of *The Wireless World* for July 8th, in which the "Autotone Portable" was described, questions whether there was not an error regarding the capacity of the grid circuit by-pass condenser, which was given as 50 mfds.

This value is correct; the condenser employed is of the dry electrolytic type, with a high capacity, but, as the maximum voltage which it has to withstand is that of the grid bias battery, it need have but a low working voltage. This type of electrolytic condenser is particularly suited for use in grid circuits where an extremely high capacity is likely to be of advantage, both in reducing hum and in preventing undesirable inter-circuit-couplings.

Writing on a similar subject, another querist asks whether an electrolytic condenser used in the grid bias circuit is likely to be subjected to a momentary rise in voltage while the receiver valves are warming up. The answer in this case is that no serious rise is to be anticipated. In practically every automatic bias system, the potential developed across the by-pass condenser will be dependent on the flow of anode current. However high the initial rise of H.T. voltage may be, it is hardly possible that an appreciable part of it should be applied across this condenser.

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.

The Wireless World

THE PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 694. FRIDAY, DECEMBER 16TH, 1932. VOL. XXXI. No. 24.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

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 : 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.

CONTENTS.

Interference and Legislation.

Co-operation of the Electrical Industry Essential.

INTERESTING developments are taking place in connection with the problem of electrical interference, and it is very gratifying to us to find general support forthcoming for the recommendations which we have put forward in recent issues.

Summarised, the views which we have expressed, are :

That legislation should be framed to give the Postmaster-General authority to control electrical radiation of a type liable to cause interference with wireless reception ;

That the electrical industry should co-operate to ensure that electrical apparatus marketed or installed should in future be interference-free ;

That legislation should first of all seek to make it illegal to sell or install interfering apparatus but should also give the Postmaster-General powers to oblige owners of interfering apparatus already in existence to reduce or eliminate the trouble ;

That the Institution of Electrical Engineers, as the representative body of the electrical industry in this country, should put forward guiding principles upon which legislation could be based.

In connection with this last recommendation, we were gratified to see a reference in a Leader in our esteemed contemporary *The Electrician*, which, after quoting the suggestion put forward by *The Wireless World*, concluded " We should like to associate ourselves with this proposal, which we feel sure will be carefully considered by the Council of the Institution."

We have had many communications welcoming the efforts which *The Wireless World* is making to call attention to this problem and these have not been confined to this country. A very interesting letter has been received from M. Andre L. J. Bernaert, giving details of a Decree published on November 10th, which will have the effect of controlling electrical interference in Belgium.

The Decree is published as a direct result of a report submitted to the King by M. F. Bovesse, Minister of Posts and Telegraphs and President of the Board of Governors of the Belgian Broadcasting Institute.

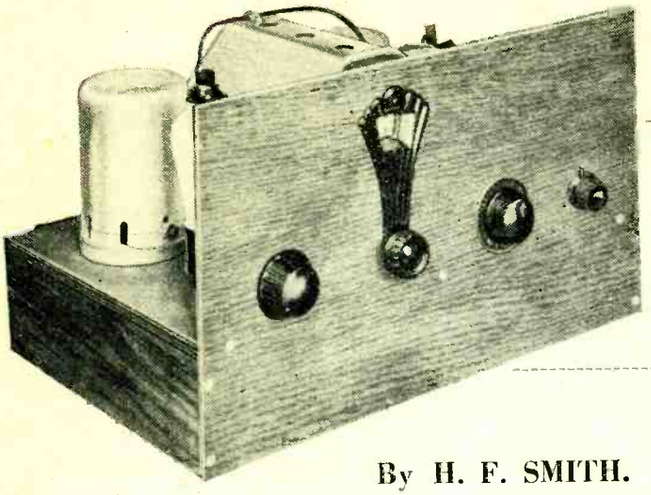
The Decree lays down that users of electrical apparatus which is liable to cause interference with reception of broadcasting stations in Belgium are responsible for taking measures to avoid or reduce the disturbance caused. The Minister of Posts and Telegraphs is responsible for seeing that the measures required are technically justified and can be applied economically.

A Committee appointed by the Ministry of Posts and Telegraphs will study the complaints received and decide what measures should be taken to effect a remedy, and the period permissible to enable the work to be carried out by the owners.

Legislation very much on these lines would, we think, meet the case in this country, the Postmaster-General to be the controlling authority and to have the advantage of the views of an Advisory Committee partly nominated by the Institution of Electrical Engineers, in order to ensure that measures required to be taken to eliminate interference in special cases were technically justified and reasonable. In this country, we should however, like to see the future sale or installation of interfering apparatus prohibited in addition to reducing existing interference. This seems much fairer than subsequently coming down upon the owners of the machinery after it has been installed.

The Wireless World STRAIGHT THREE

An Extremely Efficient Set for Battery Operation.



PRINCIPAL FEATURES.

General.—*Three-valve H.F.-det.-L.F. receiver for battery feed. Operated with external aerial and loud speaker.*

Circuit.—*Single-tuned input circuit; variable-mu H.F. valve, linked by two-circuit intervalve coupling to a regenerative grid detector. Output valve coupled by resistance-fed transformer; directly connected loud speaker.*

Controls.—*(1) Single tuning control. (2) Combined volume control and on-off switch. (3) Reaction condenser. (4) Wave-range switch.*

By H. F. SMITH.

THERE is little advantage to be gained by complicating the design of H.F.-det.-L.F. sets; the conventional arrangement which, by a process of elimination, has become almost standardised is the best for all-round use. True, there are elaborations which may be introduced; some are beneficial, some of doubtful merit; but all too often their inclusion may actually restrict the general usefulness of the set. Even if they achieve their primary objects, they may bring about a falling-off in some other direction.

This is not to say that any standard design is bound to be satisfactory. On the contrary, there is a world of difference between two sets built to the same basic circuit, in one of which all essential details are right, and the other in which there may be nothing fundamentally wrong but where the performance of each individual circuit leaves something to be desired. In the final results the cumulative effect of half a dozen minor deficiencies is likely to show up to a more-than-noticeable extent.

Quite deliberately, no stunts have been introduced in the present design, which represents an attempt to avoid all such losses due to complications, and within the price limit imposed to produce the best possible all-round receiver for battery operations.

A "Standard" Circuit.

The receiver includes a total of three tuned circuits; there is a risk that any less number may lead to dissatisfaction on the score of selectivity. In the arrangement of these three circuits there is nothing unusual, excepting that two of them are employed as an intervalve coupling instead of in the aerial-grid circuit; the properties of the variable-mu H.F. valve allow this to be done without prejudice to selectivity. Otherwise the circuit is a straightforward version of the H.F.-det.-L.F. combination which has stood the test of time and is shown diagrammatically in Fig. 1.

Instead of trying to embrace a wide band of frequencies in the filter, matters have been arranged by means of double-capacity coupling to attain little more than optimum coupling between the two circuits, and the general characteristics of the detector and L.F. amplifier have been chosen to offset the loss of high notes which must inevitably take place. It is now realised that the idealistic "9-kilocyle" filter is almost unattainable in practice, and even if it were its initial adjustment would require the resources of quite a well-equipped laboratory.

At first sight it may seem a retrograde step to have chosen a three-electrode output valve instead of one of the latest pentodes. While the present writer yields to none in his admiration of these high-efficiency valves, his experience shows that the difficulties of matching them to the loud speaker render them hardly suitable for general consumption. It is much easier to get good-quality reproduction with a high-efficiency triode such as that employed in the set to be described. But there is no reason why one of these pentodes should not be fitted, provided that the constructor obtains a specially wound loud speaker, or, alternatively, employs a suitable coupling device for linking the valve to a loud speaker with windings of standard impedance.

Like the circuit arrangement, the construction of the receiver is straightforward and without elaboration. Almost all the components are mounted on or under a baseboard with a fairly deep lower compartment in which almost all the exposed wiring may be concentrated. Wood is used throughout for the construction of the chassis as additional screening, beyond that provided by

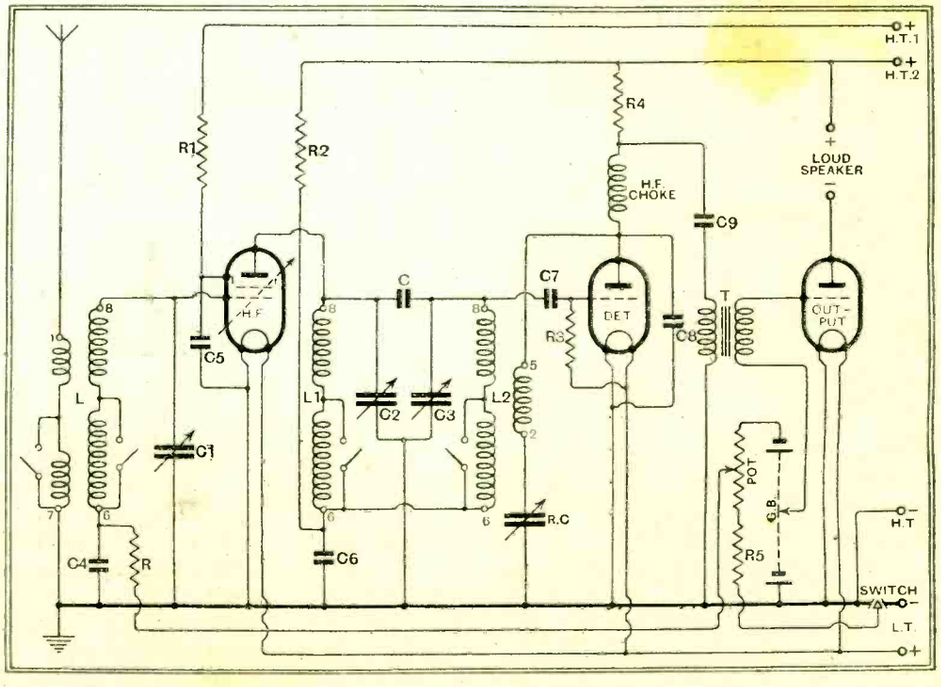
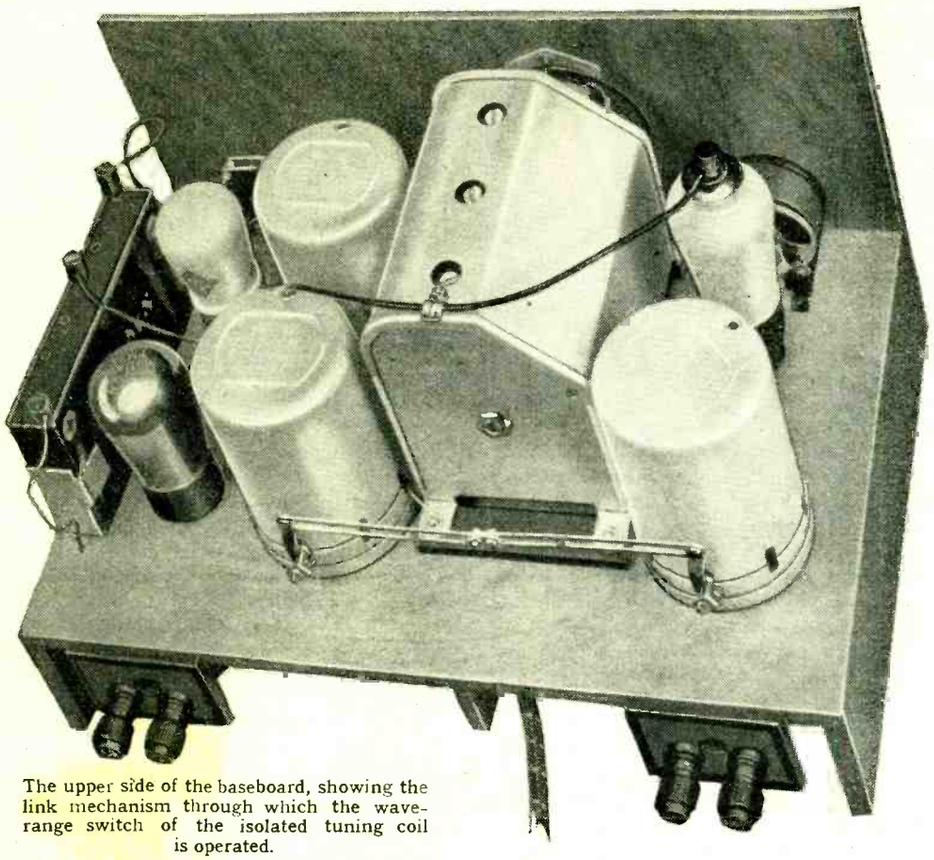


Fig. 1.—Complete circuit diagram. The condenser C_6 acts both as an H.F. decoupling capacity and as a link between the tuned circuits. Values of components: C, see text; C1, C2, C3, ganged condensers, 0.0005 mfd.; C4, C5, 0.1 mfd.; C6, 0.04 mfd.; C7, C8, 0.0002 mfd.; C9 1 mfd.; R, 5,000 ohms; R1, R2, 1,000 ohms; R4, 50,000 ohms; R5, 2,000 ohms; POT., 25,000 ohms.

The Wireless World Straight Three.—

the components themselves, is unnecessary, and would not lead to any improvement in performance.

If the prospective constructor decides not to buy a ready-made chassis and cabinet, he should first prepare the baseboard and panel. The former is of ⅜in. plywood, measuring 9in. × 14in.,



The upper side of the baseboard, showing the link mechanism through which the wave-range switch of the isolated tuning coil is operated.

and is cut away to clear the combined volume-control potentiometer and on-off switch. Supporting cheeks of similar wood, 9in. long and 2½in. deep, are screwed to each side to give additional strength; one of them acts as support for the condensers C4 and C5. A wooden batten is screwed across the underside of the baseboard to act as a support for C6; channels should be cut in this batten to pass various conecting wires if neatness is to be studied. Alternatively, the strip could be replaced by a simple metal bracket for the condenser.

Constructional Details Explained.

Having prepared the baseboard, the components should be mounted on its upper surface, using Fig. 3 as a guide to their positions. It should be observed that the layout is not particularly critical, but the relative positions of the ganged tuning condenser and of the coils should be arranged with some care from the mechanical rather than the electrical point of view. In the interests of appearance, the condenser is raised a quarter-inch above the baseboard by strips of wood placed under its feet, in order that its control knob may be on a line with the others. This procedure also has the effect of making the soldering tags under the condenser rather more accessible, but in the absence of a small soldering iron it is best to join wires to the stator tags of each unit before mounting. The two brush contacts to the rotor may also be joined together, a wire being fitted for ultimate connection to L.T. negative and earth.

Compactness, and also electrical efficiency, are ensured by mounting the tuning coils in the manner shown. This is made possible by the special link connection supplied with them, through which movement is transmitted to the wave-range switch of the coil L, which is out of line with the others. With regard to the actual mounting of the coils, the manufacturers' instructions should be studied, and before they are finally screwed down holes should be drilled. adjacent to the appropriate coil terminals, for wires which will be passed through the baseboard. Similarly, three 1-in. holes must be made for the valve holders.

After having mounted the components on both sides of the baseboard, this and the front panel may be brought together, drilling suitable holes for the control spindles and condenser escutcheon on the latter. Before securing the panel finally in position, the reaction condenser and potentiometer should be mounted on it.

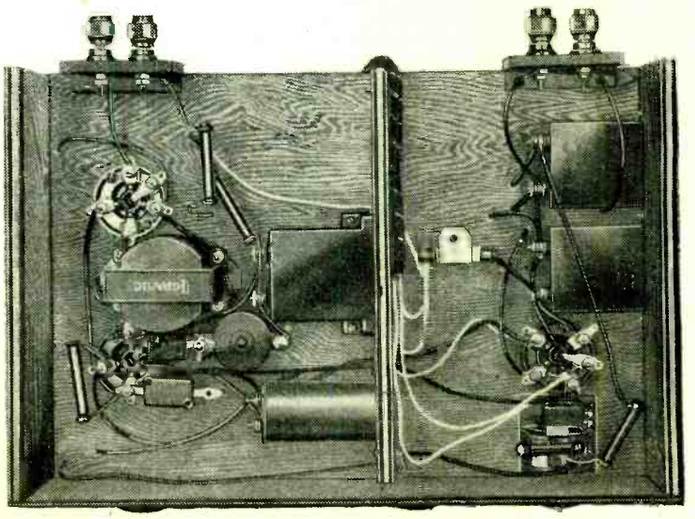
Top-end Coupling Condenser.

There is no component to be made beyond the tiny coupling condenser C, which serves as a top-end capacity link between the intervalve circuits. No commercial component is sufficiently small and compact; the capacity, indeed, amounts only to a micro-microfarad or so. This capacity is afforded by a pair of insulating leads joined between terminals No. 8 on coils L1 and L2. The free ends of the leads are not metallically connected to anything, but are placed close together, as shown in Fig. 2. Using 2 mm. sleeving, with three twisted strands of No. 22 wire in each section, the correct capacity is obtained with an overlap of nearly 1¾in. The two connections are bound together with thread, and the small condenser thus formed is housed inside the screening can of L2.

For wiring the receiver, No. 22 tinned copper wire in 2 mm. sleeving is probably most convenient. Matters are arranged so that all terminals are reasonably accessible, and by running straight point-to-point connections there is virtually no risk of introducing undesirable interaction. Practically the only danger to guard against is the introduction of short-circuits to the metal work, particularly where leads emerge from the screening cans. The practical plan may be taken as a guide in wiring, it being borne in mind that wires which pass through the baseboard bear corresponding reference letters at each side.

All fixed resistors are conveniently supported by their connecting wires, but R1 may be anchored to the baseboard by a simple paper clip, as shown in Fig. 3. The condensers C7 and C8 are fixed directly to the valve-holder H.F. choke terminals.

It should be noted that the H.F. anode lead is taken directly from the valve cap through a hole provided in the screening can of L1, and that this insulated lead may be anchored to a clip on top of the condenser, as shown in the illustration on this page.



A "worm's-eye" view of the base compartment, in which all the smaller components and most of the wiring are concentrated.

The Wireless World Straight Three.—

Again, this is mainly for the sake of appearance. Contrary to usual practice this lead is not screened. Stability can be attained without doing so, and the consequent reduction in stray capacity is all to the good, as it allows a wider waverange to be covered. But if there are any signs of instability, which might be provoked by an exceptionally "hot" H.F. valve operated at high voltages, this wire should be passed through a length of sleeving covered by metallic braiding, which must be earthed.

Due to the fact that tuned-anode coupling is employed in the H.F. stage, the windings of the coils L1 and L2 are at the potential of the H.T. supply with respect to earth and the metal work, and so reasonable precautions should be taken against introducing a short-circuit. Such an occurrence as an accidental contact between the vanes of C2 and C3 would cause such a short-circuit, and accordingly care should be taken to see that this does not exist, and also that no stray wires are in contact with the coil screens.

Initial adjustment is, practically speaking, confined to the operation of "trimming." To make a start, the three controls on top of the ganged condenser should be screwed fully home, and then slackened off by about two full turns. Then, with the volume control at maximum (full clockwise rotation), it should be possible to tune in at least the local station. Signals should then be brought up to maximum strength by adjusting each trimmer in turn. Finally, the adjustment should be remade when tuned to a station of low wavelength—250 metres or so—after which no subsequent alteration should be necessary.

There remains a possibility that the capacity of the home-made condenser C may not be quite right for optimum coupling between the two circuits with which it is associated, though, fortunately, it can hardly be seriously wrong if the instructions given are followed. If, after trimming, tuning is found to be broad, we have an indication that there is rather too much capacity, and accordingly a reduction should be made by opening out slightly the ends of the insulated wires which form the condenser. To determine whether this alteration is desirable, a careful test should be made at about the middle of the medium waveband.

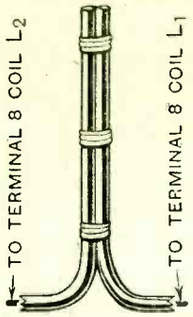


Fig. 2.—The small home-made condenser C, consisting of wires separated by lengths of sleeving.

Conversely, coupling capacity may conceivably be too low; this will be suggested by weak signals and very sharp tuning. The appropriate correction for this defect is to lengthen slightly the parallel parts of the condenser wires, still taking care that they are properly insulated from each other. A rather better plan is to increase capacity by twisting up another strand or two of wire with the three already encased in the lengths of sleeving. It is worth while taking a little trouble to make sure that coupling is exactly right, as it is only by doing so that maximum range and selectivity can be attained.

It will be noticed that a 9-volt grid bias battery is specified in the "List of Parts." This voltage will be ample for the output valve used, and, from the point of view of volume control, will enable the H.F. valve to be desensitised sufficiently to prevent overloading in all except the most difficult receiving conditions. But, where signals from a powerful local station are exceptionally strong, it will be an advantage to substitute a 16-volt battery, which will afford a greater range of control. There will be just enough room for it on the baseboard.

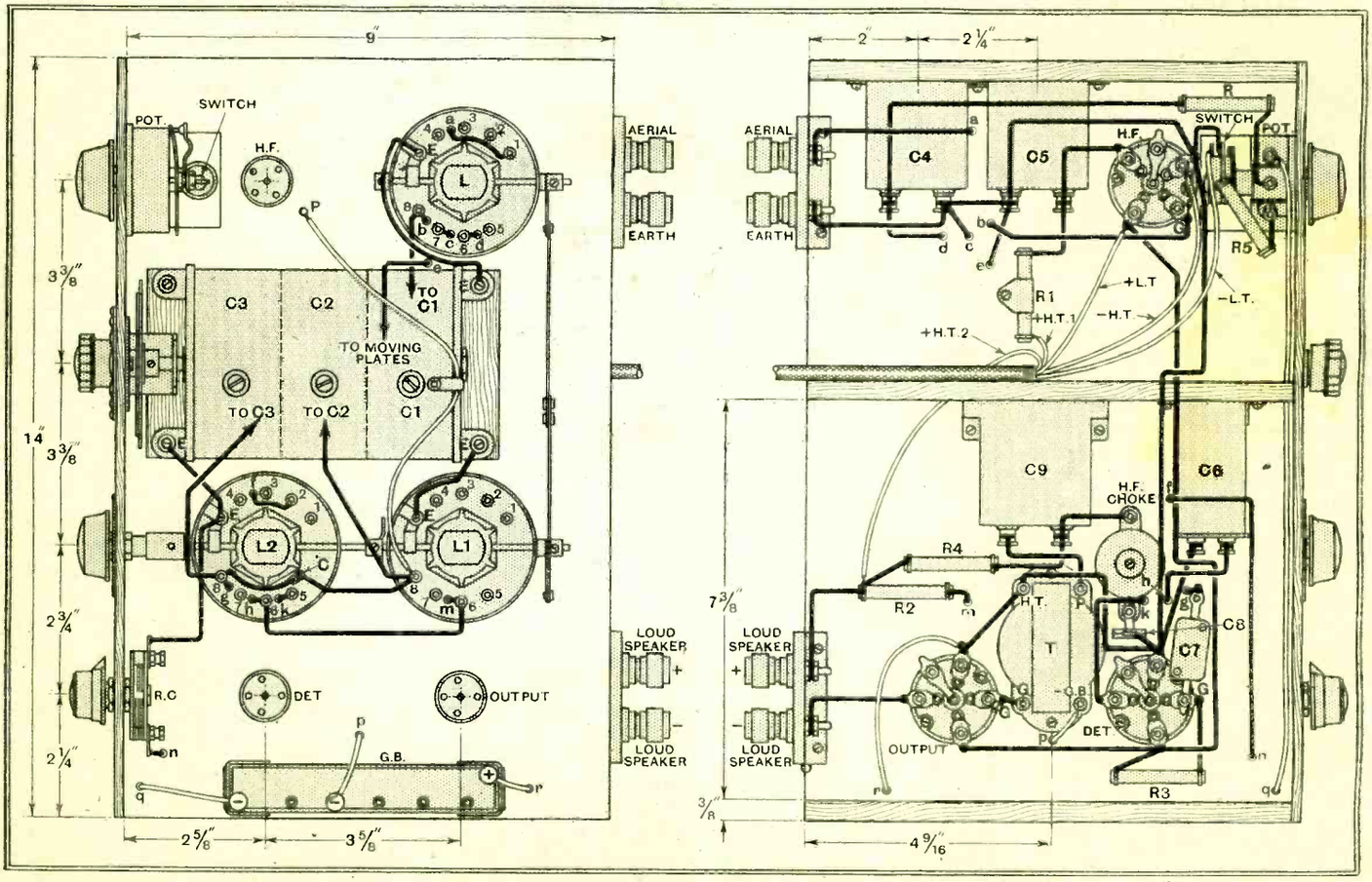


Fig. 3.—The complete practical wiring plan. Left: the upper side of the baseboard. Note particularly the arrangement of the condenser C, which is mounted inside the screen of L2. Right: the underside of the baseboard. Wires passing through it bear corresponding lettering, and so their ultimate connecting points may readily be traced.

Whatever the voltage of the bias battery chosen, the potentiometer lead should be plugged into the most negative socket, while the other "wander" lead, from the L.F. transformer, should be joined to the tapping appropriate for the output valve.

With regard to H.T. supply, the plug marked H.T. + 2 should

The Wireless World Straight Three.—

be joined to the highest voltage point available, up to a maximum of 150 volts. The other connection, H.T. +1, feeds the screening grid, for which a voltage of about 70 is suitable. As usual, just as high a voltage as the valves are rated to withstand is to be advocated, but very fair results are obtainable with as little as 100 volts.

The question of a container may safely be left to the constructor's personal taste, but the cabinet specially designed for the set, with space for batteries, solves the problem very satisfactorily, and allows ample scope both with regard to the choice of a loud speaker and its position from the acoustic point of view.

There is a good deal of latitude in the choice of components, at any rate if alterations in layout are to be made, but in at least one detail great care should be exercised: the coupling condenser C6 must definitely be of a type that is non-inductive. Two or three microhenrys of inductance in this component is enough to prejudice the functioning of the tuning system.

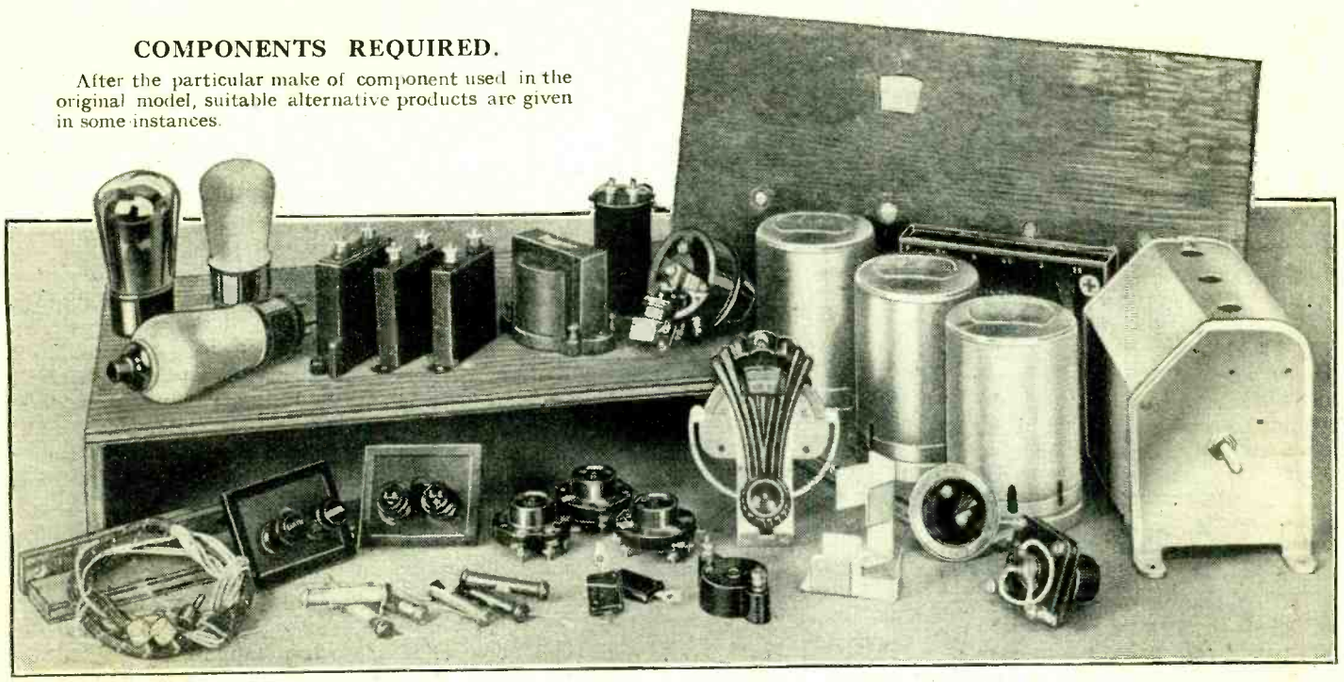
Wild claims as to the performance of any three-valve set should always be discounted; with regard to the results to be expected from the present set, it will be enough to say that it made a very convincing showing against another three-valve type which the writer has hitherto regarded as a satisfactory standard. As a final test, the two receivers were carefully and fairly compared: the "Straight Three" was well ahead on the scores of general selectivity and quality. As to sensitivity, there was little to choose between the two, in spite of the fact that the "standard" was fitted with a pentode, which gives more magnification.

The "Straight Three" is by no means an expensive receiver to build. All the parts necessary for the construction of the set itself cost less than five pounds. Batteries, valves, cabinet, and loud speaker are not, of course, included in this price.

A model of this receiver is available for inspection by readers at 116, Fleet Street, E.C.4.

COMPONENTS REQUIRED.

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



1 3-Gang condenser, 0.0005 mfd., **C1, C2, C3.** **(Ormond 7/R.490/S.3)**

1 Disc drive for condenser, with black knob **(Ormond R.362)** (Formo, J.B., Polar, Radiophone, Utility.)

1 Variable condenser, bakelite dielectric, 0.0003 mfd., with knob. **R.C.** **(Ormond R.508)** (Burton, Graham Farish, Lotus, Telsen.)

1 Fixed Condenser, 0.04 mfd., non-inductive. **C6.** **(Dubilier 9200)**

2 Fixed condensers, 0.1 mfd., **C4, C5.** **(T.C.C. Type 50)**

1 Fixed Condenser, 1 mfd., **C9.** **(T.C.C. Type 50)**

2 Fixed condensers, 0.0002 mfd., **C7, C8.** **(T.C.C. Type M)** (Formo, Graham Farish, Hellesens, Lissen, Peak, Telsen, Wego.)

1 Set of three shielded tuning coils, complete with wave-range switches, adjustable link, and switch-knob assembly, **L1, L2, L3.** **(Telsen)** (British General, Colvern, Formo, Lissen, Tunewell, Varley, Wearite.)

1 L.F. transformer, 3:1 ratio, **T.** **(Igranic T.24 B)** (Ferranti, Lissen, R.I., Siektun, Telsen, Varley.)

3 Valve holders **(W.B. under-baseboard type)** (Benjamin, Bulgin, Burton, Clix, Eddystone.)

1 Potentiometer, 25,000 ohms, with ganged 3-point switch **(Bulgin V.S.10)** (Wearite.)

2 Resistors, 1,000 ohms, 1 watt, **R1, R2** **(Erie)**

1 Resistor, 2,000 ohms, 1 watt, **R5** **(Erie)**

1 Resistor, 5,000 ohms, 1 watt, **R** **(Erie)**

1 Resistor, 50,000 ohms, 1 watt, **R4** **(Erie)**

1 Resistor, 1 megohm, 1 watt, **R** **(Erie)** (Dubilier, Loewe, Claude Lyons, Varley, Watmel.)

1 H.F. choke **(Lewcos M.C.)** (British General, Bulgin, Burton, Goltone, Igranic, R.I., Varley, Wearite.)

2 Two-way terminal mounts **(Junit)** (Belling-Lee, Goltone, Lissen, Telsen.)

4 Terminals, "Aerial," "Earth," "L.S.+," "L.S.−" **(Belling-Lee Type B)** (Burton, Clix, Eelex, Igranic, Swain.)

3 Wander plugs **(Belling-Lee Midget)** (Clix, Eelex, Goltone, Lissen.)

1 Battery cord, 5-way **(Lewcos)** (Belling-Lee, Bulgin, Concord, Goltone, Harbros.)

1 Grid bias battery, 9 volts **(Drydex)** (C.A.V., Ever Ready, Grosvenor, Hellesens, Lissen, Pertrix, Ripaults, Siemens, Smith.)

1 Pair G.B. battery clips **(Bulgin No. 1)** (Burton, Gripso, Ormond.)

2 oz. No. 22 tinned copper wire, 4 lengths 1 mm. sleeving, wood panel 14 by 8, wood for baseboard.

Screws: Seven ½in. No. 4 C/sk., seven 1in. No. 4 R/hd., six ¾in. No. 4 R/hd., six ¾in. No. 4 R/hd., six ¼in. No. 4 R/hd., nine ½in. No. 4 R/hd.

Cabinet **(Apollo Gramophone Co., Ltd.)**

Valves: Marconi V.S.2, metallised; Cossor 210 DET, metallised; Mullard PM2A, or other valves with similar characteristics.

BLUE PRINT.

For the convenience of readers constructing the Straight Three, full-sized blue prints of the complete layout and wiring diagram are available from the publishers at 1s. 6d. post free.

Monodial D.C. Super.

It is regretted that an error occurred in the list of parts for the Monodial D.C. Super in our issue of December 2nd. The resistance R_{21} was shown as consisting of two Cressall resistance mats, types ERF and ERH of 200 and 250 ohms respectively. Actually, R_{21} is made up of two mats, type ERF and ERE of 200 and 150 ohms respectively.

The B.B.C. Year Book for 1933.

The past year has been one of unusual interest in the history of the British Broadcasting Corporation, and on this account the Year Book for 1933 is so full of valuable information that it is difficult in a brief review to determine where to begin and where to leave off. The first forty-two pages are devoted to a historical resumé of the progress of broadcasting and the growth of the B.B.C. during the first ten years of its life from November, 1922, to October 31st, 1932.

The second section of the book is devoted to a general account of Broadcasting House, and, naturally, considerable space is devoted to the programme section, which includes international broadcasting, hints on obtaining auditions, articles on music, talks, and news.

The subject of Empire Broadcasting occupies forty-two pages, in which the past history and the future plans are outlined, while the International Section includes the year's work of the U.I.R. at Geneva and some of the problems under discussion at the Madrid Conference. The Technical Section is full of interest, and gives chapters on Ultra-short wave broadcasting, Interference, and Television. The book contains 480 pages, is well illustrated, and costs 2s. net.

UNBIASED

By
FREE GRID.

Helping Scotland.

AN indignant Highlander has sent me a collection of Scottish newspapers in which appear such ominous headlines as "Highland Storm Grows" and "Wants of Isolated Listeners Deliberately Ignored." From a perusal of these I gather that feeling is very strong concerning the inadequacy of the Scottish Regional station.

My correspondent, evidently over-estimating my influence with the B.B.C., asks somewhat fiercely what I am going to do about it. I cannot, as he desires, conscientiously clamour for the B.B.C. to besprinkle the lonely Highlands with expensive relay stations, nor can I agree with his alternative suggestion that the B.B.C. should supply a first-class multi-valve set to every Highlander who successfully passed a "mean test."

I do think, however, that the B.B.C. could do a great deal towards alleviating matters if they adopted my plan and undertook to establish listening posts at various centres. At each listening post a first-class set, tuned permanently to Falkirk, would be switched on in the morning and off at midnight by an accurate eight-day clock mechanism.

A man would call at each post once a week to change the accumulators and wind the clock, such simple duties not calling for skilled labour. Programmes would be distributed over Post Office land lines to various country telephone exchanges and then to subscribers. Obviously, every intending subscriber would be required to have the telephone installed at the usual rates, but such petty details I leave to be worked out by the B.B.C. and the P.M.G.

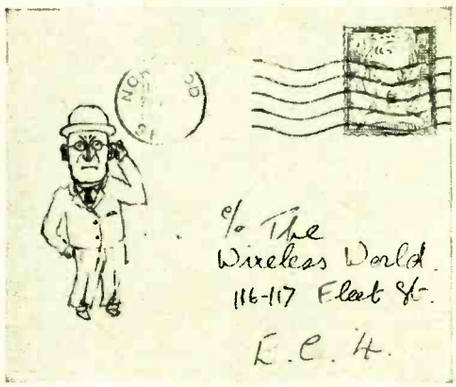
A Necessity.

WHEN travelling up North the other day I was greatly incensed when asked to pay a shilling for the use of headphones connected to the train's broadcast

Wireless is a necessity

receiver. Why argue that one would have to pay this sum in any case for a magazine or a meal on the train, in spite of the fact that one had paid the fare? There can be no comparison between the services.

Magazines and dinner are, in my opinion, luxuries; as such, they should be paid for. Wireless is, however, as much a necessity as the heating and lighting of a compartment, and, as such, should be included in the fare. The next time that I have occasion to travel on one of these radio-equipped trains I shall feel tempted to bring my own headphones.



This letter, testimony to the world-wide fame of "Free Grid," came safely all the way from Norwood (—Ed.).

Clocks.

NOT long ago I became the proud owner of a mains-driven clock. This device proved so fascinating that I determined to replace all my existing "time-pieces," as the pawnbroker usually calls them, with electric ones. I did not, however, wish to sacrifice my existing clock cases in favour of the wretched futuristic-looking devices which one sees nowadays, and as I was assured that electric clock movements could be obtained separately I sallied forth with hope in my heart and the children's money-box in my coat pocket. But to my chagrin I found that manufacturers apparently cater for the electrification of scullery clocks only, as I could get nothing but what is called the "3½in. standard drum movement."

If any kindhearted reader can tell me where I can light upon something a little more substantial—a 5¼in. movement to start with—I shall be eternally grateful.

Figures that Stagger.

IT has always been a great mystery to me how some manufacturers, more especially those who are new to the radio business, arrive at the type numbers of their sets. A newly formed firm has recently put its first set on the market with the label: Type 740B. I have been racking my brains trying to find out how they arrive at this classification. The number of valves can have no relation to the figure, because the set has four of these, and I fail to see how the figures can refer in any way to the filament current consumption. If they had, I might have thought that a tip had been taken from the valve makers.

Incidentally, the firm in question must have a real hustler as sales manager, for the serial number on the set which I have just been privileged to inspect is 140,297, although the firm have only been marketing sets for just over a fortnight!

Where to Place the Listener.

I HAVE been studying an article which strives to tell us just where we may, or may not, place our loud speakers. Apparently the loud speaker must be at ear level. This preliminary condition at once puts out of court a large percentage of existing arrangements in which the loud speaker is either below ear level, as in the case of the average radio-gramophone, or somewhat above it, as when it is mounted on a baffle and slung from the picture rail. According to the perpetrator of the article, who attempts to show us the error of our ways in somewhat pompous terms, even the idealists who have gone to the trouble of getting a builder to knock a hole in the wall or of using the entire ceiling as the mouth of an exponential horn have apparently wasted their money.

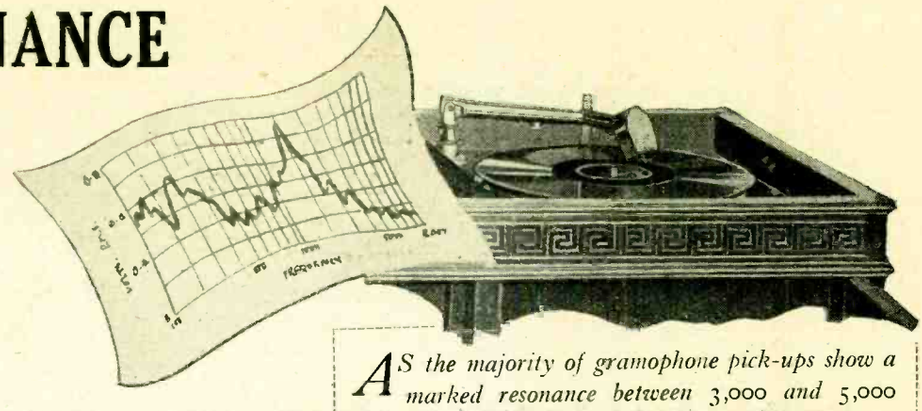
But this is merely a beginning. We are also told never to sit at the side of a loud speaker, but always at the front. I can only think that the good gentleman has never known the blessings of matrimony, otherwise he would realise the difficulties of seating his offspring in single file in the average room. In addition, we are bidden to remember that the acoustic conditions of the room, and, therefore, the position of the loud speaker, depends on the number of people in it, and so I can only suppose that a necessary preliminary

Ourselves through the loud speaker.

to any member of the family wishing to escape the concert would be a careful repositioning of the loud speaker, which, as Euclid said, is absurd.

PICK-UP RESONANCE AND NEEDLE SCRATCH.

Some Experiments with a Scratch Filter.



AS the majority of gramophone pick-ups show a marked resonance between 3,000 and 5,000 cycles, a scratch filter containing a tuned acceptor circuit, giving a substantially level overall characteristic, is advocated. It is shown that scratch is emphasised by armature resonance.

By
A. W. STEWART.

PRACTICALLY all pick-ups show resonance at the upper end of the frequency response curve; indeed, it might more truly be said of some models that they possess a frequency response at the low-frequency side of a resonance! The type referred to in this article, however, is that which has a substantially uniform characteristic, a peak occurring at some frequency between 3 and 5 k.c., followed by a tailing response up to about 7 k.c. This definition is true of all the better instruments, and, indeed, extension beyond this range for the present form of lateral cut record would be useless, owing to the fact that even the best recordings do not extend up to this limit.

By using the class of filter shown in Fig. 1 very good results are obtainable, and the scratch is reduced to a commendably low level. As the action of this filter is to cause a trough in the characteristic by acting as a short circuit to A.C. of the frequency to which it is tuned, by adjusting the resistance the loss in the filter circuit can be made to cancel out the gain due to the resonance, the net result being a fairly level overall curve.

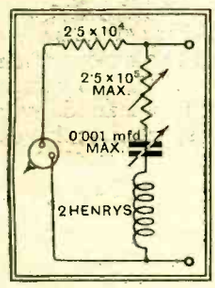


Fig. 1. — A filter which reduces needle scratch to a low level.

A Marconi pick-up was connected to an amplifier in the manner indicated in Fig. 2 (a), the valve being inserted as a buffer to eliminate the possibility of resonance due to the pick-up inductance and the filter capacity. A record was played which contained a prominent upper register. As the condensers were slowly closed, the tinny sounds gained in volume, little alteration in the power of the scratch being evident. When the cut-off frequency came below the resonance frequency of the pick-up, the sound at once became intolerably shrill and full of surface noise. Further extension of the range downwards caused little material difference.

The Scratch Band.

The filter was next inverted, thus becoming a low pass, as shown Fig. 2 (b). Cutting out more and more top produced no audible difference in the scratch until the peak was passed. The removal of this removed the scratch, and with it such of the top as the maker of the record had seen fit to include. As connected now, the amplifier included the conventional low-pass filter, and the quality was of the low order usually associated with this state, the H.F. cut-off being about 3.5 k.c. The distribution of the record noise was now occurring over a band of about 4 to 5 k.c. With the series resonant circuit, the inference was that the same noise extended from 5 to 6 k.c. On loading the needle with lead, the natural frequency was reduced to about 3 kilocycles, and the repetition of the above experiment under these new conditions pointed to the result that the noise had now changed its zone to a much lower band.

A pick-up of a different make was next examined. This was noted for its outstanding scratch output, and possessed a readily determinable peak of surpassing height at the pitch of 5.2 k.c. This instrument yielded the information that the scratch band was in the 5-6 k.c. band.

The noise would therefore appear to be in some way connected with the resonant phenomenon. The continuous train of impulses from the track will keep the oscillatory system excited. The individual particles will give transient impulses to the armature system, thus evoking the note at which the free vibration occurs. As a result, we get the mixture of the scratch and resonance which is loud possibly because of the amplification associated with a resonant circuit.

The case must now be considered of the reproduction of a pure tone with a frequency differing by only one or two kilocycles from that of the peak. As they differ in pitch, on meeting a non-linear device, such as the ear, there will result a difference tone. This must of necessity take the form of scratch, but will have a "background frequency" equal to the difference tone between the peak and the frequency being reproduced. A variable frequency record exhibits the effect in an admirable manner.

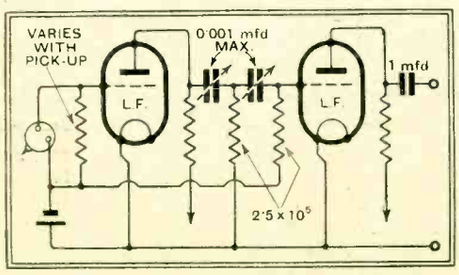


Fig. 2 (a).—An experimental circuit containing a buffer valve to prevent the possibility of resonance due to pick-up inductance and filter capacity.

An Interesting Experiment.

When the system contains a source of cut-off such as the speakers largely used by the cinema industry, it is very interesting to hear the scratch changing in tone as the pitch of the recorded note varies, the true noise being above the speakers' ability to reproduce. This beating is noticeable in instrumental solos where the frequencies involved are of the order specified, and even in a piano passage in an orchestral piece the effect is quite evident, although a scratch filter be used. This is due to asymmetric conditions in the pick-up. This should not occur, but, alas, it frequently does! Where it does not the simple series circuit of Fig. 1 will be found to give a very complete freedom from scratch, owing to its effect in suppressing the peak, which the writer ventures to suggest is the primary cause of excessive scratch, and not, as is usually implied, the record material. If the size of the particles needful to make a 6 k.c. surface noise be worked out, they attain somewhat to the dimensions of fine emery powder. Furthermore, when a needle is held between the fingers on a record, the sound then heard is more of the order of 10 k.c. at the lowest, but the needle is a very efficient radiator of the 8 k.c. note of a frequency test record, hence its powers in this direction cannot be held accountable, so that the bulk of the scratch would appear to lie above this mark. The experiences of others, who have been experimenting with scratch filters, would be warmly welcomed by the writer.

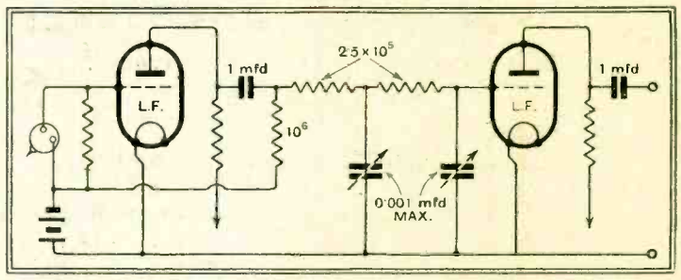


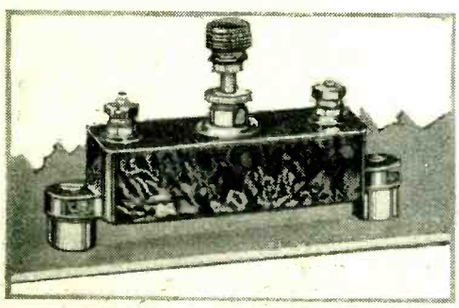
Fig. 2 (b).—By inverting the filter it becomes a low-pass circuit.

Practical HINTS AND TIPS.

AIDS TO BETTER RECEPTION.

WHEN a semi-variable compression condenser is inserted in series with an aerial circuit, it should be remembered that both sets of plates are at high oscillating potential, and further, that any capacity between either set and earth will be additive to that existing across the tuned input circuit. When stray capacities seem to be excessive, with consequent restriction of wave range, the trouble may be traced to the fact that a condenser of the type in question is mounted on a metal baseplate or chassis;

Reducing Stray Capacity.



The high stray capacity which exists between a compression condenser and a metal base plate may be reduced by fitting spacing pieces.

with most designs the lower plate will be separated from the baseboard by a thin sheet of insulating material only, and so the capacity is bound to be high.

The remedy is to mount the condenser on distance pieces about $\frac{3}{8}$-in. thick, in the manner shown in the accompanying illustration.

If a compression condenser is shunted across a tuned circuit, and mounted directly on an earthed metal base, it is worth while taking the trouble to see that the earthed side of the circuit is joined to the lower vane (that nearest to the baseplate). Alternatively, the plan of mounting the condenser on distance pieces may be adopted also in this case.

WITHOUT carrying out an eliminative test, it is always difficult to determine whether an excessively loud background of mains hum is due to an A.C. receiver itself or to the field supply of the moving-coil loud speaker. The best and simplest procedure is to disconnect the output transformer primary and to connect across it a resistance of roughly 2,000 ohms. Next, the two wires that have been removed from the output transformer are joined together in order that the normal load on the source of anode current may be maintained.

Set or Speaker?

The speech-frequency circuits of the loud speaker are now completely disconnected from the receiver, and so, if hum still continues, it must be due either to an insufficiently smoothed field current supply, or, just possibly, to the pick-up of ripple by the output transformer. This latter effect is most unusual.

SO-CALLED moulded resistors of the carbon type consist of a composition rod, the conductive material being equally distributed through the whole mass. This being so, it will be realised that the resistance of the element may be reduced to any reasonable extent by reducing the cross-sectional area of the rod. As the material is not excessively hard this reduction may easily be effected with the help of a file.

Adjusting Resistances—with a File.

An appreciation of these facts enables us to see at once how a very accurate adjustment of resistance value may be made. For instance, the composition rod may be clamped in a vice and wired in series with a battery and meter, its thickness then being reduced with a file until the exact value of current corresponding to the desired resistance is indicated by the instrument. The ability to adjust resistance in this way is particularly likely to be useful when a non-standard value is required.

Another practical application is in connection with the fixed potentiometer feed system through which voltage is customarily applied to the screening grid of an H.F. valve. It is not always easy to calculate the precise value of the resistances of which the potentiometer is composed, and sometimes the need arises for making adjustments. These could, of course, be carried out with the help of a variable potentiometer, but this is unnecessarily expensive, as the correct adjustment when once found need not be subsequently altered.

Although a resistor may be adjusted by filing *in situ* from the electrical point of view, no risk should be run of allowing carbon dust to impair the general insulation of the receiver; this means in practice that the resistance to be adjusted should be wired with temporary extension leads.

Finally, it may be pointed out that the current-carrying capacity of a resistor will be lessened in proportion to the extent that its cross-sectional area is reduced.

IT seems that quite a number of the highly efficient 4-valve sets described in *The Wireless World* as long ago as 1926 and 1927 are still in commission. Reference is here made to sets with the basic circuit arrangement of a neutralised triode H.F. valve, anode bend detector, and two L.F. stages.

Reviving an "Old-Timer."

As an example of these sets has been in the South Kensington Science Museum for some time, it may be argued that they should have been forgotten years ago, but the reason for their survival is that they were as much ahead of contemporary technique as is, say, the "Monodial" of that of to-day.

Although these old sets, particularly when a two-circuit aerial tuner has been added, give extraordinary results even now, they are deficient to a serious extent in one important respect. On many transmissions, reproduction is marred by a peculiar and irritating roughness; this defect must be ascribed to the anode bend detector, which was not designed to cope with the modulation methods of to-day.

By changing over to grid detection this defect can be remedied, but the set will then lose much of its selectivity and general attractiveness. A better plan, for those who are willing to sacrifice a good deal of sensitivity, is to convert the existing detector into a diode. The appropriate alterations are shown in Fig. 1, from which it will be seen that the conversion is extremely simple, and that only a few shillings need be expended in extra parts.

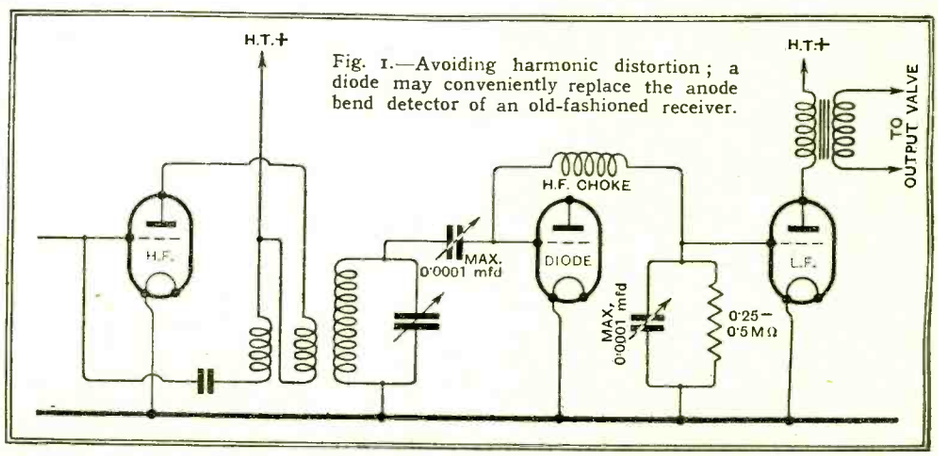


Fig. 1.—Avoiding harmonic distortion; a diode may conveniently replace the anode bend detector of an old-fashioned receiver.

NEWS of the WEEK.

Current Events in Brief Review.

Munich Wants Reports.

MUNICH, the new German 60-kW. broadcasting station, made its official bow on Saturday, December 3rd, on 533 metres. The management of the station is anxious for reports as to how Munich has been received before and after the change-over.

"The Professor's Station."

THIS is the title which the Königswusterhausen (Berlin) broadcasting station has won for itself by reason of its constant flow of educational talks. On January 1st, however, the programmes are to be reorganised on an entertainment basis by a new company, the Deutschlandsender G.m.b.H.

A Mike at the Butcher's.

NEAR Porte Champerret, Paris, is a butcher's shop in which the customers and the salesmen communicate through the medium of loud speakers and microphones. The explanation is that the "shop" is a glass-walled refrigerator. Customers choose their chops, cutlets or steaks through the glass.

Wanted: A Parleuse.

FRENCH listeners like lady announcers. Radio Algiers, the first station under French control to have a "speakerine," is faced with the problem of finding her successor, and it is significant that the notion of a male announcer has not even been considered. More than fifty candidates have applied for the position of "parleuse"—incidentally, a better title than the Anglo-French word used in France.

£109 per Hour.

THE Dutch Press has apparently been taken into the confidence of the management of Radio-Luxembourg, the 200-kW. publicity broadcasting station, which only needs a wavelength in order to set all Europe listening. It appears that AVRO—the neutral broadcasting association of Holland—has signed a contract for microphone facilities at Luxembourg at the rate of £109 per hour. The contract is subject to the approval of the International Broadcasting Union.

Television on B.B.C.'s 7-metre Transmitter.

AS first forecast in *The Wireless World*, the ultra-short-wave transmitter of the B.B.C. at Broadcasting House is now being used for television by the Baird System. These special transmissions are sent out on a wavelength of 7.3 metres on Wednesdays and Fridays from 3 to 5 p.m.

Images with ninety lines up to as many as 240 lines in place of the present thirty-line pictures have been transmitted experimentally in the Baird laboratories, and when ultra-short-wave broadcasting becomes established the result of this research will become available to the public.

The Baird Company will welcome any reports.

English from Algiers.

THE Algiers broadcasting station now transmits an English talk every Wednesday.

China Calls the World.

CHINESE legations and consulates throughout the world have been instructed to listen regularly for special announcements from the new 75-kW. broadcasting station at Nanking, which now operates daily.

Athlone: The New Neighbour.

MONDAY next (December 19th) is likely to be the opening date of the new 80 kW. broadcasting station of the Irish Free State at Moydrum, near Athlone, and the inaugural ceremony will probably be conducted by President de Valera. Test transmissions after ordinary broadcasting at 10.30 p.m. will continue for some weeks, and there will also be special tests on varying power at 4.30 p.m. each day. Reports of reception will be welcomed by our contemporary, the *Irish Radio News*, 179, Pearse Street, Dublin.

A Royal Honour.

A GREAT honour has been bestowed on Britain's youngest industry. The Royal Warrant, already held by The Gramophone Company, Ltd., for gramophones and records, has just been extended to include Radio Apparatus, so that "His Master's Voice" are now official suppliers of Radio Receivers to The King.

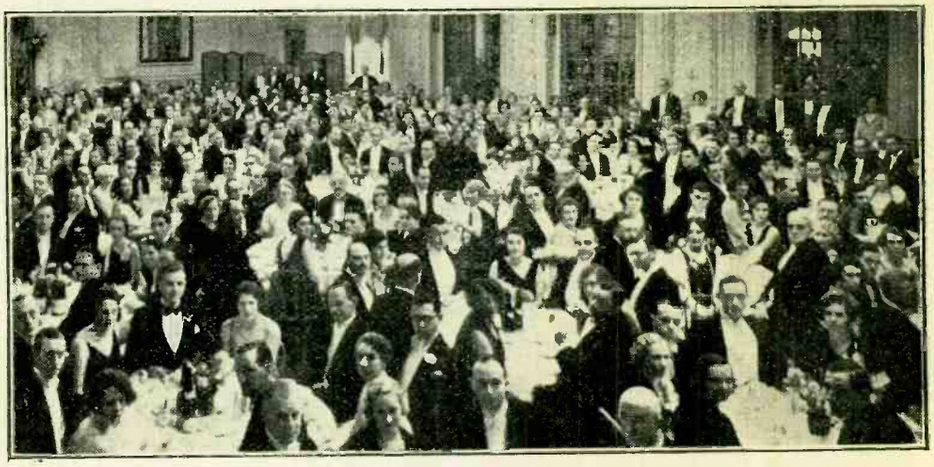
Empire Broadcasting.

THE Empire Broadcasting station of the B.B.C. at Daventry was revealed to the public gaze for the first time on Monday last, when *The Wireless World*, in company with a small party of home and Empire Press representatives, was enabled to view the new transmitters and inspect the directional aerial "arrays."

It was reported that most encouraging reception reports had already been received from all five Empire zones except Canada, in regard to which special wavelength arrangements may be required.

Finding the Ideal Eye Witness.

THE German broadcasting authorities have devised a plan for discovering latent descriptive talent for eye-witnesses' reports. Candidates are shown two or three photographs of some sporting event or of an accident, and after two minutes' study and reflection they are expected to give an interesting "eye-witness's account" of the incident lasting for a quarter of an hour. Records of their talks are made and submitted to a committee, who decide whether the candidates' descriptive imagination merits an engagement.



MANUFACTURERS EN FETE. Some of the guests at the Annual Dinner on December 7th at the Savoy Hotel of the Radio Manufacturers' Association. Lieut.-Col. J. T. C. Moore-Brabazon, M.P., President of the Association, was in the chair. The distinguished company standing on the right includes the Marchese Marconi, the Rt. Hon. J. H. Whitley, chairman of the B.B.C. Board of Governors, and, next to Colonel Moore-Brabazon, Mr. Leslie McMichael.

The Wireless World Diary.

AMONG the handiest of small Christmas presents is *The Wireless World* Diary for 1933. Compiled by the staff of this journal, it contains 78 pages of facts, figures, and explanations of the kind which every wireless amateur requires for frequent reference. The total number of pages is 192. Bound in leather cloth, with backloop for pencil, round corners, and gilt edges, the Diary costs 1s. 6d. at all booksellers, or 1s. 7d. post free from the Publishers, Dorset House, Tudor Street, London, E.C.4.

Programme from Bethlehem.

GERMANY'S projected relay of a Christmas programme from Bethlehem has been definitely cancelled, but we understand that the National Broadcasting Company of America intends to make the attempt.

BROADCAST BREVITIES.

By Our Special Correspondent.

The Empire Questionnaire.

AMONG the many things which the B.B.C.'s long experience enables them to do "in style" is the preparation of a questionnaire, whether it relates to our domestic habits, our attitude to man-made static, or our reaction to the transmissions of a new regional station. Hence it is no thrill to discover in the new Empire broadcasting questionnaire a little masterpiece.

Searching Queries.

It is more than adequate. It covers every question which you yourself, dear reader, would put to a friend in the Dominions who was doing his best to get good signals from the new short-wave transmitter

It is, too, a friendly questionnaire. "Are you bothered by atmospherics?" it asks, and then, assuming that, of course, you *are* (who ever liked the brutes?), proceeds: "When are they most troublesome?"

"In what manner could your receiver be improved?" rather begs the question, but the intention is honourable.

I advise every Empire listener to apply to the B.B.C. for the Empire questionnaire.

Monday's the Day.

At the time of writing, the new omni-directional short-wave aerials at Daventry have not been tested. A few satisfactory reception reports have been received from Australia, Canada, Africa, and scattered spots, as a result of the directional transmissions, but I understand that the B.B.C. are not seriously considering any report until after the opening on Monday next, December 19th.

Experiments in Plymouth.

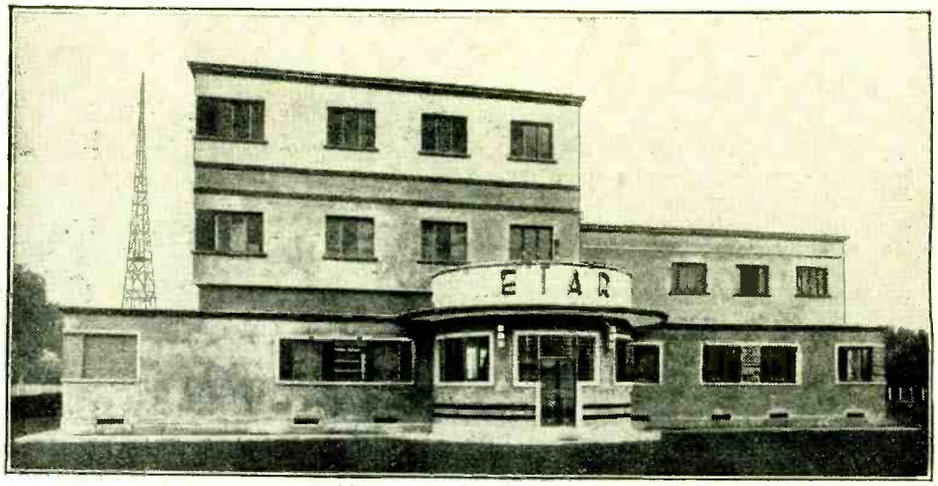
DIAL twirling will shortly be fashionable in Plymouth, when the relay station on 288.5 metres is being supplemented with an experimental transmitter on 245.9 metres. If results are better, the engineers may reduce the wavelength to 200 metres.

Yorkshire Still Going Strong.

INDUSTRIAL depression has not discouraged the North of England in its staunch adherence to broadcasting. According to figures supplied to me by the B.B.C. the number of new licences issued this year in the Northern Region is more than three thousand in excess of last year's figure. In five of Yorkshire's leading towns there were 14,252 new licence holders on the records twelve months ago. This year there are 17,360 more.

Oh, Halifax!

Leeds and Bradford each make a good showing with additions of 6,048 and 4,402 respectively, as compared with 4,386 and 2,472, and the only considerable town showing *a decrease in the increases* (*not* a decline in licence figures) is Halifax, with a 1,673 increase this year, as against 1,851 twelve months ago.



RADIO ARCHITECTURE. Bold clean lines characterise the new Milan broadcasting station which was recently opened by Signor Mussolini. Milan is now easily heard in this country. The power is 50 kW and the wavelength 331.5 metres.

Postscript.

Cynics are pointing out that the Post Office "Black Maria" vans recently visited the whole of the Yorkshire area.

Blattnerphone Obituaries?

AT least one member of the B.B.C. staff has written his own obituary for broadcasting. I hope he will be prevailed upon to record it personally on the Blattnerphone.

The First New Voice.

A FORTNIGHT ago I asked readers to listen for new voices on the London announcing staff. The first of the new arrivals is Mr. R. A. de Groot, from the B.B.C. offices at Leeds. Mr. de Groot is twenty-four years of age, and is the youngest regular B.B.C. announcer.

Real Negroes.

COLOURED artists are to be seen in plenty in Broadcasting House nowadays. They are members of the new Kentucky Minstrels which is being organised for the B.B.C. by Harry Pepper, who will act as producer and will introduce all the paraphernalia of the nigger troupe, including bones, corner men, and stump orators.

The Kentucky Minstrels will be heard by London Regional listeners on January 6th.

"Mac" and the Film Stars.

JOHN MACDONELL, whose name has become inextricably linked with the Surprise Items—his own invention—tells me that one of his greatest difficulties is to persuade film stars to approach the microphone.

"I meet a 'star' at Southampton," he told me, "and accompany him or her in the train to London."

"They must," I put in, "be delighted at the mere prospect of broadcasting."

"Not a bit of it," said "Mac."

Mystery Solved?

"Film stars," he explained, "are afraid of the broadcast microphone. It may be because they have come to rely so much upon their personal appearance on the films. The talkie microphone doesn't trouble them."

I sympathise and understand. Take any film star (not an import from the legitimate stage) and judge him or her by voice alone . . .

"A Health Unto His Majesty."

THE KING will broadcast his message to the Empire at about 3.5 p.m. on Christmas Day.

The Empire programme will begin at 2 p.m. and, for this special occasion, the omni-directional short-wave aerials at Daventry will be used to enable listeners all over the world to hear His Majesty's message at the moment of broadcasting. It will also, of course, be included on a Blattnerphone record of the Empire programme to be transmitted during the various Empire zone times.

Around the Empire.

During the Empire programme, the B.B.C.'s spokesman will establish contact with many parts of the Empire, radiating westward from the British Isles. Greetings will be returned by speakers in the s.s. *Majestic* in the Atlantic; Halifax, Nova Scotia; Montreal; Toronto; Winnipeg; Vancouver; Wellington, New Zealand; Melbourne, Sydney, Cape Town, and Gibraltar.

Dancers for Henry Hall.

"LET Henry Hall and his boys have the run of the Concert Hall, with the floor cleared for a few picked dancers, and you'd have the finest broadcasting dance band in Europe."

So said a man who listened to Henry Hall and the B.B.C. Dance Band playing at the recent staff gathering at the Grosvenor Hotel. The opinion was that the band shone on that occasion in a more dazzling fashion than it ever does in the studio.

Logical.

Well, why not? If vaudeville has its audience to stimulate the performers, why not let the dance band enjoy the stimulus of seeing people dance?

A Yuletide Thought.

AT Christmas time my thoughts fly back to Mr. Fox, the five-millionth licence holder. I think that the Post Office, or the B.B.C., or the two united in a common bond of sacrifice, might present Mr. Fox with the cost of his far-famed licence, which has brought the cause so much useful publicity. Failing that, they might at least pay his return fare from Wood Green to Portland Place on the occasion of his recent broadcast talk, for which he did not receive one penny.

LETTERS to the EDITOR

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.

B.B.C. and Frequency Tests.

DURING the last few weeks many people interested in radio, with whom I come in contact, have expressed their appreciation of the recent audio frequency test, and I have no doubt that if this is the case in Sheffield it must also be the same with many enthusiasts throughout England.

You would doubtless earn the thanks of many of your readers if you "took up the cudgels" on behalf of the continuation of these tests, either as an extra or in place of the now obsolete tuning note.

Sheffield. R. HOLT.

Try It On the Cat.

A GOOD test of the high-frequency response of a loud speaker can be made on that very unscientific object, the domestic cat. This animal seems to be very sensitive to high frequencies (any cat will prick its ears if a noise is made, with the lips pursed, by drawing air in suddenly—a noise which is a sort of sucking whistle). Consequently if an animal imitator is "on the air" it is interesting to watch a cat near the loud speaker. If it is agitated and curious we can be satisfied that the high-frequency response is satisfactory. If it is not interested we are not getting what we ought to get for good reproduction. I have seen an example of the reaction with a moving-coil and balanced-armature moving-iron instrument respectively.

Now then, "Free Grid," can't you discover an animal which responds most to very low frequencies—then we shall be all complete with zoological testing apparatus.

London, S.E.11. C. L. BOLTZ.

Are There Too Many Operators?

I WISH through the medium of *The Wireless World* to draw attention to the ever increasing list of fully qualified unemployed wireless operators.

Admittedly the shipping industry is in a deplorable state, but why should such a number of trained operators be turned out from the various colleges all over the country? During the period June to September approximately 190 second-class P.M.G. certificates were issued. The prospects of these men obtaining employment are very poor, as the training given does not qualify them for any other occupation.

I and several of my acquaintances hold 1st class P.M.G. certificates but are unable to obtain any hopes of an appointment, whereas quite a number of men who hold the old 1st class P.M.G. certificate are able to obtain berths.

An acquaintance of mine recently obtained his 1st class P.M.G. and applied to a well-known trawling company for a berth. In their reply they asked him to state his wages and whether he would do deck work. Surely this state of affairs should not be tolerated.

Perhaps the shipping companies do not realise that it costs on an average not far short of £200 and no small amount of study to qualify for a 1st class P.M.G. certificate.

I do not pretend to be able to advance any system to absorb all the trained operators, but would advise any young man who is contemplating taking up operating as a career to weigh up the facts, as the profession is already overcrowded, and should there ever be a boom in shipping there is already more than enough fully qualified men to cope with the demand.

WORDAW.

Wavelength Allocation.

IN a leading article of *The Wireless World*, No. 689, November, 1932, a mention is made of an Alternative Scheme for Wavelength Allocation in Europe. This suggestion is in no way new. The same proposal was made by me in 1928, when the conditions were much worse than now, particularly as to the instability of certain stations. My suggestion was discussed by the International Broadcasting Union in May, 1928, and was later published in your monthly journal, *Experimental Wireless*, July, 1928. The details of what I called "group-allocation" instead of the "polygonal allocation" are to be found on pages 394, 395, and 396 (6), where reasons are also given for the suggestion in question.

I only draw your attention to this fact as the proposal now raised is an old one. My suggestion at that time should be read in connection with my other proposals as to the allocation questions.

Stockholm, Sweden. SIFFER LEMOINE.

Checking Mains Frequency.

I WONDER if there are any other amateur experimenters like myself who have wanted to check accurately the frequency of their A.C. mains, or more important still, as in my case, the frequency of the output of their rotary convertors? If so, they have probably been thwarted by the high cost of a good frequency meter and the following simple solution may be of value to them.

The stroboscopic gramophone speed testing disc, a gramophone and a watch with a second hand are all that is needed.

It is a simple matter to arrive at the formula $\frac{F = NR}{120}$ where F is the frequency in cycles per second, N the number of black sectors on the disc, and R the revolutions per minute of the turntable when the sectors appear to be stationary.

To ascertain the frequency, adjust the speed of the turntable to bring the sectors apparently stationary, and count the number of revolutions in one minute. Multiply the latter by the number of black

YET ANOTHER RECORD. Mrs. J. A. Mollison, of England-Cape flying fame, incidentally created another record when she gave the first world-broadcast from the Cape Town station. The picture was taken on the day after her arrival.

sectors and divide the result by 120. The answer gives you the frequency.

The H.M.V. and Garrard 78 r.p.m. stroboscopic discs have 77 black sectors, whilst the Garrard 80 r.p.m. disc has 75.

Chatham, Kent. R. T. GROGAN, Lt.-Comdr. R.N.

Interference.

YOU deserve the thanks of all wireless enthusiasts for taking up the question of electrical interferences in your issue of December 2nd. I hope that you will not let the matter drop until some definite steps are taken by the authorities to eliminate this scourge. I am informed by the Post Office engineers that the two principal sources from which interferences emanate in this city are (a) trolley buses, and (b) violet ray apparatus. I speak feelingly regarding the latter type of interference. There are two houses well within 300 yards of my house using violet ray apparatus almost continuously until after 9 o'clock in the evening. I complained to the Post Office and although they easily traced the offenders they are quite unable to take any steps to alleviate the trouble. My receiving set is the original Monodial A.C. Super modified to work off D.C. mains. With such a sensitive set the sounds emitted by the loud speaker are like a machine gun in operation when the violet ray experts are at work, the volume of sound being very much worse on the long wave band. Before closing I should like to say what a magnificent set the Monodial Super has proved. It is without doubt by far the best set I have ever had the pleasure of handling.

Nottingham. R. G. BAIRD.

DISTANT RECEPTION NOTES.

THOUGH my experience of foreign station reception dates back to the time when there was only one foreign station in existence (the Eiffel Tower, then the sole regular broadcasting station in Europe), I cannot remember a time when conditions for the reception of distant stations were better than they are at the present moment. Often, for instance, American stations are every bit as easy to pick up after midnight as those in Europe before.

I said something like this the other day to a friend who owns an efficient three-valve set though he refused to believe me. Then, he reported on the following day that he had been able to receive a dozen at good loud speaker strength between midnight and 1 a.m.

Newcomers to transatlantic listening will be amazed, when they first make the attempt to bring in American stations, at the volume and the quality with which they can be received. Old hands, long past their first thrills, will find a surprising difference between American reception nowadays and that of six or seven years ago.

The best-heard Americans at the moment are WJOD of Miami on 230.6m., WCAU of Philadelphia on 256.3m., WHAM of Rochester on 260.7m., WPG of Atlantic City on 272.6m., WTIC of Hartford on 282.8m., WBZ of Springfield on 302.8m., KDKA of Pittsburgh on 305.9m., WENR of Chicago on 344.6m., WABC of New York City on 348.6m., WGY of Schenectady on 379.5m., WJZ of New York City on 394.5m., WGN of Chicago on 416.4m., and WEAF of New York on 454.3m.

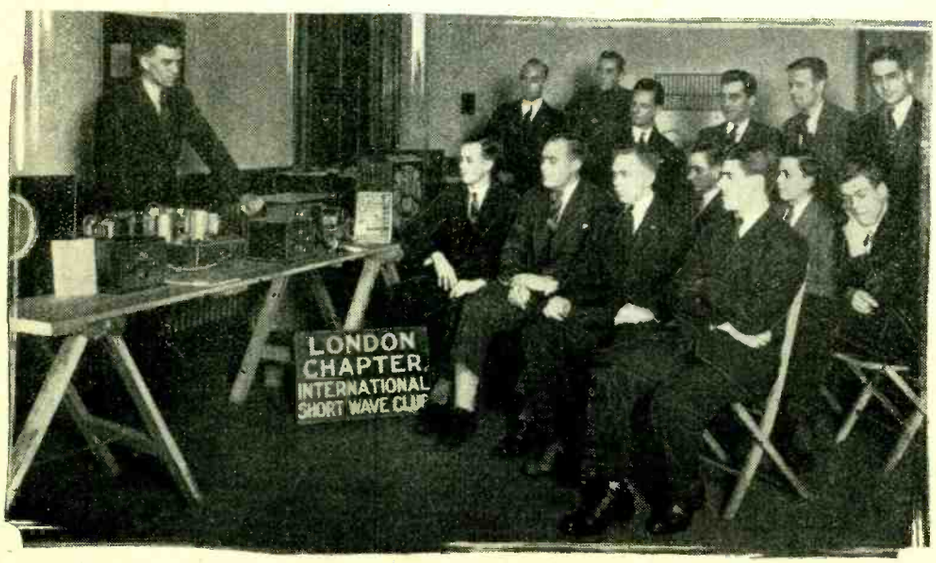
Real Entertainment Value.

Unless conditions are bad, the odds are definitely in favour of being able to receive most of the stations mentioned, and there are many others in addition. There is, for example, a strong and clear transmission on 336.9 metres which I have not yet succeeded in identifying with certainty—identification is sometimes rather difficult owing to the amount of simultaneous broadcasting that takes place in the United States.

In Europe the number of reliable transmissions with genuine entertainment value is now extraordinary. On the medium waveband the list includes, Trieste, Heilsberg, Hilversum, Breslau, the Poste Parisien, the two Brussels stations, Strasbourg, Toulouse, Leipzig, Berlin Witzleben, Langenberg, Prague, Munich and Budapest. On the long waves Kalundborg, Warsaw, Zeesen, Radio-Paris and Huizen are equally good.

There are many others which only just fail to obtain a place in one of the lists because there are nights when they suffer from interference or are lacking in strength. Fécamp is a noteworthy station; on good nights excellent reception is assured, but when fading is about Fécamp suffers rather badly, except in the S.E. of England. Frankfürt, Turin, Bratislava, Göteborg, Milan, Katowice, Rome, Beromunster, Florence, Vienna and Motala all come in well more often than not.

Some stations, on the other hand, are becoming increasingly difficult to receive owing to the great field strength of their neighbours on adjacent channels. Real problems at the present time are provided by Hörby (between Frankfürt and Toulouse PTT), Moravska-Ostrava (between the London National and Lille), Lwow (between the Scottish Regional and Toulouse), Bucharest (between Leipzig and the Midland Regional), Söttens (between the Midland Regional and Katowice) and Lyons Doua (between Berömunster and Langenburg). The main trouble is that to be able to single them out from the wipe-out of their neighbours the receiving set must be highly selective; and if it is highly selective the unpleasant form of interference known as sideband splash makes its appearance. D. EXER.



THE SHORT WAVE MOVEMENT. One indication of the increasing popularity of the short waves is the number of clubs which devote part or all of their time to the subject. This photograph, taken at a recent meeting of the International Short-wave Club, London, shows Mr. Fanshawe, of Messrs. Peto Scott, Ltd., demonstrating short-wave receivers and adaptors.

Judging Quality by Ear.

THE Gramophone Company have sent us the following list of H.M.V. recordings of the suggested test pieces listed in the article "Judging Quality by Ear," which appeared in our issue of Nov. 25th.

TESTS OF GOOD HIGH FREQUENCY RESPONSE.

"Meistersingers Overture" (Wagner)
Berlin State Opera Orchestra .. B2188

"Dance of the Seven Veils" (Strauss)
Berlin State Opera Orchestra .. D1633

"Till's Merry Pranks" (Strauss)
London Symphony Orchestra .. D1418–9

"Tod Und Verklarung" (Strauss)
London Symphony Orchestra .. D1525–7

"Don Juan" (Strauss)
Symphony Orchestra D1309–10

Second Symphony, 2nd Movement (Borodin)
London Symphony Orchestra .. DB1555

TESTS OF GOOD BASS RESPONSE.

Seventh Symphony, 2nd Movement (Beethoven)
Philadelphia Symphony Orch. .. D1640–1

Fourth Symphony, 3rd Movement (Tchaikovsky)
Royal Albert Hall Orchestra .. D1040

"L' Apprenti Sorcier" (Dukas)
New York Philharmonic Orch. .. D1689

Symphony in D Minor (César Franck)
Philadelphia Symphony Orch. .. D1404–8

TESTS OF GOOD TRANSIENT RESPONSE.

Ninth Symphony, 2nd Movement (Beethoven)
Symphony Orch. and Philharmonic Choir D1166–7

"Capriccio Espagnol" (Rimsky-Korsakov)
London Symphony Orchestra .. D1861–2

"Petroushka Ballet" (Stravinsky)
London Symphony Orchestra, .. D1521–4

Toccata and Fugue in D Minor (Bach)
Philadelphia Symphony Orchestra D1428

TESTS OF PIANO REPRODUCTION.

Piano Concerto No. 1 (Tchaikovsky)
Hambourg and Royal Albert Hall Orchestra D1130–1

"Carnival of the Animals" (Saint-Säens)
Philadelphia Symphony Orch. .. D1992–4

TEST OF VIOLIN REPRODUCTION.

Violin Concerto, 1st Movement (Beethoven)
Kreisler and State Opera Orch... DB990–2

TEST OF INDIVIDUAL INSTRUMENTS.

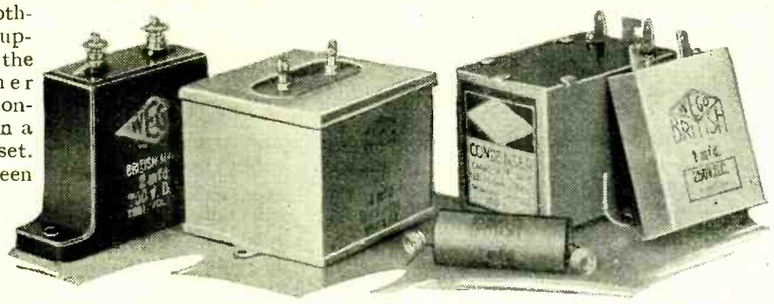
"Bolero" (Ravel)
Boston Symphony Orchestra .. D1859–60

LABORATORY TESTS.

NEW RADIO PRODUCTS REVIEWED.

WEGO CONDENSERS.

THE range of paper dielectric condensers made by the Wego Condenser Co., Ltd., Bideford Avenue, Perivale, Greenford, Middlesex, is particularly extensive, for it includes some fourteen different types, and of these ten are included for use in receivers either for smoothing, for decoupling, or for the various other functions condensers serve in a wireless set. Tests have been made with a few representative specimens, and in every case the condenser successfully withstood a considerably higher voltage than its normal working potential. No trace of leakage could be determined, and we are convinced that the condensers will be found entirely satisfactory under normal operating conditions. In addition to this the prices are very reasonable.



Selection of Wego condensers.

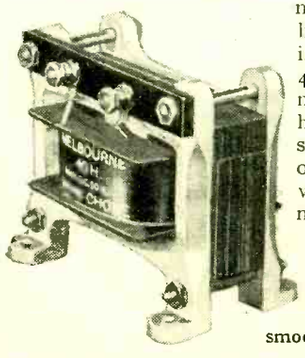
The type A.L.U., which are rated at 250 volts D.C. working, are made in all the usual values from 0.1 mfd. to 10 mfds. The first-mentioned size costs 1s. 3d., while the largest model is priced at 11s.

Types H.S. and H.R. are both well suited for use in mains receivers utilising high voltages, for the former is rated at 600 volts D.C. working, while the last-mentioned operate at 750 volts D.C., and are fitted with porcelain insulated terminals. The H.S. series are available in seven values, ranging from 0.1 mfd. to 6 mfds., at prices varying between 2s. 6d. and 10s. 6d. each, according to size. In the H.R. type a 4-mfd. size, which is the largest stock model made, costs 10s. 6d.

In addition to a number of intermediate types there is a range of tubular condensers rated at 600 volts D.C. working and available in all usual values from 0.00005 mfd. to 0.05 mfd. Up to 0.0005 mfd. the price is 6d. each. A 0.05 mfd. size costs 11d.

MELBOURNE MAINS CHOKES.

MADE by the Melbourne Radio Supply, Norwood Buildings, Hoe Street, Walthamstow, London, E.17, these chokes have been developed especially for use in mains sets and battery eliminators. The 40-henry model tested has a D.C. resistance of 520 ohms, and with the nominal rated current of 25 mA. of D.C. flowing showed an inductance of 44 henrys. It will carry, however, up to 50 mA. without signs of magnetic saturation, but the inductance falls to 20 henrys. This value is sufficient to provide adequate smoothing in most cases, as we have verified by a practical test.

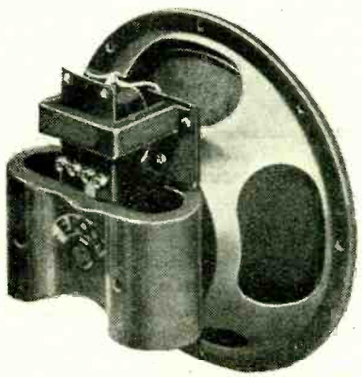


Melbourne 40-henry mains smoothing choke.

Its high inductance with D.C. of the order of 30 mA. flowing renders the choke well suited for use in mains sets and battery eliminators connected to D.C. supply mains reputed to be unusually rough. This choke costs 10s. 6d., and there is a 20-henry model rated to carry 80 mA. available at the same price.

EPOCH 20C LOUD SPEAKER.

THE sensitivity of this unit is equal to anything we have so far tested in the medium-size permanent magnet moving-coil class, and for a given input is 4 or 5 decibels above the average. The output in the bass is principally in the region from 100 to 200 cycles, with a trough at 150 cycles. Between 200 and 2,000 the characteristic is aurally flat; above the latter frequency there is a rise to 2,500 cycles, and the output from there up to 4,500 cycles is higher than in the middle register. Above 4,500 cycles there is a gradual cut-off, but the output at 8,000 cycles is still useful.



Epoch 20C permanent magnet moving-coil loud speaker unit.

The general character of the reproduction is clear and brilliant, with sufficient bass to give satisfactory balance in music without making speech sound hollow.

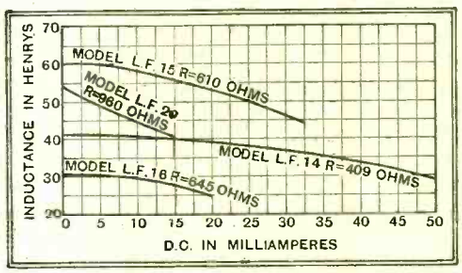
The unit is exceptionally well packed, and the price of 35/- includes a 5-ratio output transformer.

BULGIN SMOOTHING CHOKES.

BULGIN L.F. chokes are now housed in metal cases designed for universal mounting, so that they can be screwed either to a baseboard in the normal manner or mounted on a metal chassis with the terminals passing through clearance holes. There are six models in all, and these should suffice for all present-day requirements, for they range from a super-power type to a small but compact model designed to carry 15 mA.

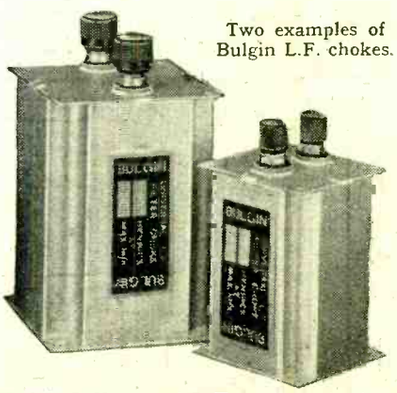
Tests have been carried out with four specimens, and in every case we found that the actual inductance values available somewhat exceeded the makers' figures. However, this errs in the right direction, with the result that actually better value is obtained than might be expected from a perusal of the makers' catalogue, and the prices are most reasonable.

The curves shown on the graph will serve as a useful guide in the choice of the most suitable model for any particular purpose. Our measurements were made with 6 volts A.C. applied to the chokes, and although the performance of each model was investigated with smaller A.C. voltages, the inductance values were still maintained at a high level. For example, with 3.5 volts applied to the L.F.15 model, the inductance curve was lowered by the small amount of 5 per cent. only.



Inductance curves of four specimen Bulgin L.F. chokes.

The measured D.C. resistance of each model tested is marked on its curve, and these were found to be in reasonably close agreement with the makers' figures. The comparatively high D.C. resistance of the L.F.20 model actually is of little consequence, for when passing its maximum current of 15 mA. only 14.4 volts are dropped across the choke. Similarly, in the case of the L.F.14 type, its 409 ohms accounts for 20.5 volts drop only.

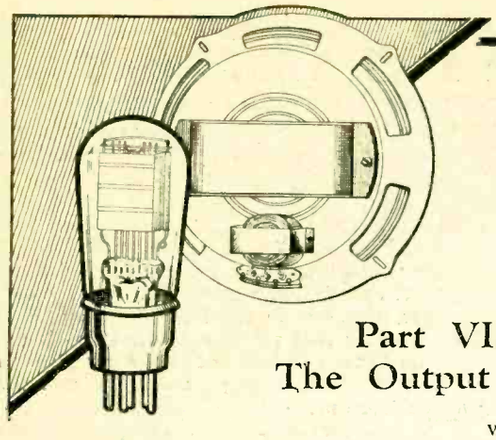


Two examples of Bulgin L.F. chokes.

Models L.F.14 and L.F.15 are priced each at 10s. 6d., and models L.F.16 and L.F.20 at 7s. 6d. each. The makers are A. F. Bulgin, Ltd., Abbey Road, Barking, Essex.

Change of Address.

Owing to the expansion of their business, the Milnes Radio Company, Cottingley Bridge, Bingley, Yorks, has moved into more commodious premises at Victoria Works, Church Street, Bingley. The telephone number remains unchanged, and is Bingley 500.



THE SIGNAL THROUGH THE RECEIVER

Part VIII. The Output Stage.

SEEING a pentode valve in the output stage of our receiver, our first instinct is to enquire why it should be chosen in preference to an ordinary triode. The answer lies in the fact that it is intended that the set should be driven from batteries, which implies that the amount of power available to operate the loud speaker will in any case fall well below the modern standard set up by mains-driven receivers. The power-level can, of course, be raised by allowing the output valve—pentode or triode—to draw a higher current from the high-tension battery, but this inevitably means shorter battery life and consequently higher running costs. What we require is therefore a valve that draws only a small anode current but nevertheless yields a high output.

The power taken by the valve, omitting, of course, its filament current, is measured in milliwatts, and is equal to the product of anode voltage and anode current in milliamps. The power that can be given by the valve to the speaker before overloading, and consequent distortion, sets in is also expressed in milliwatts, but is not calculable from any of the ordinary published characteristics of the valve. It can be obtained by a geometrical construction from the anode-voltage/anode-current curves, but for practical purposes it is considerably more convenient to derive it from the *Valve Data Supplement* included with the issue of this journal for November 11th last. Consulting this to obtain information regarding 2-volt valves that take anode currents up to 12 milliamps. at 150 volts, we find that the average efficiency of all triodes of this class is 14.3 per cent. That is to say, of the power taken from the high-tension battery 14.3 per cent. is converted into the electrical equivalent of speech or music, and so made available to drive the speaker. The remaining 85.7 per cent. is wasted.

Turning to pentodes, we find that of the seven that fall within the current-limit of 12 milliamps. (in which screen-current is included) one has an efficiency of 41.6 per cent., while the lowest figure found is 20 per cent. Leaving out this last, and taking an average of the remaining six, we get a mean efficiency of nearly 35 per cent., which is practically 2½ times the efficiency of the average triode. This tells us that for the same consumption of power from the high-tension battery a pentode will deliver at least twice as much power to the speaker as a triode. In a battery set, where anode current is expensive, and where for that reason the power available for the loud speaker will inevitably be on the low side, the attraction offered by the pentode's extra output is almost irresistible.

The construction of a pentode, as reference to the circuit diagram of the set (Fig. 36) will indicate, involves the use of three grids. Of these the inmost is the one to which the signal is applied, since its position is such as to give it control over the flying electrons as near as possible to their source in the filament. The next grid is connected to H.T. positive, and corresponds in function with the screening-grid in a screen-grid valve, though it is not usually constructed to provide electrostatic screening between anode and grid. The third grid is earthed to the filament, and provides the main difference between pentode and screen-grid valve.

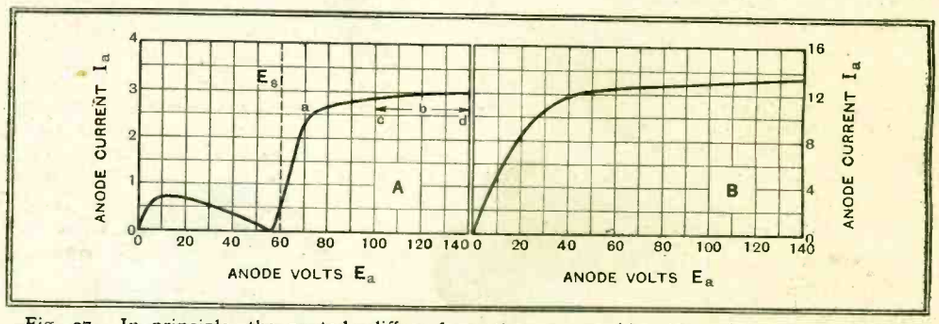


Fig. 37.—In principle, the pentode differs from the screen-grid valve only in possessing an earthed grid between screen and anode. This extra grid converts the screen-grid curve A into the pentode curve B.

In Figure 37 are sketched two curves, each of which represents the variation of anode current I_a as anode voltage E_a is varied from zero upwards. That on the left is typical of a screen-grid valve, and that on the right of a pentode. The curves are alike in that for high anode voltages they are almost horizontal, which implies that changes in anode voltage make but little difference to anode current. In both cases the voltages applied to grid and to screen, which are, of course, assumed to remain constant while taking the curves, are almost entirely responsible for fixing the anode current. At lower anode voltages the curve for the screen-grid valve performs a rather extraordinary

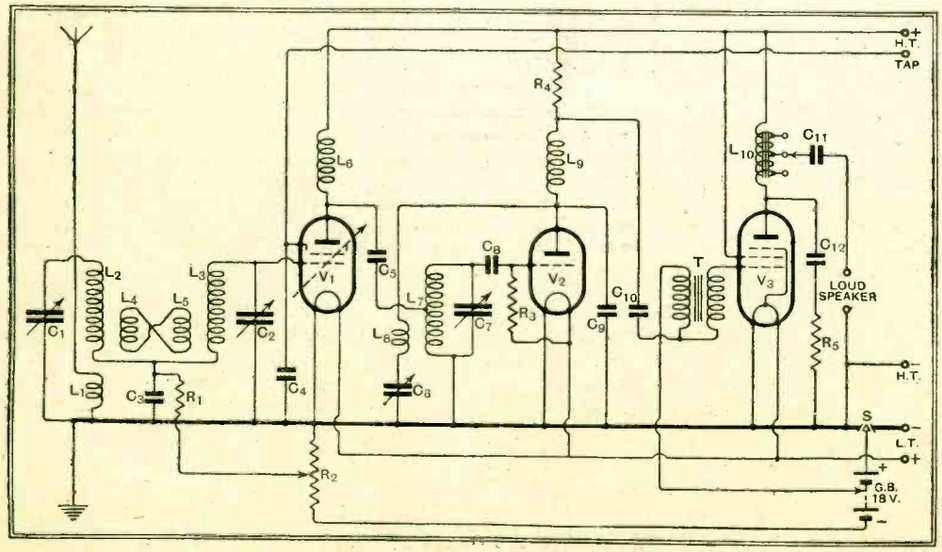


Fig. 36.—Circuit details of the modern receiver through which the signal is being traced.

The Signal Through the Receiver.—

series of contortions, which begin at about the point where the anode voltage is reduced to the value marked at the dotted line. This represents the fixed screen-voltage E_s.

When the electrons arrive at the anode they knock out further electrons from it by the force of their impact, but so long as it is held at a voltage considerably more positive than that of the screen they are attracted back to the anode. Their loss is therefore only momentary, and their little trip does not alter the total number of electrons arriving at the anode. But as the anode voltage begins to drop down towards that of the screen, some of these ejected electrons are attracted to the screen instead of to the anode, and the net anode current begins to fall, as shown at *a* in the illustration.

THIS is the concluding instalment of a number of articles tracing the progress of the signal through the various stages of a typical modern receiver. The reader following the entire series will have a complete grasp of the fundamental principles of radio reception. The previous instalments appeared in the issues dated October 7th, 14th, 21st and 28th, November 4th, 18th and 25th, 1932.

If a signal is applied to the grid of the valve, and an impedance is connected in its anode circuit, an alternating voltage will be developed across this impedance. So long as this voltage is only small, no harm will be done, for even at the lowest momentary voltage the anode will still be much more positive than the screen. The signal might perhaps swing the anode voltage from *c* to *d*, these being on either side of the steady voltage *b*. But if the signal were very much greater the bend *a* on the curve would be reached on the downward swing, and distortion would necessarily result.

The Suppressor Grid.

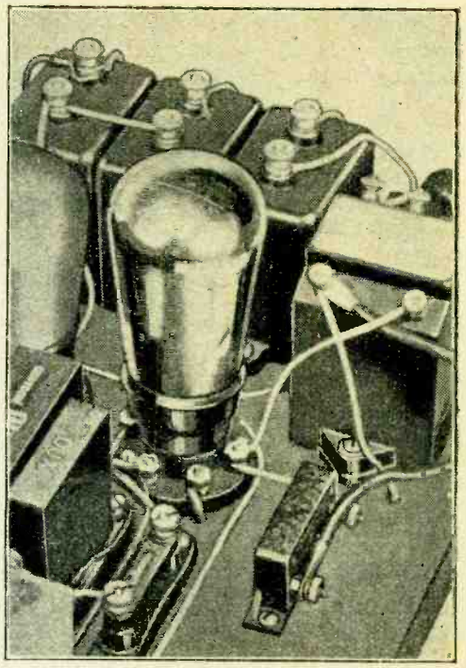
In a screen-grid valve large signal-swings do not as a rule have to be handled in the anode circuit, so that the bend at *a* does no harm. But in an output valve matters are rather different; to obtain the theoretical maximum of power it would be necessary for the signal to swing the anode from zero up to double the applied high-tension voltage without encountering a bend on the curve. It is clear that before there can even be an approach to the ideal curve the secondary electrons that produce the dips in curve A must be in some way suppressed.

In the pentode this is done by inserting the third grid, sometimes known as the "suppressor grid," between screen and anode. An electron ejected from the latter will now not be attracted to the screen even if this is more positive than the anode, because the electron is now screened from its attraction by the earthed suppressor grid. It returns, therefore, to the anode, which is the most positive object within its range. The curve of the pentode thus follows the form shown at B, and in a well-designed valve the straight portion extends back as far as possible into the region of low anode voltages.

The removal of the dip in the curve by the suppressor grid that is the characteristic feature of the pentode thus makes it permissible to allow a very much larger signal-voltage to be superimposed on the steady anode voltage; the power that can be had from the valve before distortion sets in is thus enormously enhanced.

In Fig. 39 is given a series of anode-volt/anode-current curves of a typical "high-efficiency" pentode, and it will be seen how far to the left the straight portion of the curve has been extended by its designer in the endeavour to reach the theoretical ideal of a series of parallel straight lines. From these curves it is possible to calculate the correct load to connect in the anode circuit of the valve, and to compute the undistorted power available with this as well as with other values of load.

It will be noticed that the curves of Fig. 39 are roughly horizontal over the greater part of their length, which means that variations in anode voltage do not have any very great effect upon the anode current. If there is a loud speaker in the anode circuit, therefore, a signal-voltage applied to the grid will cause anode-current fluctuations which are almost as great as if the speaker were absent. A signal of any given amplitude will thus set up in the valve a signal current which depends almost entirely upon the slope of the valve, and is but little affected by the anode circuit load. At first sight it would appear the higher the impedance of the speaker the greater would be the power developed in it, since raising the impedance would increase signal-voltage while



The components associated with a battery pentode output stage.

leaving speech-current unchanged. For small amplitudes this conclusion is perfectly correct, but when large amounts of power have to be handled the voltage-swing on the speaker requires to be carefully controlled to prevent distortion.

There is therefore a quite definite impedance that enables the valve to give its greatest undistorted power, and this impedance is such that when the valve is given the greatest signal, and hence the greatest anode-current swing, that it can handle without distortion, the voltage-swing across the speaker is just not high enough to swing the anode to so low a voltage that distortion arises. A higher impedance than this, while giving a greater output for a small signal (higher amplification) will give rise to terrible distortion if the full current-swing is evoked; to prevent this the signal will have to be cut down so far that the final

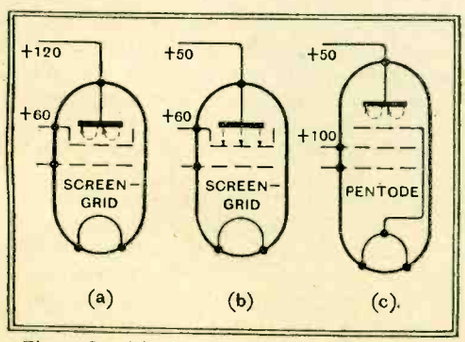


Fig. 38.—(a) Screen-grid valve, normal voltages. (b) Screen-grid valve, at moment when anode is less positive than screen. (c) Pentode, anode less positive than screen. Dotted lines show paths of secondary electrons from anode; note how the earthed grid in (c) repels them to anode, as at (a).

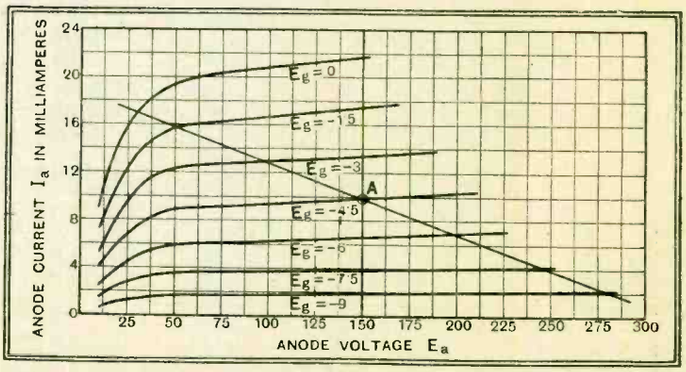


Fig. 39.—Anode-volts/anode-current curves of typical high-efficiency pentode. It is from these curves that available output and best load are found.

The Signal Through the Receiver.—output is less, not more, than that obtained with the correct load. Analysis of the curves on these lines shows that the particular valve to which they refer will give its greatest output when the load in the anode circuit has a value of 17,000 ohms.

Now it is a well-known fact that the impedance offered by a loud speaker depends to some extent upon the frequency of the musical note for which the impedance is measured. With a moving-coil speaker the variations are not very large, so that if it is designed to offer the 17,000 ohms required by our pentode as an average over the musical range it may be assumed that the impedance will not be so far from the correct value for any notes that the loss of power resulting will be seriously noticeable. An ordinary cone-type speaker with a moving metal armature (a "moving-iron" speaker) does not, however, show this commendable constancy of impedance, and is therefore rather difficult to fit nicely to a pentode.

Moving-coil Speaker.

Fig. 40 shows very graphically the variations of impedance of a moving-coil and a typical moving-iron speaker over the musical frequency-range. The horizontal line at 17,000 ohms indicates the load required for our particular pentode. The curve for the moving-coil speaker does not depart at any point very widely from this line, so that one may be sure that this speaker will give satisfactory results. Theoretically, full output with minimum distortion will only be obtainable at 110 and 2,400 cycles, these being the points where the curve actually crosses the line. Between these points, where the impedance is too low, power will fall off a little, while outside them, where the impedance is too high, there will be a little distortion. But as the divergence from 17,000 ohms is but small, it will be possible to stop this distortion by turning down the signal-strength slightly on the volume-control of the receiver, when good quality will be restored at the cost of an almost inappreciable loss of strength as compared with a theoretically perfect speaker.

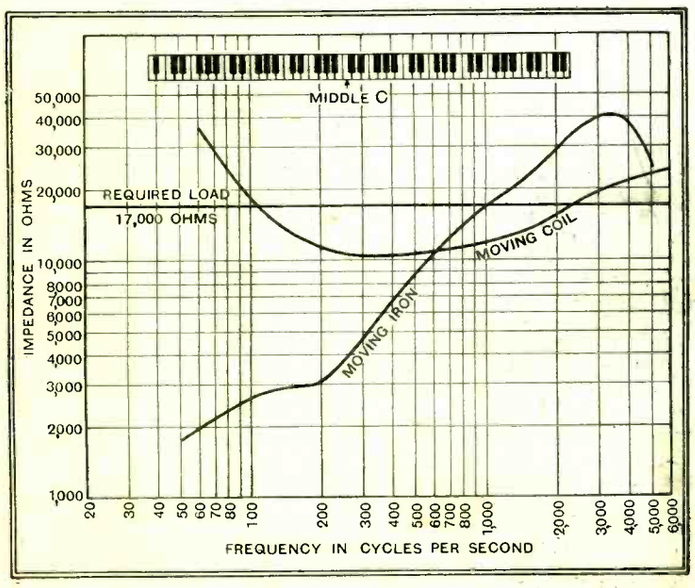


Fig. 40.—Showing variation with frequency of the impedance of typical moving-iron and moving-coil speakers. The correct load for the pentode considered is shown for comparison. Note the musical scale at the top of the diagram.

The Pentode Transformer.

It would be quite possible for the moving-coil curve to find itself right down at the bottom of the diagram, so that its lowest impedance, instead of being just over 10,000 ohms, scarcely exceeded 1,000 ohms. This would mean, of course, that at no frequency could the pentode deliver into it the maximum power of which it is capable. The adjustment necessary to lift the curve from this lower position back to that which it occupies on the diagram is the introduction of a transformer, this having more turns on the primary than on the secondary. The tapped choke L_{10}, seen in the circuit diagram of the set (Fig. 36) fulfils this duty, the primary consisting of the whole choke while the secondary contains only those turns included between the tap chosen and high tension positive. There is thus a step-down transformer effect.

The effect of a transformer is very marked, for the impedance of the primary depends on the *square* of the ratio. That is to say, if a 10 to 1 transformer is inserted between a speaker and the valve that feeds it, the apparent impedance, as viewed by the valve, is not ten times, but ten squared or one hundred times as great. For our example, in which we desire to raise the impedance of a moving-coil speaker ten times, the ratio must be $\sqrt{10}$, or 3.16 to 1. The one-third tap on the choke L_{10} (reckoning from the H.T. + end) would therefore be found best on trial.

In fitting a moving-iron speaker to the pentode matters are very much more difficult, for the impedance of the speaker varies over an enormous range—in the example taken, from 1,700 to over 40,000 ohms. A transformer can only lift or lower the curve as a whole, and a moment's consideration of Fig. 40 will make it completely clear that no such treatment can possibly make the curve into even the roughest approximation to the desired horizontal straight line at 17,000 ohms.

If we simply connect the speaker direct to the valve, the feed-condenser C_{11} going directly to its anode, the load offered by the speaker will be correct, as the curve shows, at about 1,000 cycles, or two octaves above Middle C. At this frequency full power will be developed, but all the middle and bass notes will be sadly lacking because the impedance of the speaker is far too low. If we like we can match the speaker at 250 cycles by connecting C_{11} to the centre-tap on the choke, thereby in effect lifting the speaker-curve bodily until it intersects the 17,000-ohm line at this frequency. Bass will then appear at not too far short of its full strength, but those parts of the curve referring to higher notes will indicate far too high an impedance. The practical result of this would be that the high notes would be far too prominent, and horribly distorted as well if the set were tuned so as to give anything like full volume.

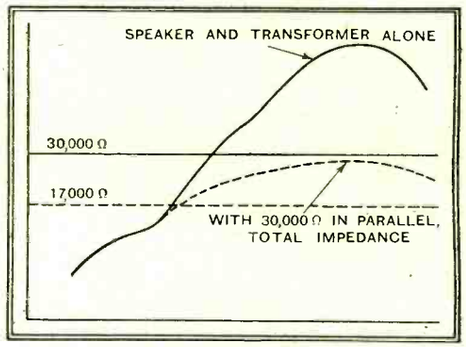


Fig. 41.—Showing the effect upon total impedance of connecting 30,000 ohms in parallel with L_{10}. Note that the rise of impedance is now limited, preventing the development of excessive voltages upon the anode of V_3, and so preventing distortion.

The transformer, or tapped choke, thus enables us to get proper bass with this particular combination of speaker and valve, but it is powerless to prevent the over-emphasis and distortion of high notes that follows the enormously high impedance of the speaker-transformer combination at the highest frequencies. An entirely new device is required to check this rise in impedance.

If we were to connect a resistance of, say, 30,000 ohms directly across the whole of L_{10}, it is evident that no matter how high the impedance of the speaker the total impedance in the anode circuit of the valve could never rise above that of the resistance. The very high anode-voltage swings which are responsible for the distortion would therefore not occur. At the highest notes, for which the speaker-impedance is high, some of the signal current would be diverted into the resistance, thus preventing the overloading and distortion that would otherwise appear at these frequencies. Put differently, we make a new combined impedance-curve representing the joint impedance of speaker and resistance; Fig. 41 suggests quite roughly the general trend of this. It is clear that, though not perfect, it provides a closer approach to the horizontal straight line than can be had without the addition of the resistance.

The main disadvantage of offering this parallel path for the signals is that some part of these will flow uselessly through

The Signal Through the Receiver.—the resistance even at frequencies for which the speaker impedance is correct or too low. Since this occurs at the lowest frequencies, this leakage can be stopped by connecting a condenser in series with the resistance, choosing for it a value such that it makes but little difference on the high notes; a suitable capacity is 0.005 mfd. for a pentode requiring a high load, such as that under discussion. In the set the complete combination of resistance R_5 and condenser C_{12} is seen connected between anode and filament of V_3. This position is possible because the condenser prevents the passage of direct current, and is desirable because it returns the signal current that passes along this path directly back to the filament and not through the H.T. source.

In practice the choice of tapping on L_{10} and of values for the impedance-limiting circuit R_5C_{12} will depend both on the characteristics of the pentode and on those of the loud speaker; but the suggestions given will be found a very suitable basis for experiment. The tapped choke and the impedance-limiter are both necessary if the set is to work well with a loud speaker chosen for other qualities than its suitability for a pentode; but with a speaker specially wound for use with a pentode the tapped choke may not be required, though it will always be well to retain the resistance and condenser that serve to prevent over-emphasis of the high notes.

Now that the speaker has been reached the journey through the set along the path of the signal is finished. The writer will conclude by expressing the hope that the trip has not been altogether devoid of interest, and that by avoiding some at least of the possible pitfalls lurking by the wayside the final signal, as it emerges from the speaker, will be near enough to the original music to give acceptable entertainment.

That American Broadcasting.

Impressions by a Returned Prodigal.

IT is worth while to bear in mind the remark of a French wit that all generalisations contain a grain of falsehood—even this one. The only way one can gain the whole truth on such a complex matter as American broadcasting is to listen to all of it. Failing the impossible, the next best is to pick out a few high spots.

The most impressive characteristic of American broadcasting as compared with English is the ever-present advertising. It is clever, it is crude, it is subtle, it is blatant. Some advertisers throw their story at you; others emulate the ways of the snake-charmer. Most advertisers have a theme song with which their "hour" (sometimes a half, but mostly a quarter of an hour) both opens and closes. For instance, during the summer, when all windows are open, I sat down to most of my Sunday meals at 1 p.m. to the tune of Auld Lang Syne from a neighbour's set. This always opened the programme advertising underwear or some other incongruous commodity.

Always a Snag.

The broadcasting time is precious, and the highest prices are paid for the periods from 6 p.m. on, when the poor tired business man is at home. Some companies pay fabulous sums to eminent operatic and music-hall celebrities. But there is always a snag. The half-hour of America's foremost baritone is interrupted for nearly ten minutes by a talk on motor car tyres. America's most popular comedian is due to speak from 10 p.m. to 10.30 p.m. on certain nights, but the listener must, from 10 p.m. to 10.15 p.m., first absorb a few truths about chewing gum or some other article. Such people, however, draw the listener.

Time is so precious that the items are literally timed to seconds. Whether an item is finished or not, it is ruthlessly cut out "on the dot," irrespective of any æsthetic considerations. The next item is waiting, and it starts immediately. The programmes are "slick." The waits often provided by the B.B.C. are irritating beyond measure after listening to the American programmes.

Too Much Freedom.

The result of this preciousness of time is that few items are more than half an hour in length. The programmes are consequently kaleidoscopic; one has constantly to be jumping up to tune out one item and to find another. Exceptions occur on Sundays, when symphony concerts from some outside source are broadcast, or when a mid-day concert is given. Apart from these the listener seldom hears serious musical works in full; time will not permit and the listener will not stand it. Some two years or so ago "St. Joan" was broadcast in England. Most American papers commented on it. The surprise was almost universal, not so much that anyone could stand Shaw unadulterated for two hours, but that anyone could stand *anything* for two hours at a stretch!

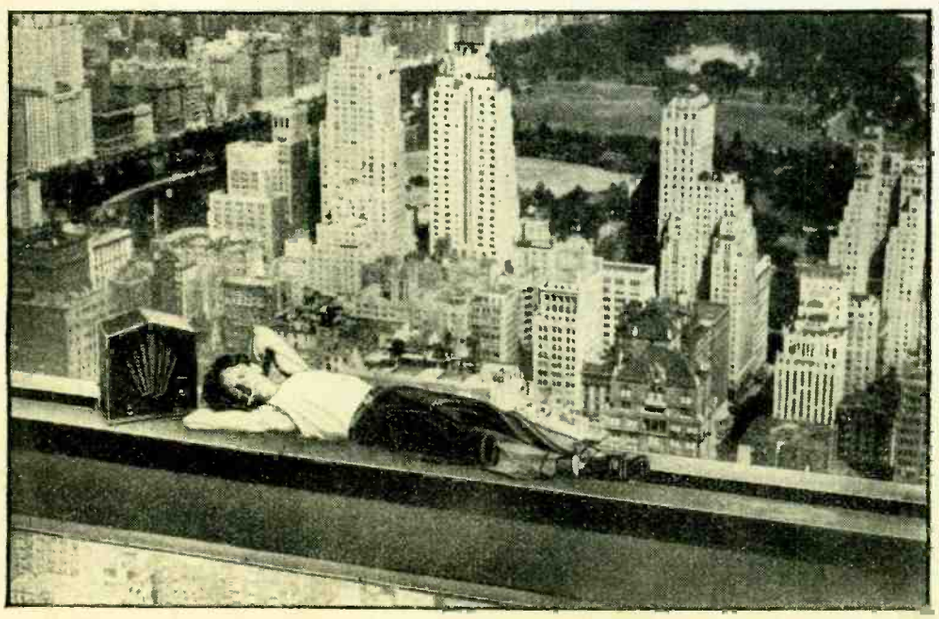
American stations are legion. A good number are in the two big "chains," but there are many which are free lance. The technical and production qualities of the stations are as various as they are multitudinous. They rise to the greatest heights, but they plumb the lowest depths of banality and rubbish. One appreciates, on returning to England, the better balance of the programmes, and also the co-ordination of the stations. There is here a feeling that there is a sound policy at the back of it all. In America the broadcasting is free; the American individualistic spirit is allowed full play.

But there are murmurings. People are tiring of the advertising. The advertisers are beginning to realise that too much blatant publicity can do them harm; their public is becoming nauseated by the toothpaste, underwear and breakfast cereals. The matter is being pressed in Congress. And yet the advertisers must call the tune, for they are the only people who pay. Nothing short of a revolution will induce the public to pay for something which at present it obtains for nothing—as it thinks.

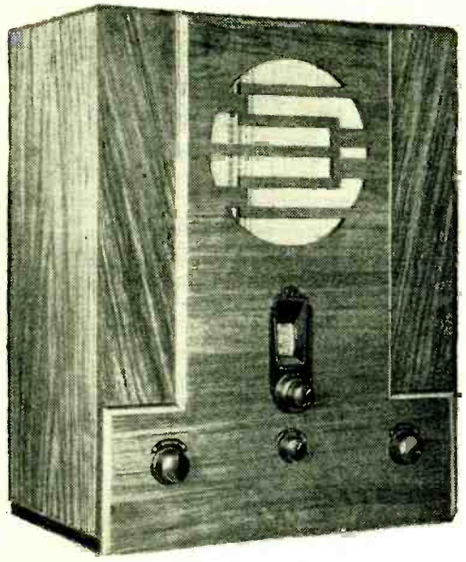
A Loud Speaker "Cure."

During the past summer loud protestations were raised against the loud speaker nuisance. I am sure that the worst place in England is a heaven to the hell that the summer nights are in New York. Last year the night temperature scarcely dropped below 80° during one week. Every available window on such nights is open, and every working wireless set belongs to everyone. I heard the description of a world championship fight one night from a set four storeys above. It was no use complaining, for two policemen with friends were on the pavement below taking it all in! I know of a certain cure for this nuisance, but it requires one prerequisite—a telephone. One victim found that protests to his neighbour were of no avail. His remedy was simple: every morning at 2 a.m. he rang his neighbour up on the telephone and told him how much he had enjoyed the programmes. After a few nights the loud speaker was quietened. I give this simple solution to any who care to make use of it.

E. W.



TIRED OF ADVERTISING? This steel worker on the new Rockefeller Radio City Building, New York, takes advertisers' programmes lying down sooner than pay a listening fee. Millions of less exalted listeners do likewise.



Telsen Macnamara Receiver.

Good Quality, Exceptional Volume, and a Straightforward Circuit Arrangement.

PUBLIC taste with regard to quality of reproduction is not yet quite as exacting as it might be. But the manufacturer who looks ahead has already realised that a change is bound to come, and that his receivers will eventually be judged mainly on this score. Accordingly, if he be wise, he provides just as good quality—and as much of it—as he can possibly afford, and effects any economies that may be necessary in other directions. In this way the foundations of an enduring reputation are laid.

The Telsen Macnamara Receiver is one in which "quality first" has evidently been the slogan of the designers. Although it is anything but an expensive set, reproduction is distinctly above the average standard, and the volume of undistorted output is appreciably greater than we have come to expect from the popular type of H.F.-det.-L.F. three-valve set, to which category this receiver belongs.

For these results a certain amount of credit must be given to the cabinet, which from the acoustic point of view, as well as that of appearance, is unusually well designed. It is of solid walnut—rather unusual in these days of plywood—and is quite free from unnecessary ornamentation.

Flexibility of Control.

Simplicity is the keynote of the circuit arrangement. The input circuit is of the single-tuned variety, double-wound transformers being employed both for this and the H.F. intervalve coupling. Next comes a power grid detector, linked by a resistance-fed transformer to an output pentode. Energy for the anode circuit and for the loud speaker field is derived from a full-wave rectifier. Additional precautions against the introduction of hum include a neutralising coil associated with the loud speaker, and an adjustable potentiometer across the L.T. secondary of the power transformer.

The tuning system may best be described as of the semi-ganged variety. The main control is effected by a knob which rotates both condensers simultaneously, while a second concentrically mounted knob is arranged to swing the rotor element of one of the condensers through a few degrees. In this way perfect alignment is assured, and there is no need for "re-ganging" after, say, changing a valve.

As there are rather more external controls than usual, the set is considerably more flexible than the average specimen of its class. Volume may be regulated both by controlling aerial coupling through the medium of a series condenser—which, by the way, includes a cut-out switch which is closed at maximum capacity—and by the adjustment of reaction.

There is no skimping in the matter of anode wattage supply; total current consumption amounts to nearly 60 milliamperes, and a voltage over 400 is delivered from the rectifier. After allowing for a drop in the loud speaker field winding, there remain about 270 volts for application to the valves. A point worth noting is that the rectifier is of the latest slow-heating type, and, as might be expected, measurements show that there is a very small voltage rise when the set is first switched on. This should confer an extra measure of immunity against the risk of broken-down condensers.

Thanks to the general flexibility of the control system, the set is more responsive than usual to the touch of that type of user who can handle wireless apparatus sympathetically, and who realises the whys and wherefores of the various adjustments. For instance, a very satisfying performance, both with regard to selectivity and sensitivity, can be realised by loosening aerial coupling and then increasing reaction to the point where the loss in signal strength is made good. Unlike many other sets, the effect of using a good deal of reaction is not to impair quality; on the contrary, the overall frequency characteristics of the detector-L.F. portion of the set are such that a good deal of high-note "cutting" can be introduced into the H.F. circuits without sacrifice of brilliancy. It would appear that the pentode valve itself introduces enough automatic correction to compensate for such loss.

FEATURES.

General.—*A self-contained three-valve receiver with built-in moving-coil loud speaker of the energised type. For operation on A.C. supply with an external aerial; mains aerial fitted. Provision for gramophone pick-up and external loud speaker.*

Circuit.—*One H.F. stage, with single-tuned input and intervalve circuits. Capacity-controlled reaction. Power grid detector; coupled by resistance-fed transformer to output pentode. Full-wave rectifier; smoothing by loud speaker field coil.*

Controls.—*(1) Single tuning control with concentric trimmer. (2) Wave-range switch. (3) Reaction. (4) Selectivity control (aerial series condenser). (5) On-off switch.*

Price.—*15 guineas.*

Makers.—*Telsen Electric Co., Ltd., Aston, Birmingham.*

Good Quality Reproduction.

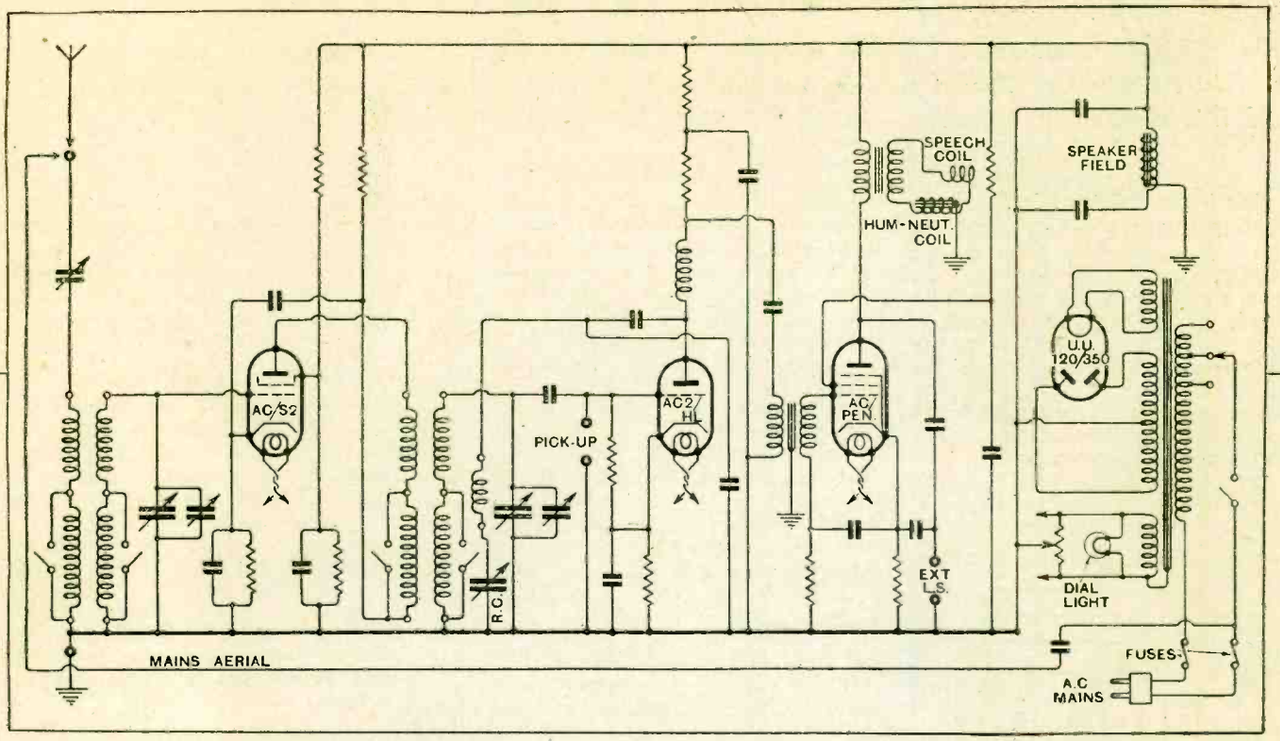
From the absolute point of view, of course, selectivity would be higher with a three-circuit tuning system, but the simpler arrangement of the Macnamara has much in its favour; operated properly, selectivity is sufficient for all reasonable needs; and range, without being exceptional, is up to the average standard.

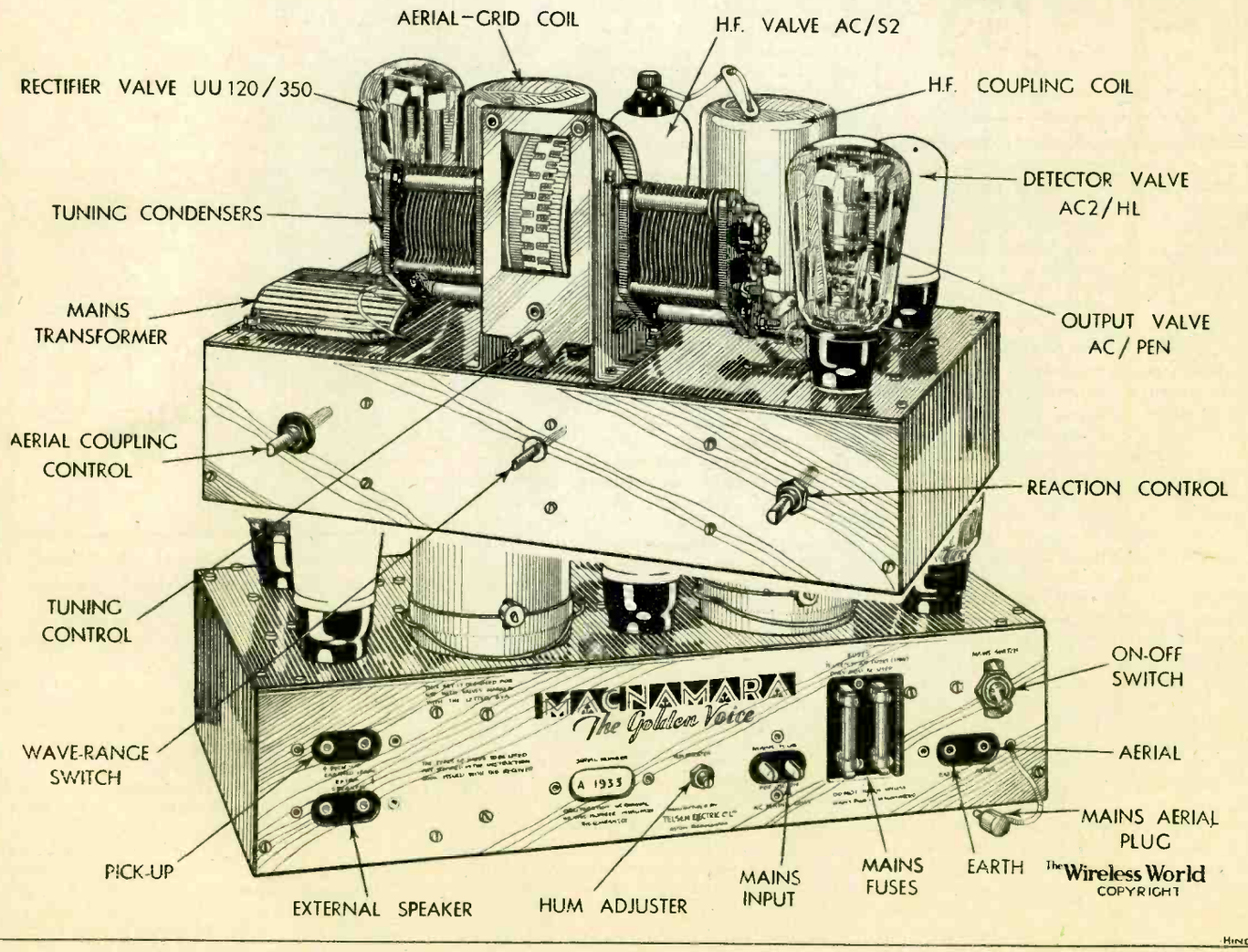
Fairly frequent adjustment of the concentric balancing control is necessary to ensure precise alignment of the circuits, but for ordinary purposes it is sufficient to readjust at two or three points while passing from one end of the waveband to the other. The external trimmer is also of benefit for compensating for any considerable changes that may be made in the aerial coupling. In short, it enables the user to make sure that both circuits are always exactly in resonance, a matter about which there is always some uncertainty with a less flexible tuning arrangement.

One is particularly struck by the clarity of reproduction. There is no blurring, and individual instruments in massed orchestral items can be followed, which indicates an absence of harmonic distortion. Balance in the middle register is good, and high-note output is carried up as far as is consistent with reasonable immunity from heterodyne interference. The only possible point of criticism with regard to quality is the resonance—almost inevitable in this type of set—which occurs at slightly over 100 cycles. Fortunately, this is not obtrusive enough to be annoying.

In addition to the walnut-cabinet model which forms the subject of this review, the same chassis and loud speaker, mounted in a plain wooden box, is available at the price of 12 guineas. This model should appeal particularly to those who possess an existing piece of furniture in which it can be housed.

A SIMPLE BUT EFFECTIVE CIRCUIT.





Two views of the Macnamara chassis, and (inset) the complete circuit, in which high-efficiency valves are used throughout.

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.

Rectifiers in Parallel.

A CORRESPONDENT who wishes to obtain an exceptionally large output from his H.T. power supply unit proposes to use two rectifying valves connected in parallel. He intends to join the anodes of each valve to their counterparts on the other, and asks whether this plan is the best that he can adopt.

When two rectifiers are to be employed it is usually unwise to join them together in parallel in the obvious way, as suggested by our reader; this procedure is likely to lead to a reduced valve life. Instead, it is recommended that the anodes of each individual valve should be connected in parallel, the two valves then being used as half-way rectifiers. A circuit diagram which will make this matter clear is given in Fig. 1.

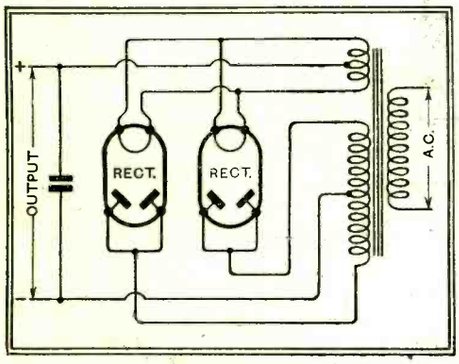


Fig. 1.—A pair of full-wave rectifiers wired to operate as half-wave valves.

High Anode Current.

AS a result of connecting a milliammeter in series with the anode of his directly heated pentode valve, a reader finds that the current which flows immediately after switching on is many milliamps higher than the rating of the valve, but it falls to the normal value after a half a minute or so. We are asked to explain this effect, and also to suggest how the excess flow of current may be prevented. Our correspondent is afraid that the valve may be damaged by operating it under present conditions.

Without details of the receiver, we can only assume that the earlier valves are of the indirectly heated type, and so they do not begin to draw current from the H.T. rectifier until some time after the set has been switched on. As a consequence, H.T. voltage will rise above its normal value, and current through the pentode will be abnormally high during the warming-up period.

It seems very likely that this initial voltage rise may be rather greater than it need be, for the reason that the heaters of the earlier valves and the filament of the directly heated pentode are all supplied with current from the same L.T. secondary of the power transformer. If this be assumed, then the only practicable way of biasing the output stage is to insert a resistance in the main H.T. negative lead. When the indirectly heated valves have reached their working temperature, their anode current must flow through this resistance, and consequently its ohmic value is less than that of a true self-bias resistor inserted in the individual cathode lead of the valve to be biased. Unfortunately, a directly heated output valve cannot be biased in this way unless it is fed with L.T. current from a separate winding on the power transformer.

The fitting of a delay-action H.T. switch would put our reader's fears to rest, but we do not think he need be greatly perturbed, provided that the initial rise in current of the pentode valve does not exceed some 20 per cent.

Barring the Foreigner.

WHEN asking our advice on the choice of a receiver, correspondents sometimes describe their requirements by saying that they do not need a long-range receiver: "Just sufficient sensitivity for reliable reception of all the main British stations."

Actually, the ability to receive the more distant British stations with a fair degree of reliability implies an extremely high order of sensitivity in the set. Signals from these relatively near-by stations do not get the same amount of assistance in transit from the Heaviside layer as do those at greater distances. At the present time, it is by no means unusual to find that the field strength of a Continental station, as measured after dark in this country, temporarily attains a higher value than that of a local transmitter, perhaps only twenty or thirty miles distant.

Slow Starters.

A READER who is using indirectly heated A.C. valves complains that it takes "several minutes" before they warm up properly to their work, and even then he is not satisfied that the results obtained from the receiver are all that they should be. We are asked if this slow-starting peculiarity of his valves is an indication that anything is wrong.

We have never encountered valves which take as long as our reader states to attain normal emission, or, at any rate, as near normal emission as is discernible by ear. It would appear very likely that the voltages applied to the heater elements are abnormally low. Alternatively, there is the possibility that his valves have been seriously overrun at some time, and so have suffered damage.

Fitting the Band-pass Unit.

IT should be made clear that when adding the Flexible Band-pass Unit (*The Wireless World*, October 14th) to an existing receiver, all tuning apparatus prior to the first valve of the set should be removed or disconnected.

A reader who proposes to retain his existing single-tuned input circuit, and to precede it by the unit, is strongly advised not to pursue this course; although a three-member filter can be devised its design is complicated, and, as in this case the third member is to be tuned by a separate condenser, operation would be extremely tricky.

Reaction with a Diode.

A READER who remembers that we have published information concerning the application of reaction to a diode detector has not access to the back number in which this matter was discussed, and asks us to publish a circuit diagram showing the appropriate connections.

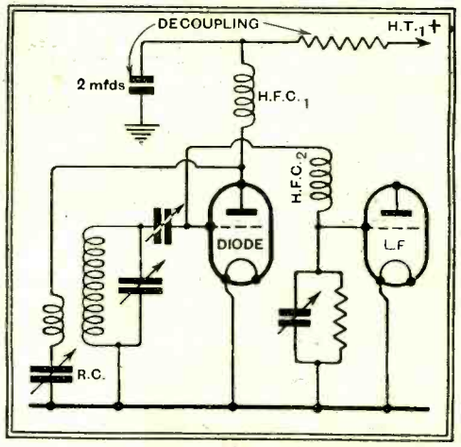


Fig. 2.—Using the anode circuit of a diode for reaction. H.F.C.$_2$ is the usual high-frequency stopper; H.F.C.$_1$ is an additional choke which deflects H.F. energy through the reaction circuit.

When reaction is not employed in a diode set the detector anode is normally left free. For purposes of introducing regeneration, however, it may be connected in the manner indicated in Fig. 2. The choke H.F.C.$_1$, the reaction coil, and the reaction condenser R.C., may have the values usually associated with these components in more conventional sets. If a voltage-absorbing or decoupling resistance should be necessary in the anode circuit, it is essential that the by-pass condenser used in conjunction with it should have a low reactance at modulation frequencies; if the diode is to work as distortionlessly as when reaction is not employed, at least 2 mfds. should be used.

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.

The Wireless World

THE PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 695. FRIDAY, DECEMBER 23RD, 1932. VOL. XXXI. No. 25.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

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: 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.

CONTENTS.

EDITORIAL COMMENT.

Empire Broadcasting.

Congratulations to the B.B.C.

THE new Empire Broadcasting Station began its preliminary tests at the new site at Daventry in November and has now commenced regular transmissions.

Elsewhere in this issue some details are included to give an idea of the general plan and scope of the station and its service.

We congratulate the B.B.C., and the chief engineer, Mr. Noel Ashbridge in particular, for having found the means of carrying out, in practical form, those ideals which we ourselves in particular have so long hoped they would be able to achieve. Naturally the B.B.C. does not yet claim a hundred per cent. service—there are too many factors influencing the situation for any such guarantees to be possible at present, and perhaps not the least of these is the question of finance. The B.B.C. is at present (so far as we are aware) bearing the full cost of the service, although no doubt, when the value and full potentialities of the scheme have been realised some other means of financing the service will be found, and those benefiting from it will begin to contribute to the cost of maintenance.

Reports already received indicate quite clearly that the station is making a very good showing and is proving itself to be capable of a very reasonable average performance throughout the Empire.

To form a proper idea, however, of what conditions of reception are like, and to decide upon the ideal wavelengths and times of transmission in the various zones, it is essential that the engineering staff of the B.B.C. should have the co-operation of intelligent observers in all parts of the Empire. For this reason we would particularly urge our readers overseas to do their part in supplying whatever helpful information they can so as to hasten any modifications in the transmissions which may be necessary to make the fullest use of the service which the new station has already shown itself to be in a position to give.

Radio Interference.

Further Support for Our Proposals.

THE importance and urgency of the electrical interference question, which *The Wireless World* has stressed in recent issues, continues to evoke sympathetic interest from all quarters and we would particularly draw attention to a Leader appearing in the *Electrical Review* of December 16th, in which the seriousness of the present situation is discussed. The question is asked "Can the I.E.E. do anything to enlist the sympathetic interest in all concerned in solving a difficult problem?" And, the writer adds "The efforts being made by *The Wireless World* to get something done have our full sympathy. Electrical apparatus is now being sold at such a rate as to place the industry under an obligation to the community at large to take practical steps to effectively prevent 'man-made' interference with radio reception."

An extraordinary amount of ingenuity is being exercised to eliminate electrical interference in association with broadcast receivers. If only a part of this effort were devoted to tackling interference *at the source*, far more effective results would accrue than are possible with any methods of eliminating this interference *at the receiver*.

Reading Print by Photocell.

Electric Aid for the Blind.

By R. C. WALKER, B.Sc.

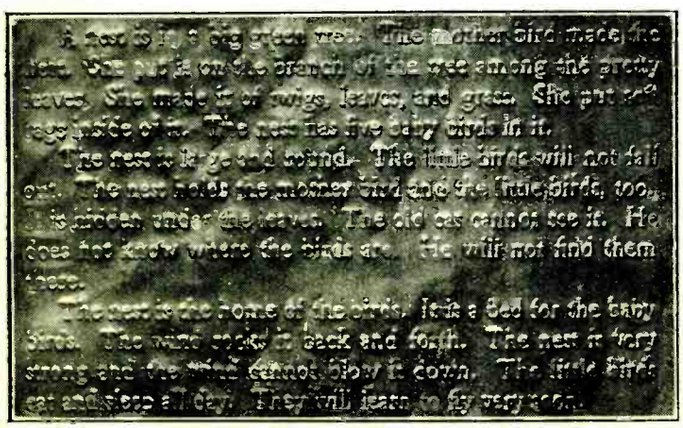
The Visagraph in use.

EVER since the earliest stages of its development, the photocell has been known familiarly as the "Electric Eye," but this designation has recently come to express its functions in a much more extended sense, inasmuch as the photocell can now replace, in a very restricted manner, the sense of sight. This article describes two type-reading instruments, the Photoelectrograph and the Visagraph, both of which employ photocells.

TO convey to the blind information on paper is nothing new; in fact, it is sometimes forgotten that the original invention of Louis Braille is now over a century old, and the world-famed activity of the Braille Press and its service to the sightless is one that can scarcely be over-estimated. But ability to read ordinary print without a previously prepared text has not been possible until quite recently.

Two machines, each having some functions in common, but differing entirely in the manner in which they use the photoelectric cell, have been developed to enable ordinary print to be read by a blind person. These are the Photoelectrograph, which is based on very simple principles, and the Visagraph, a more recent invention which, though more complicated electrically, is wider in its scope, and will most probably prove of greater service. Both instruments have in common the effect that impressions conveyed to the user through the sense of touch are produced by means of a system of relays, and both are the outcome of much arduous and patient work on the part of their inventors.

The Photoelectrograph consists of a movable carriage on which is placed the printed matter to be read, this surface facing upward. The printed surface is brilliantly illuminated by light projected downwards from a specially designed lamp, adjustment being provided to enable the size of the spot of light to be altered as desired. The carriage is of such a construction that it permits the displacement of the text in any direction at the will of the user, and its manipulation is easy of attainment. As each letter comes under the scanning beam it appears in the form of a raised dot outline, and is identified by the fingers of the operator. Fig. 1 shows in brief outline the essentials involved in the operation of the machine. T represents a letter of the text under illumination by the projector. The light reflected by the surface of the paper is picked up by an optical system represented by the single lens, which spreads the projected image of the letter on to a network of photocells, each of which is connected through its amplifying system to an electromagnetic relay. In this manner some of the photocells are illuminated, while those covered by the shadow outline remain dark. The relays to which the photocells are connected each operate a movable armature which, in turn, controls the vertical up-and-down motion of a small metal rod. The ends of all the rods are level on a rectangular grating, the surface area of which is about the size of the tactile portion of the reader's finger, so that the letters are felt as they are raised up in relief by the upward movement of the armature rods. The number and arrangement of rods correspond exactly to the lattice of photocells receiving the illuminated image.



Sheet aluminium of about 0.002in. thickness receives the impression. The characters can be enlarged to assist identification.

Since the original patent was taken out by the inventor, M. Thomas, in 1924, several modifications have been produced, and three forms of the machine, with rod units varying from 6 to 42, and having, of course, the same number of photocells and relays, have been made up. The simplest form is that in which the print is translated into the Braille type with which most blind people are familiar. The second type of machine was built for the reading of printed matter and manuscripts, and it was found that a 42-mesh grating was sufficient to enable all letters to be identified. The third type of machine, a combination of the two former, is designed to deal with all texts, and enables the user, by means of a switch, to apply it to either of its two purposes. It is thus possible to produce the impressions in Braille or in Latin script.

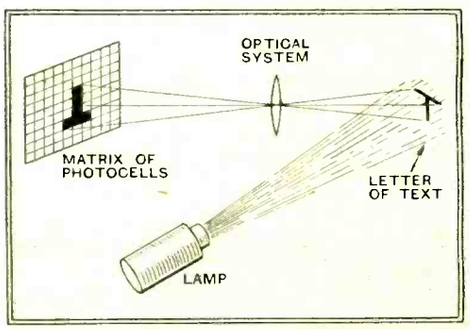


Fig. 1.—Diagram showing the essential principles of the Photoelectrograph.

Fundamentally, the apparatus is simple in principle, but the use of forty-two photocells and relays is objectionable, and makes the apparatus unduly costly. It must also be remembered that with ordinary Braille print there is a permanent record, and the reader may use both hands and not be restricted in the amount of

Reading Print by Photocell.—time he can spend over the identification of a word or retracing a sentence.

With the Photoelectrograph only one letter of the text appears at a time, there is no permanent record, and the user is limited to the fingers of one hand for detection. Also, if a word is not identified by the time its termination is reached, it is necessary to repeat it, which makes reading laboriously slow. In addition, the relief outline tends to disappear by the pressure of the fingers, and one letter is forming while the previous letter is disappearing, so that the reader is apt to get confused.

Some of these troubles have been overcome in the Visagraph, a later machine working on rather different principles.

In this machine the text, which is placed face downwards, is illuminated by an optical system consisting of a light source and three lenses capable of adjustment to accommodate print of different sizes. The illuminating beam is interrupted by a scanning disc (Fig. 2) having

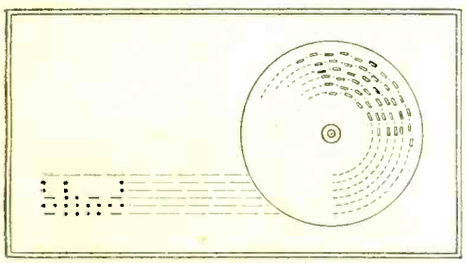
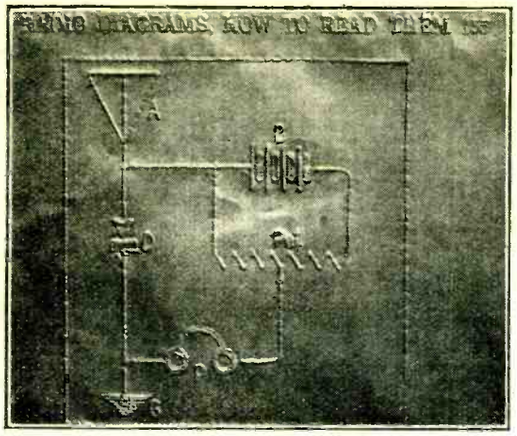


Fig. 2.—The scanning disc in the Visagraph has six concentric rings of perforations differing in number so that the light incident on the page is formed in six adjacent spots, each with a different frequency of interruption.

six concentric rings of perforations differing in number, so that the light incident on the page is formed of six adjacent spots, each with a different frequency of interruption. The six frequencies selected are numbers carefully chosen between 1 and

Examples of reproduced typescript.

100, and are arranged to avoid common harmonics and sub-harmonics. The dimensions of the slots and spaces in the scanning disc are equal, a condition which produces an approximately sinusoidal current wave in the photocell circuit. Experimental work showed an advantage in slightly staggering the perforations, as illustrated in Fig. 2. Mechanically, the apparatus consists of a scanning carriage



Diagrams can also be reproduced.

on which the book is placed face downwards, and a reproducing carriage moving in synchronism with the former by means of a motor drive. The reproducing carriage is mounted on rollers on stationary guides, and a sheet of thin aluminium which receives the impression in relief is mechanically fed across the surface, as shown in the title illustration.

The Visagraph employs only one photocell, which picks up light of the six frequencies previously described. After amplification the resulting photoelectric current is passed on to a circuit (Fig. 3) containing the six transformer primaries, A, B, C, D, K, L. With each primary is coupled a secondary tuned to one of the frequencies of the scanning disc. In Fig. 3 only one secondary with its triode is shown for clearness. Each secondary has an anode reaction coil, which serves to accentuate the tuned frequency, to the exclusion of all others. In the anode circuit of each triode is an electromagnetic relay, the armature of which is held in the off position by a spring.

Connected to the free end of each armature is a vertical rod constrained to move in the direction of its length. The ends of the six vertical rods are in one and the same horizontal plane and level with the reader's fingers. Since each of the light beams scans a different portion of a letter of the text, a composite current consisting of six superimposed frequencies is passed to the amplifier, and each component current controls the movement of the indenting rod responsible for recording on the metal foil its own portion of the typescript.

The reproducing carriage can, with advantage, be advanced at a higher rate than the scanning carriage in order to enlarge the characters horizontally and facilitate identification by touch. Sheet aluminium about 0.002in. in thickness is usually employed to receive the impression.

It is, of course, not necessary for the reader to keep pace with the reproduction of the image, since the impression is fixed and can be read at leisure. When finished with, the foil may be passed between rollers to erase the image, and the same sheet may then be used again many times. Alternatively, if a permanent record is desired, the foil may be treated with a suitable composition and preserved for future reference. In addition, the machine may be used to print on to heavy paper and several copies made at a time.

The utility of the Visagraph is not confined to the reproduction of Latin script, but may be used equally well for reading drawings, maps, charts, radio circuits, and typewriting.

In the latest form of the machine—the Automatic Visagraph, as opposed to the earlier form, or Printing Visagraph—the blind reader merely places the open book

The Visagraph can deal satisfactorily with ordinary script.

on the scanning carriage, when, by means of a switch, it is automatically aligned and the magnified raised letters begin to appear, line after line. Upon completing the page, the machine automatically stops. In

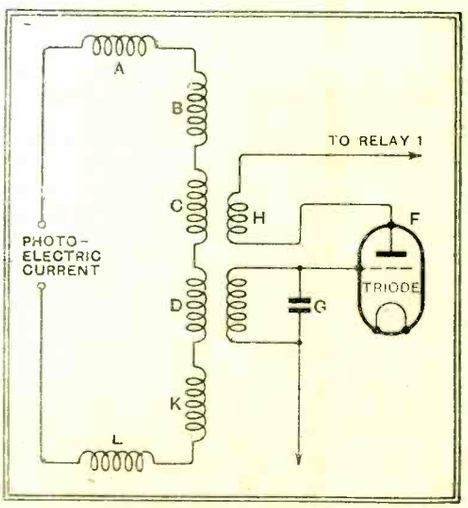


Fig. 3.—After amplification the photoelectric current is passed on to a circuit containing six transformer primaries, A, B, C, D, K and L. With each primary is coupled a secondary tuned to one of the frequencies of the scanning disc. In the diagram only one secondary is shown, with its triode.

Reading Print by Photocell.—
addition, there is only one printing point, and the size of the machine has been considerably reduced, so that it is now not greater than that of a small card-table. The reader is able, by a simple adjustment, to alter the height and width of the letters to his convenience, so that the magnification shall be most suited to his sense of touch.

It is clear that the production of such apparatus, whilst intended to supplement, and not to supersede, the Braille type, enormously widens the scope of appreciation of the blind, not the least important of which is the ability to understand simple pictures. The Automatic Visagraph is already receiving close attention as an accessory in the education of those who live in total darkness.

DISTANT RECEPTION NOTES.

At this season of the year innumerable receiving sets are being tried out for the first time, tested after improvements, calibrated for the first time or recalibrated in order to obtain a chart showing more precise readings than that originally made. Stations, of which no great use is made in the ordinary way, since their transmissions cannot be relied upon to have genuine entertainment value, now have a usefulness of their own. The smaller fry and the more distant stations, besides enabling the calibration curve to be traced with precision, also provide excellent tests for the sensitiveness and the selectivity of a receiving set. Down at the very bottom of the medium waveband are a good many small stations that are surprisingly well heard at the present time. These are the little Swedish relays whose rating ranges from 150 to 250 watts. The best of them at the moment are Jönköping on 201.3 metres, Kristinehamn on 203 metres and Gävle on 204 metres. On 210 metres Budapest No. 2 is well heard and it is usually possible to receive this station some little time before dark. The German station Flensburg on 227.4 metres can also be received if interference is not too severe. Somewhat higher up are certain of the smaller French stations which are not usually difficult to receive. These include Beziers on 240 metres, Toulouse PTT on 255 metres, Lille PTT on 265.4 metres, and Rennes on 272 metres. Above 300 metres there are comparatively few small stations with wavelengths of their own, though it is often possible to tune in and identify certain of them at times when their wavelength partners are silent. Interesting transmissions of this kind that I can recommend to the reader are Falun on 307 metres, Poznan on 335 metres, Bolzano on 368.1 metres, Paris PTT on 447.1 metres, Lyons Doua on 465.8 metres, and Palermo nominally on 542 metres, but at the present time using a rather shorter wavelength.

For the reception of the bigger stations conditions continue to be remarkably good. Fécamp is much steadier than it was a week or two ago, such fading as there is being generally of a mild variety. Nürnberg is becoming better and better and Trieste, though varying a little in strength from night to night, is well heard.

D. EXER.

In Next Week's Issue:—

The MODERN D.C. THREE.

A Straight Set with Variable-mu H.F. Stage and Screen-grid Detector: Hum-free Operation on the "Roughest" of Mains.

THE introduction of new indirectly heated D.C. valves has rendered possible the production of receivers for D.C. mains which are practically equal in all respects to their A.C. counterparts. The "Modern D.C. Three," comprising a variable-mu H.F. valve, screen-grid detector and pentode output valve, has a number of circuit innovations which should appeal to those who wish to be abreast of the more advanced technique of to-day. A sound output equivalent to more than 1 watt A.C. is obtained by the inclusion of an energised moving-coil speaker of high flux density.

Selectivity is maintained at a high level by the use of a band-pass filter after the first valve, and damping, due to the Miller effect in the power grid detector, is eliminated by the use of a screen-grid valve in this stage.

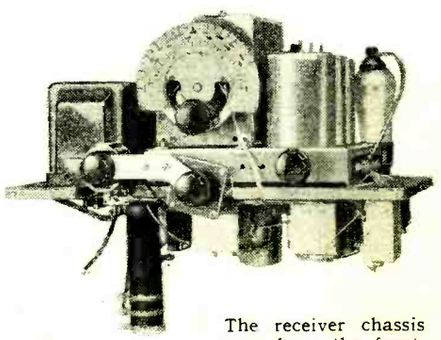
As a result of the employment of a new form of aerial coupling, the receiver does not suffer from the prevalent fault of decreasing sensitivity at the higher dial readings of both wavebands.

LIST OF PARTS.

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

1 Radiopak, British Radiophone, Type 535D less potentiometer, but with two extra knobs and trimming tool.

1 Potentiometer, Wearite 5,000 ohm/G42, ganged Q.V.C. 3 watts, wire-wound, 5,000 ohms and two-pole switch, with ¼in. spindle bush, supporting strip and distance piece.



The receiver chassis seen from the front, showing the mains voltage-dropping resistance. Tuning is facilitated by an illuminated scale calibrated in wavelengths.

3 5-pin Valve Holders Clix, chassis-mounting type
1 4-pin Valve Holder Bulgin, Type VH4
(Benjamin, Burton, Eddystone, Radiophone, W.B.)

1 H.F. Screened choke Peto-Scott "Keystone"
(Bulgin, Kinva, Wearite.)

1 L.F. transformer Benjamin "Transfeeda"
(Bulgin, Formo, R.I.)

1 Fixed condenser, 4 mfds., 250 volt D.C. working Wego, Type ALU
3 Fixed condensers, 2 mfds., 250 volt D.C. working Wego, Type ALU
7 Fixed condensers, 1 mfd., 250 volt D.C. working Wego, Type ALU
1 Fixed condenser, 0.002 mfd. mica T.C.C., Type 34
1 Fixed condenser, 0.0001 mfd. mica T.C.C., Type 34
1 Fixed condenser, 0.0002 mfd. mica T.C.C., Type 34
(Dubilier, Ferranti, Formo, Graham Farish, Peak, Telsen.)

1 Strip resistance, 25 ohms Claude Lyons, Type FW.25
1 Strip resistance, 200 ohms Colvern
1 Strip resistance, 250 ohms Colvern
1 Strip resistance, 1,000 ohms Colvern
1 Strip resistance, 8,000 ohms Colvern
1 Strip resistance, 10,000 ohms Colvern
1 Strip resistance, 15,000 ohms Colvern
1 Strip resistance, 25,000 ohms Colvern

2 Metallised resistances, 250,000 ohms, 1 watt Dubilier
1 Metallised resistance, 50,000 ohms, 1 watt Dubilier
(Erie, Claude Lyons.)

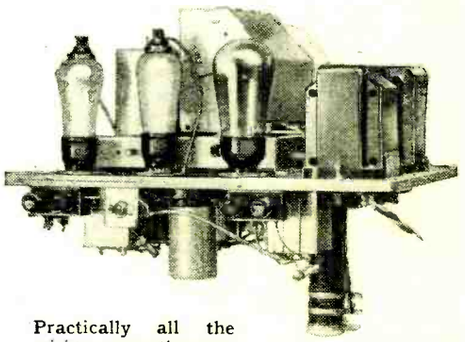
2 Fuses, 500 milliamps, and holders Microfuses
(Belling-Lee, Bulgin, Ferranti, Goltone.)

1 Single-pole change over switch Bulgin, Type S.81
"Radio and Gramo"
(Peto-Scott, Claude Lyons.)

1 D.C. mains resistance, Bulgin, Type M.R.8
skeleton type

2 L.F. chokes, 250 ohms, 20 henrys Varley D.P.10
(Ferranti, R.I., Savage, Sound Sales, Wearite.)

1 Reaction condenser, Graham Farish "Lit-los"
0.00015 mfd., solid dielectric
(Peto-Scott, Telsen.)



Practically all the wiring connections are below the baseboard leaving the upper deck exceptionally clean and neat.

4 Terminals, aerial, earth, pick-up (2) Belling-Lee, Type "B"
(Burton, Clix, Eelex, Igranic.)

2 Terminal mounts Belling-Lee
(Goltone, Junit, Lissen, Telsen.)

1 Bulb, 6-volt, 0.15 amp. Bulgin, Type OB

1 4-pin plug Peto-Scott "Keystone"
(Bulgin, Eelex.)

1 Loud speaker Magnavox Magna Model 142, 5,000 ohms

3 ozs. No. 22 tinned copper wire, 6 lengths Systoflex, etc.

1 length screened sleeving Harbros
(Goltone, Lewcos.)

Screws: 31 ¼in. No. 4 R/hd., 14 ⅜in. No. 4 R/hd., 8 ½in. No. 4 R/hd., 14 ½in. No. 4 R/hd., 2 ¾in. No. 4 R/hd., 4 ¾in. No. 6 R/hd., 4 1in. No. 4 R/hd., 4 6BA ¾in. R/hd., with nuts and washers, 4 4BA washers for speaker fixing screws

Plymax baseboard, size 9in. x 14½in. x ¾in. Peto-Scott
and bracket for Radio-grano switch

Cabinet F. W. Edwards, 15, Clerkenwell Green, London, E.C.1

Valves: Osram VDS metallised, Osram DSU metallised, Osram DPT
(Marconi).

oooo

The Wireless World Diary.

As an "eleventh-hour" Christmas purchase *The Wireless World* Diary for 1933 is an excellent choice. It is specially compiled by the staff of this journal as a booklet for handy reference, containing, in addition to the Diary, 78 pages of facts, figures and explanations. It is obtainable, price 1s. 6d., at all booksellers, or at 1s. 7d., post free from the Publishers, Dorset House, Tudor Street, London, E.C.4.

The IMPORTANCE of IMPEDANCE.

A Simple Explanation of a Much-used Term.

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

MANY technical questions arise in connection with receiver circuits, which are seemingly complex but could often be answered if the constructor possessed a full understanding of the underlying principle of impedance.

Clearly a grasp of such a principle is worth having, even at the cost of a little effort, for it enables one to work things out for one's self instead of being dependent on the dubious mercies of local "experts."

The principle, reduced to its simplest form, is that *power* is the product of pressure and current. Or to put it into more practical shape, using the units with which we are familiar, watts = volts × amps. So the amount of electrical power in a circuit is not affected by the voltage, so long as the amperage is sufficient to make the product of the two the same at all times. Thus if a 1,000-watt electric fire is necessary to warm a room, precisely the right power could be provided by 10 amps from a 100-volt supply, or 5 amps at 200 volts, or 1 amp at 1,000 volts. But precisely the same circuit design most emphatically is not permissible in each case, as would rapidly be made evident on connecting the 100-volt appliance to the 1,000-volt supply.

Reactance Explained.

It is therefore necessary to do more than specify the power, and it may appear that to make the matter quite definite it is sufficient to mention the voltage also. That is true in the case of electric fires, lamps, motors, etc., which are always specified by these two figures, but that is because a greater power or voltage would materially shorten the life of those appliances. In receiver circuits, however, the amount of power which is being transmitted is usually varying from moment to moment, and at the most may be far below the point at which it would have a destructive effect on the components in its path. Even the slenderest aerial wire is generally in no serious danger of being made red-hot by the received signals.

To get at the quantity that is of greatest importance in controlling the design of the circuit it is necessary to take into account the even more elementary principle which is familiar under the name of Ohm's Law. Using the same units as before—Volts/Amps = Ohms, and going back and applying this to our electric fires, we find that the differences between them, which are not revealed by the figures for the power they can handle, are clearly shown by their resistances, which are 10, 40, and 1,000 ohms respectively.

All this may seem very elementary, and in the case of unvarying currents (D.C.) it actually is; because ohms refer to only one thing—resistance, and the resistance is a fixed quantity. And in dealing with constantly reversing currents (A.C.) some circuits contain only resistance and can be considered in this simple way. But generally with A.C., and particularly with high-frequency A.C. as used for radio work, resistance is the least of the three things that crowd in under the name of ohms, and that collectively are termed impedance. The other two items when mentioned together are described as reactance, and when separately quoted are inductive reactance and capacitive reactance. The relations between these three have formed the subject of many books and substantial parts of books, and their subtleties are what makes radio such an inexhaustible mine of interest. The main facts are, first, that both the reactances (and to a smaller extent resistance) depend on the frequency of the current in them, and secondly that the three do not simply add up together to form the impedance, but that the two reactances must be *subtracted* from one another and then added to the resistance, not in a straightforward manner, but geometrically at right angles to it. All this is explained in any book on A.C., but fortunately in very many situations that exist in practice the worst complications do not arise, for on estimating the various separate components of impedance it is often found that all except one are relatively small enough to be disregarded.

"IS there much loss in bringing my aerial through a 30-foot passage?" "What is the most suitable capacity for a tone-control condenser?" "How does one choose the correct ratio for an output transformer?" All these and many other questions are constantly being asked, and although the examples given appear to have little in common, they depend for their answer upon a knowledge of the fundamental principles of impedance. This function of a circuit, often regarded as complex, is here explained in simple terms.

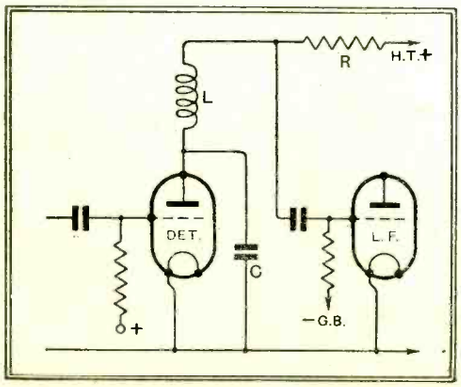


Fig. I.—The value of C—the detector anode by-pass condenser—depends to a great extent upon the value of R.

Detector By-pass.

The process of estimating the reactance of circuits containing inductance and capacitance has been made delightfully easy by the late Mr. W. A. Barclay in his chart, first published in *The Wireless World* on February 17th, 1932, p. 171, and republished herewith.

Take a typical example. We know that one of the useful features of a condenser is that it permits high-frequency current to pass much more easily than low-frequency. For this purpose it is often connected from the anode of a detector valve to earth, to draw off the high-frequency currents, which have finished their work at this point, rather than let them follow up farther into the receiver, where they would be in the way (C in Fig. 1).

One might ask—Why not do this job thoroughly while one is about it, and use a really large condenser, say, 1 mfd.? The longest wavelength to which broadcast receivers tune is about 2,000 metres. At this wavelength the condenser is about 1 ohm—a splendid low-impedance path, whereas the alternative, a choke of, let us say, 0.1 henry (100,000 microhenrys) has an impedance of about 100,000 ohms. But it must be remembered that the L.F. currents must not be drawn off in this way, but must be offered a more attractive route *via* the resistance coupling R, which we will suppose is 100,000 ohms. At a frequency of 5,000 cycles per second C is still only 30 ohms, and therefore very little of our 5,000 cycle high notes could reach the desired destination. C is far too large. The right value for C is that which is as large as possible without offering a

The Importance of Impedance.—

serious counter-attraction to the highest low-frequency we want to hear. If C is 100,000 ohms at 5,000 cycles, then it will be just commencing to draw off appreciably at that frequency, for it offers a path equally as attractive as that of the coupling resistance.

Reference to the impedance chart shows that 0.0003 mfd. is the corresponding capacity. Therefore it looks as if we now know that a 0.0003-mfd. condenser takes just the top edge off a 5,000 cycle note as compared with the lower audible tones. Perhaps our loud speaker worked from a pentode is a trifle shrill. So we try connecting a 0.0003-mfd. condenser across it. The result is—nothing, so far as the ear can tell. The reason is that we have neglected to take account of the fact that the loud speaker portion of the circuit is working at a much lower *impedance*—probably about 10,000 ohms, and the effect of the 100,000-ohm condenser is quite inappreciable. It is necessary to use one of fully ten times the capacity.

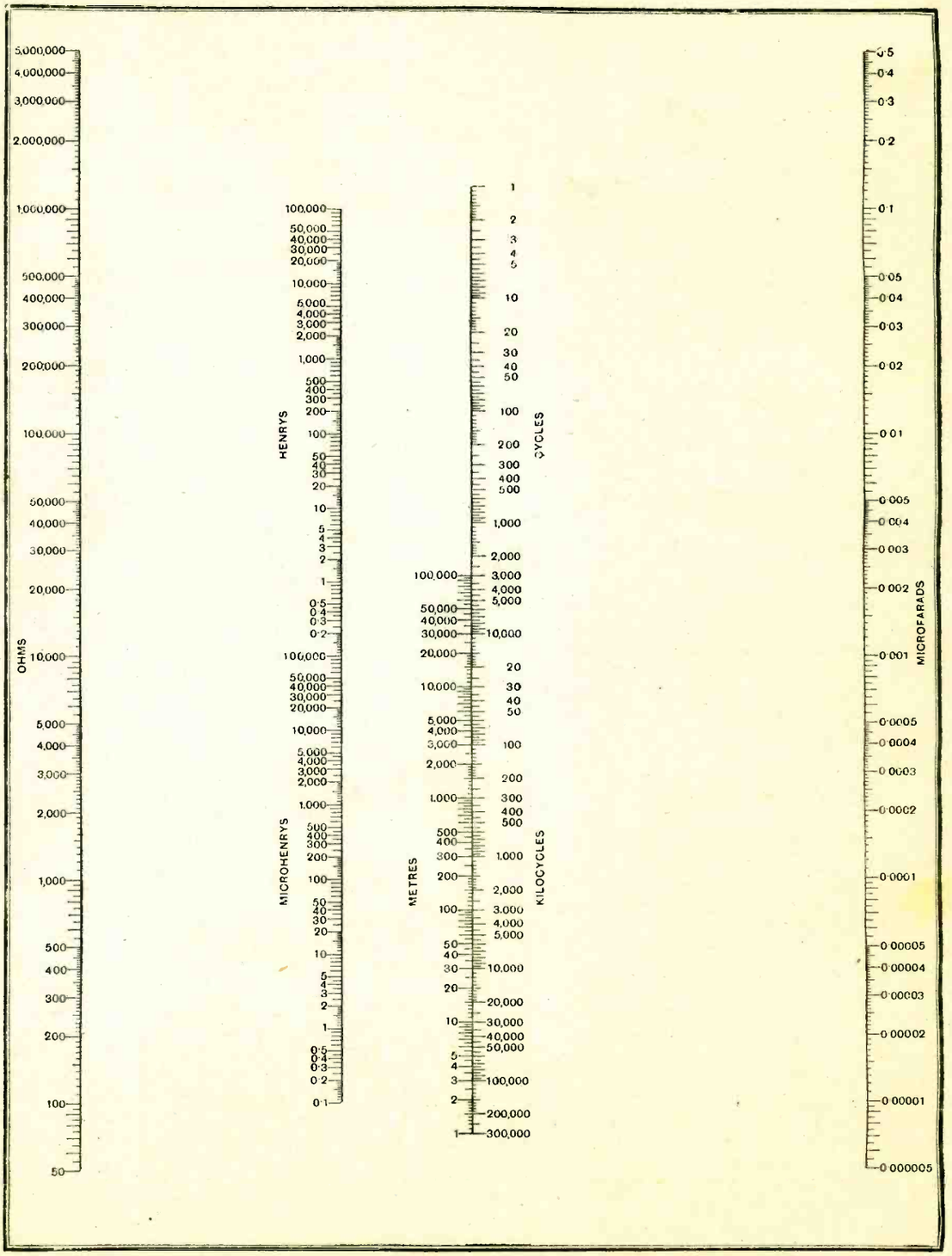
If the loud speaker is of the moving-coil type, with a coil impedance of about 10 ohms—a common value—it would take a 3-mfd. condenser to have much effect when connected across it!

Power Output.

Would it not simplify circuits immensely to keep to a standard impedance throughout, so that a component would have the same effect wherever connected? One difficulty in carrying out such an idea is that certain parts of a circuit are used by currents of widely different frequency, and so the impedance differs widely.

Then the valves set the pace. The only way of obtaining a very high amplification, without constructing the electrodes so close together that they would always be in danger of touching, is to make the impedance very high.

So we have S.G. valves with an impedance of anything up to a million ohms, and an amplification factor of 1,000 or more. The reason why power valves are never like this is discovered by a little calculation. A power valve is not very good unless it can give an output of at least 1 watt. By a little juggling with the two formulæ that have just been given we get $(\text{volts})^2 = \text{watts} \times \text{ohms}$, in this case 1,000,000. So an output of 1 watt would require 1,000 volts! This would be most inconvenient, therefore power valves are designed to sacrifice the amplification factor—which is reduced to about one-hundredth part of that given by a S.G. valve—for the sake of a low impedance, so that a reasonable output is possible without running up into extravagant voltages. The impedance is generally about 2,000 ohms; and it is necessary for the loud speaker to fit this. It would be of little use connecting a 10-ohm speaker to a 2,000-ohm valve—most of the power of the valve would be used up in overcoming its own impedance. And if the speaker were 100,000 ohms it is true that it would get nearly all of the power available, but the total circuit impedance is so high that there would not be much to get. So the load, in this case the loud speaker, must have the same order of impedance as the valve; actually about double is the best for most purposes. If it has not, then the output of the valve must be geared down or up to fit it, just as the power from a petrol engine must be



A time-saving chart from which calculations can be made of capacity and inductance in relation to wavelength and reactance compiled by the late Mr. W. A. Barclay.

The Importance of Impedance.—

geared to suit the load if the best efficiency is to be obtained.

The electrical gear box is a transformer, which alters the voltage without altering the power (except for a small percentage that it pockets as its perquisite). Therefore if the voltage goes up the current must come down. And the impedance goes up. So a capacitance or inductance or resistance that would produce a certain effect if connected in the primary circuit would produce a greater or less effect in the secondary circuit.

One might suppose that if the voltage is doubled by the transformer, the impedance would be doubled. Let us see. Suppose that when there is one volt in the primary the current is one milliamp. Impedance is therefore 1,000 ohms. The secondary voltage is, as we said, 2. Therefore the current must be only half a milliamp. Working out the impedance we get not 2,000, but *4,000*. A threefold step-up would give *9,000* ohms, and so forth—always the square of the transformer ratio.

That accounts for the rule for output transformer ratios—the correct value is the *square root* of the ratio between the loud speaker impedance and double the valve impedance.

Exactly the same principle applies in adapting the output of one valve to the input of another. The input impedance of a power valve is at least 10 or 20 times as high as the output of the preceding valve, so a *step-up* transformer gives the highest efficiency. The output of a S.G. valve and the input of a detector are often about equal to one another, so a one-to-one transformer, or simply a direct coupling by means of a single tuned circuit, is sufficient.

Aerial Coupling.

The coupling between the aerial and the first valve is rather difficult because the impedances may be almost anything, and are not easy to estimate. Moreover, the situation is usually complicated by the problem of having to obtain enough selectivity. So there is fairly general confusion as to the right thing to do. Here again, a clear idea of what impedance means is a tremendous help. Driving a car along a level road in bottom gear or up a steep hill in top gear is hardly possible without even the rawest driver becoming aware that the machine is not operating to the greatest advantage. But aerials are frequently coupled to receivers in a manner which is equally inefficient.

A small indoor aerial has a very high impedance. Therefore another impedance placed in series with it is not likely to offer much obstruction—unless it also is very high. But such an aerial is open to a very great loss if impedances are connected in parallel. To indicate what this means in practice—connecting a small aerial to the tuned circuit through a small series condenser, say 0.0001 mfd., is not likely to result in appreciable loss. Its own capacity is perhaps less. But if the connection to the tuned circuit is made to a tapping low down on the coil, thus converting it into a high ratio step-up transformer, the impedance to earth is low, and therefore does not match the high impedance of the aerial. The transfer of power is inefficient. It should be connected to the upper end, making a one-to-one transformer. Any stray capacity or leakage *in parallel* due to the aerial lead being taken close to conducting material or made fast to imperfect insulators, causes serious loss.

But a very perfect earth is not so essential, for a little extra impedance in series

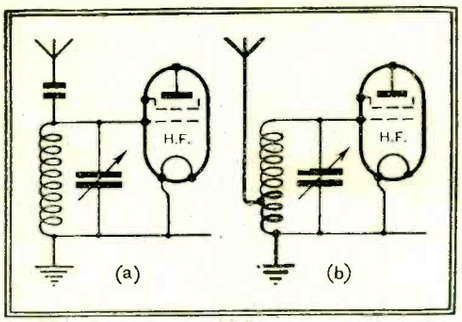


Fig. 2.—(a) The wrong way to connect a large aerial of low impedance. This circuit is quite suitable for a small indoor aerial. (b) The correct method for a large aerial. The path in heavy line should be free from bad joints or any form of high resistance.

is not likely to make much difference. It may, however, be of importance for other reasons, such as local interference.

Now consider a large outdoor aerial, running perhaps close over a metal roof. The capacity to earth is high, the impedance is low, and if led through a series condenser as small as 0.0001 much of the signal voltage might be lost therein. If it is connected like the small aerial, to the top end of the tuning coil, the tuned circuit is overloaded and heavily damped by the low impedance.

A good earth connection is most desirable if the efficiency is not to be lowered, for a few extra ohms may increase the total losses by an appreciable proportion. On the other hand, it is immune from the effects of leakage or parallel capacity to an extent that surprises those who have not become alive to the importance of impedance. A certain large aerial may be most efficiently coupled when it is connected across, perhaps, 10 turns of a 100-turn coil. Suppose there is a leakage to earth as bad as 10,000 ohms. The step-up of the coil being 1 to 10, the equivalent leakage across the coil is 10,000 multiplied by the square of 10—1 megohm, not a very serious loss. It is even possible to use lead-covered cable for a lead-in—a most unorthodox proceeding! But a most beneficial one in certain cases of electrical interference. Suppose we use as much as 50ft., which would have a capacity of about 0.002 mfd. As the greater the capacity the smaller the impedance, we *divide* this by 10^2, giving an effective capacity across the whole coil, due to the lead-in, of 0.00002 mfd.—again, not a very overwhelming burden.

This comparison will perhaps have made it clear that good advice as to what is or is not likely to lead to inefficiency in an aerial depends very much on circumstances. "What is one man's meat. . . ."

Much the same is true of other matters, such as gramophone pick-up extension leads. Some pick-ups are so high in impedance that 100,000 ohms across them has an appreciable effect. Others are so low as to stand 10,000. It would be quite possible to wind a pick-up to a still lower impedance and then match it to the valve by a step-up transformer. An extension lead run through 100ft. of lead-covered cable (the covering would be necessary to prevent "pick-up" of undesirable noise) would muffle a 100,000-ohm pick-up to an intolerable degree; the capacity would be 7,500 ohms at 5,000 cycles. So it would be quite obligatory to run a low-impedance line.

The general statement that "So much stray capacity, or so much resistance, is bad," is quite meaningless. One has to consider *is it bad in that particular circuit?* Therein lies the importance of impedance.

BRUSSELS ON WATCH.

Stations that "Wobbled" in November.

FURTHER aggravation of the European wavelength position is shown in the Brussels wavemeter chart for November. Two stations—Ljubljana and Algiers—appear to have deliberately forsaken their waves about the middle of the month to search for a better position, but evidently the "better 'ole" was not discovered, for they soon returned. Other notable offenders which had also transgressed during the previous month were *Radio Vitus*, Paris, and *Radio Lyon;* the latter, however, is now much steadier between the German common wave and Montpellier. Bremen continues to be very erratic, and is obviously interfered with by a new Hungarian relay working between Bremen and Bari. Magyarkovar, the new Hungarian station, still seems unhappy on the wavelength allotted to Budapest II (209 metres); in fact, it holds the month's record for "wobble." On one day it was found on 206 metres, on the next it was back on 209, and a day later on 210.

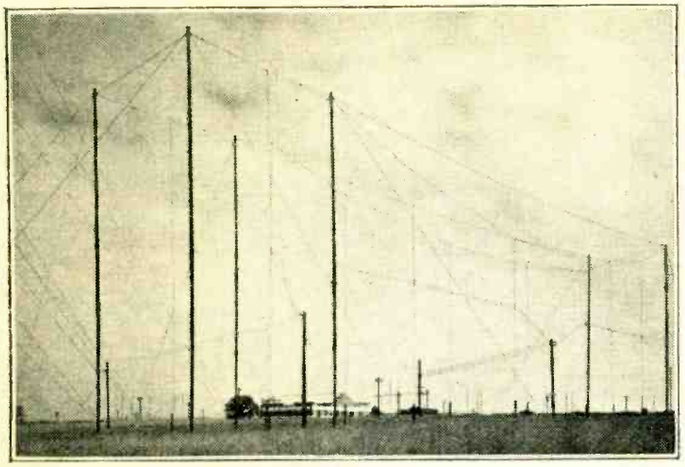
Aberdeen deviated 2 kc. below its normal wave, and was sometimes above it.

The reappearance of harmonics in the Brussels chart is a surprise. Modern transmitters, one imagined, had conquered this trouble, but Moscow's third harmonic is to be found recorded just above Stockholm, while Leningrad's second harmonic is just 2 kc. above Beograd. Daventry National's seventh harmonic appears on 1,352 kc. Sotten's second harmonic, on 1,486 kc., is probably interfering with the Scandinavian relays. Probably some of the twenty-two "unknown stations" were harmonics.

Among the newcomers must be mentioned the Latvian station at Aiviekste, near Madona, which began on 10 kW. on November 21st on a wave of 501 metres. Leningrad, on its new wave of 350 kc., has been very stable, while the new Moscow station replacing it on 300 kc. is one of Europe's steadiest transmitters.

Daventry Hails the Empire.

The World's Newest Short-wave Station.



A general view of the station seen through the West African "array."

TO attain in six years fame which is first national, then Continental, and finally world-wide, falls to the lot of very few towns possessing only 3,608 inhabitants. This is why the 3,608 inhabitants of Daventry gaze at their mast-bespangled hill with gratitude, not to say veneration. Like St. Paul, they are citizens of no mean city.

Paradoxically enough, the new Empire broadcasting station, which was opened on Monday last, is less imposing, at first sight, than its neighbour, the now obsolent 5XX, with its two 500-ft. masts and large transmitting hall. Yet, as a corporate whole, the short-wave station is every whit as perfect in design as those other models of symmetry, the B.B.C. regional stations.

The visitor's glance at once picks out the trim little transmitter building forming the hub of the Empire broadcasting service, from which there radiates the network of feeder lines leading to the scattered "arrays," five in number, which cover the whole Empire.

A tour of the station naturally begins at the transmitter building. This consists of three distinct portions: a central block containing the transmitting hall, control rooms and offices, and two wings, one of which houses the motor generators, switch gear and sub-station equipment, and the other the valve water-cooling plant, boiler room and stores.

In the Transmitter Hall.

The two transmitters, which have been constructed and installed to the requirements of the B.B.C. by Messrs. Standard Telephones and Cables, Ltd., face each other from opposite sides of the main hall, as seen in the inset picture on the opposite page. Along the south end of the hall is the power switchboard. The two control desks in the centre complete the visible equipment and the whole bears a striking resemblance to a miniature regional station. An extraordinarily spick and span effect is given by the duralumin cubicles, of which there are four for each transmitter. The front panels are of polished black slate screened at the back from the transmitter components by duralumin sheets.

To ensure the highest possible degree of frequency stability, each master oscillator valve is controlled by a quartz crystal, separate crystals being employed for each wavelength used. It is impracticable to grind crystals to such a size that they will oscillate at the very high frequencies employed by the transmitter, and for this reason the crystals used have a much lower natural frequency; the required frequency is obtained by means of a series of frequency-doubling stages.

The Empire station uses the well-tried system of modulation at low power. The output of the first transmitter unit is therefore a completely modulated carrier wave, suitable for transmission, but of insufficient power. Stage by stage the power is amplified on the push-pull principle, the first amplifier employing two 2 kW. valves, the second two 10 kW. valves, and the final amplifier four 15 kW. valves. All these valves are water-cooled. The output of the last stage is taken to a special aerial charging panel mounted above each transmitter which carries the terminals of the various aerial feeder lines.

The modulation of the two transmitters is adjusted to peak at 90 per cent., which the B.B.C. engineers consider as providing the maximum practicable efficiency consistent with a satisfactory linearity of response.

Power is supplied to the station by the Northampton Electric Light and Power Company, from the power station at Northampton, twelve miles away. There is a sub-station on the Daventry site fed from an 11,000 volt 50 cycle three-phase power line, and this is connected to the station mains by a 300 K.V.A. transformer.

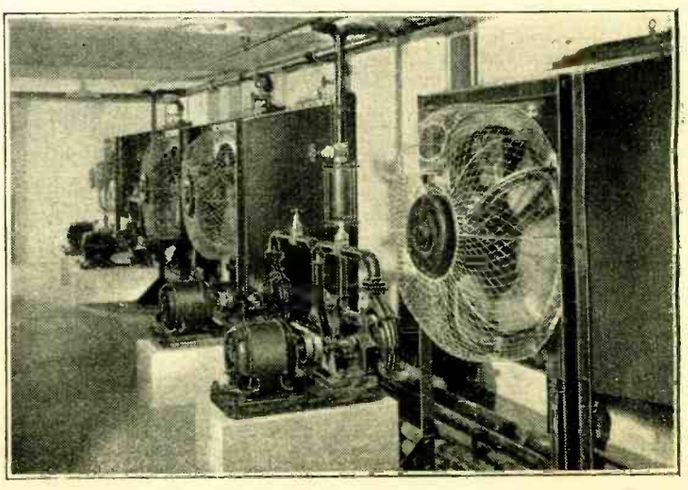
Apart from the high tension D.C. supply to the first and the main power amplifier, which comes from a six-phase rectifier with a D.C. output of 10,000 volts 6 amperes, all the power supplies for the transmitters are provided by the motor generators in the transmitter building. There are twelve of these machines, which are divided into three groups, two of which are used at one time, the third acting as standby plant.

The Five Aerial Arrays.

The atmosphere of novelty really asserts itself when we tramp across the windswept hill and examine the aerials. As will be evident from the drawing on the opposite page, no attempt has been made at a symmetrical arrangement for the perfectly sound reason that the Empire itself is not symmetrical! In the case of each aerial array the beam is shot off at right angles in the direction remote from the feeder lines, the exception being provided by the Australasian array. In this case the aerial and the reflector are interchangeable to permit of transmission either way round the Great Circle in accordance with prevailing atmospheric conditions.

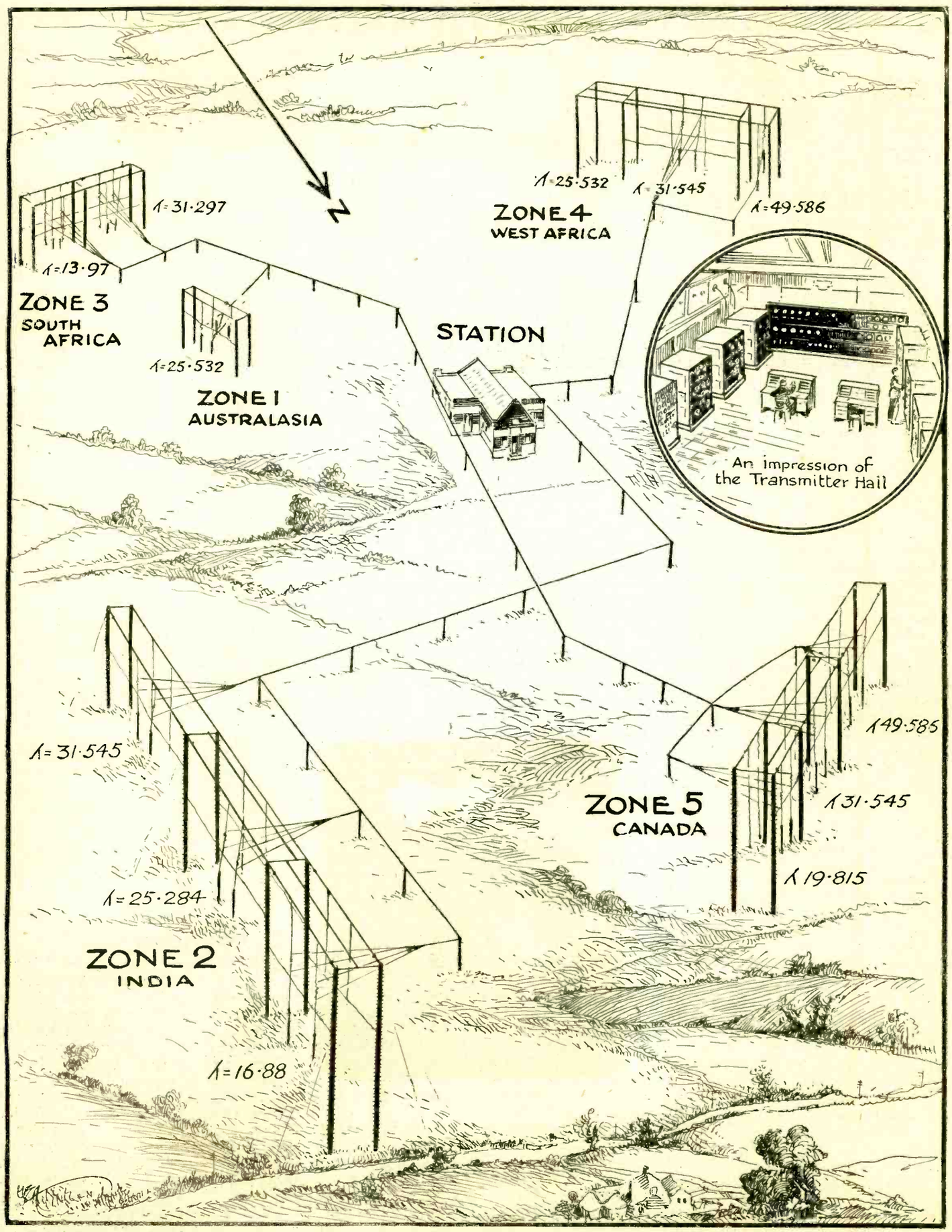
The first published map of the Empire Broadcasting system appeared in *The Wireless World* of October 14th last; a study of this map in conjunction with the bird's-eye view of the station will show how thorough are the B.B.C. plans to ensure that the Dominions or Colonies are completely served.

The reception reports so far received indicate success beyond the expectations of the B.B.C. engineers, except in regard to the Canadian zone. Here, it would appear, wavelengths of 50 metres and under are too low. We understand that authority may be sought for a wavelength around 70 metres.



The water circulating system and fans for cooling the valves.

THE WIRELESS HUB OF THE EMPIRE.



Our artist gives an impression of the new B.B.C. short-wave station as it would appear to an observer on top of one of the 500-ft. masts still used by Daventry National (5XX).

My Yuletide Mishap.

A FRIEND in whose eldest offspring (twins) intelligence is beginning to dawn, has consulted me as to the best way of filling the rôle of Father Christmas.

I have suggested that since he is still young and active he could do a lot worse than adopt a scheme invented by me one Christmas several years ago, before rheumatism had commenced to restrict my muscular activities.

The little Grid Leaks happened to be giving a party. Leaving Mrs. Free Grid to incite the children to shout their requests up the chimney to Father Christmas in the time-honoured manner, I climbed on the roof, armed with a microphone, a portable amplifier in a suit-case, a small cone loud speaker, and vast quantities of "flex." Having reached the apex of the roof I connected up my apparatus and proceeded to lower the loud speaker gently down the chimney.

When I judged it to have descended far enough to be still out of sight but within audible range of the firegrate, I began announcing that I was Father Christmas and indicating various parts of the house in which there were hidden presents.

It was not until I gathered up my gear and prepared to descend that I noticed quite a little crowd of people in the street, and a fat policeman on my ladder.

Subsequent explanations revealed the fact that my neighbour—a fussy, irascible old bachelor of early Victorian vintage—had been sitting by his fireside reading the Christmas number of the *Mutes' Magazine* when a strange object appeared in the fireplace like a bolt from the blue and commenced to speak. In his panic he had dropped and broken his favourite pipe.

Apparently, in my excitement, I had not only miscalculated the length of my "flex," thus lowering the loud speaker right down into the fireplace, but, worse still, had dangled it down the wrong chimney-pot, which, of course, is one of the disadvantages of living in a semi-detached house in which a common chimney stack is used to serve two houses.

The upshot of the matter was that I thereafter forswore any house which was not completely detached from its neighbour.

An Unhappy Frolic.

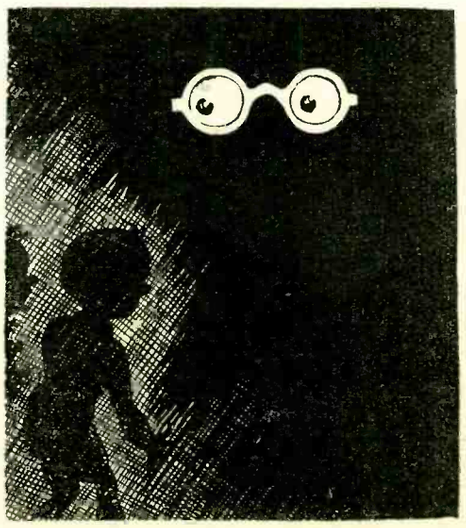
READERS will, I trust, forgive any signs of weariness which may creep into my notes this week; I am feeling completely exhausted after an uneven struggle with a synthetic Christmas tree.

Such a piece of vegetation is, or should be, quite a simple affair,; its construction has been the sequel to an unfortunate experience of last year when, in a weak moment, I accepted an invitation to "electrify" the tree at the Parish Hall treat for the benefit of the less sophisticated of our villagers.

In the interests of economy, I foolishly suggested that money should not be wasted in purchasing complete strings of lamp devices, but that ninety-six individual lamps should be purchased at the sixpenny stores, together with a corresponding number of "tuppenny" lampholders from the same source. This was agreed to.

A Startling Effect.

When the great day arrived and the children, duly armed with the customary orange and bun, were all assembled, the lights of the tree were switched on. The effect on the children was more startling than I had expected, as about half a dozen of the ninety-six lamps lit momentarily with an unnatural brilliancy, the fuses blew out with a resounding report, and the whole hall was plunged into darkness and panic.



Plunged into darkness.

When light and some semblance of order had been restored I proceeded to make a technical survey, and discovered that the lady decorators, with their usual charming naïveté, had ignored the fact that the terminals of my "tuppenny" lampholders were bare. They had lovingly decorated nearly every one by curling a string of tinsel around it, thus causing a beautiful short-circuit. It is a mystery to me how even six lampholders came to escape their depredations.

In the autumn of this year I determined that there should be no repetition of last year's fiasco, and the great idea dawned upon me of getting a well-known wireless manufacturer to make a synthetic Christmas tree in which all wiring could be run safely through the hollow trunk and branches to rigidly fixed lampholders.

Fiendish Symmetry.

Unhappily, the finished article declared only too plainly that the manufacturer lacked the spirit of romance customarily associated with Christmas trees, each twig and leaf being stuck on with a mathematical precision and a fiendish cult of symmetry which I had thought only possible to an artist of the futuristic school. Nevertheless, I thought that it was up to me to make the best of a bad job, so I started upon the work of fixing up the lights, although it consisted—as I foolishly supposed—of nothing more than the mechanical screwing of the necessary lamps into their holders.

I had reckoned without my host, or, rather, without my wireless manufacturer, however, who evidently could not get away from the fact that he was not making a wireless set, since when I went to test things out it just wouldn't work, and careful examination revealed that several of the connections were missing from inside the hollow branches. I fear, however, that I lack manual dexterity in repair work of any kind, as, after a strenuous day's work, the tree is nothing but a mass of wilted twigs and branches and I have now hastily to send out for one of the natural variety.

Send in Your Samples.

Tired and dispirited as I am, it is my firm resolve to leave no stone unturned until I find the perfect synthetic Christmas tree, and I hereby invite all manufacturers who think that they could do something in this line to submit samples to me.

Such an article would find a ready sale among the many sorely harassed paterfamilias of this world, more especially if it were also fitted with strong hooks for the receipt of presents and decorations. Surely British manufacturers can come up to the scratch, or must I turn to Germany, the spiritual home of the Christmas tree, for assistance in this matter?

And now it remains for me to wish you a less harassed Christmas than the one I am likely to have. May Easter soon roll on. Fröhliche Noël, as they say in Italy.

NEWS of the WEEK.

Current Events in Brief Review.

Movable Feasts.

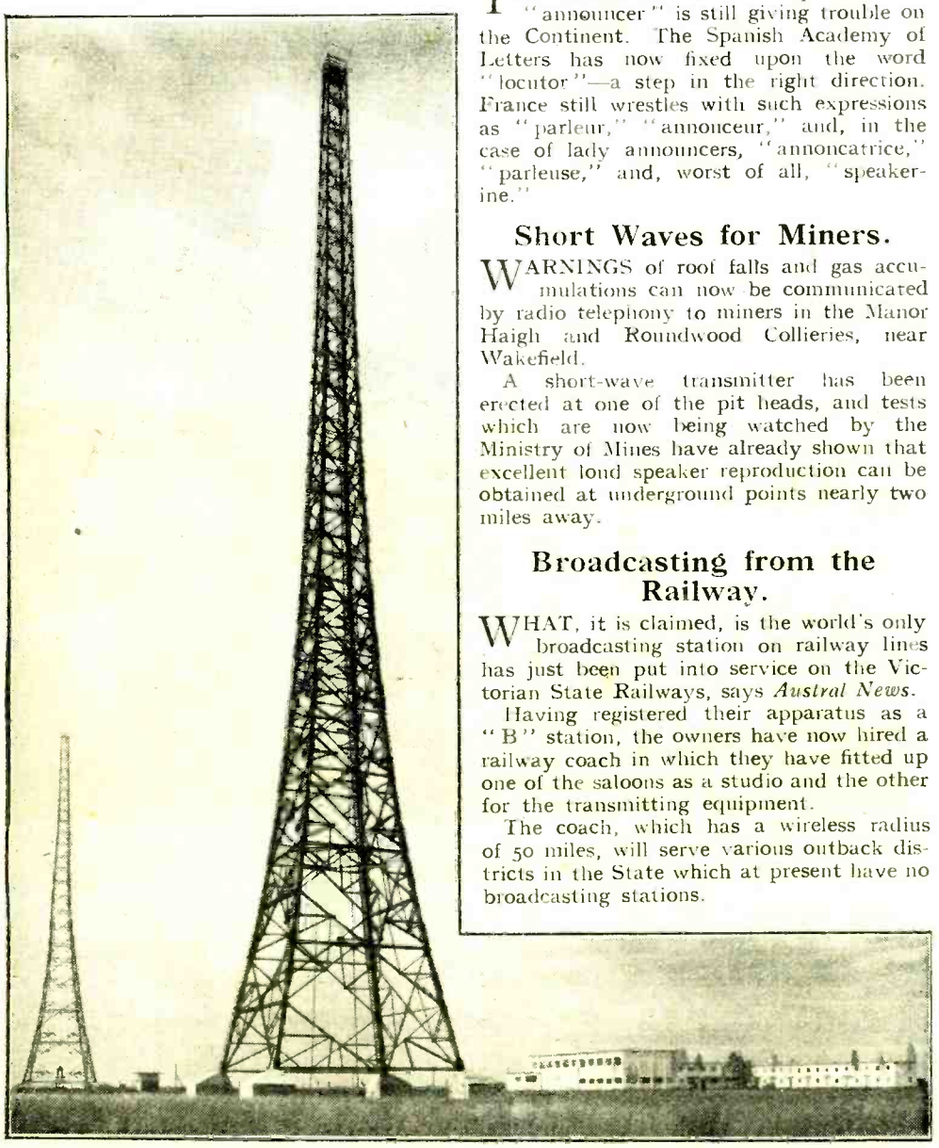
THE new high-power broadcasting station at Vienna will not be inaugurated at Christmas, as originally reported. Easter and Whitsun are both quoted as probable occasions for the début.

No "Empire Station" for Ireland.

THE Irish Free State Broadcasting Committee has decided that the very heavy capital and annual expenditure involved precludes at present the establishment of a short-wave station for overseas broadcasting.

Telewriters at German Stations.

THE nine German regional broadcasting centres are now linked together by telewriters, by means of which news bulletins, last-minute programme changes, and other information can be circulated with a minimum of delay.



GERMANY'S LATEST. An imposing view of the new Munich station which opened on December 3rd, using a power of 60 kilowatts and a wavelength of 533 metres. The management of the station has issued a special request for reception reports from all over Europe.

Believe It or Not.

A WARSAW resident, according to a correspondent, has included in his last will and testament a demand that his coffin shall be equipped with a complete wireless receiving installation, and that a pair of headphones shall be clamped on his skull.

60kW. at Fécamp?

M. FERNAND LEGRAND, director and founder of Radio-Normandie, Fécamp, has explained in a Paris journal a project for a 60-kW. broadcasting station to be erected close to the existing transmitter, but functioning on such a wavelength that interference will be impossible.

If a permit can be obtained, funds will be forthcoming immediately.

"Locutor."

THE search for a word equivalent to "announcer" is still giving trouble on the Continent. The Spanish Academy of Letters has now fixed upon the word "locutor"—a step in the right direction. France still wrestles with such expressions as "parleur," "annonceur," and, in the case of lady announcers, "annoncatrice," "parleuse," and, worst of all, "speakerine."

Short Waves for Miners.

WARNINGS of roof falls and gas accumulations can now be communicated by radio telephony to miners in the Manor Haigh and Roundwood Collieries, near Wakefield.

A short-wave transmitter has been erected at one of the pit heads, and tests which are now being watched by the Ministry of Mines have already shown that excellent loud speaker reproduction can be obtained at underground points nearly two miles away.

Broadcasting from the Railway.

WHAT, it is claimed, is the world's only broadcasting station on railway lines has just been put into service on the Victorian State Railways, says *Austral News*.

Having registered their apparatus as a "B" station, the owners have now hired a railway coach in which they have fitted up one of the saloons as a studio and the other for the transmitting equipment.

The coach, which has a wireless radius of 50 miles, will serve various outback districts in the State which at present have no broadcasting stations.

Stamps for Radio Licences?

MANY workers undoubtedly experience difficulty in finding the wherewithal to purchase a ten-shilling wireless licence. An interesting suggestion from a collier, writing to the editor of the *Empire News* (Manchester), is that prospective listeners should be enabled to buy a sixpenny or shilling stamp which could be affixed to a card. When the necessary number of stamps had been purchased, the card could be exchanged for a licence at any Post Office.

Physical Society's Exhibition.

"CATHODE Ray Oscillography" is among the subjects chosen for lectures to be given during the twenty-third annual exhibition of the Physical Society. The lecturer will be Mr. R. A. Watson Watt, B.Sc., A.M.I.E.E., F.Inst.P., who will illustrate his remarks with experiments. This lecture will be given on January 4th at 8 p.m.

The exhibition will be held on January 3rd, 4th and 5th next at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, S.W.7.

Inventor of the Coherer.

MARCHESE MARCONI has always been unstinting in praise of all who helped to set wireless on its feet in the early days. His latest gesture has been to write a complimentary message to Dr. Branly, the French "Father of Wireless," for inclusion in a volume presented to the veteran inventor on the jubilee of his receiving the degree of Doctor of Medicine. Dr. Branly, who is, of course, famous for his invention of the coherer, one of the earliest forms of wireless detector, is now eighty-six.

A Common Utility Concern?

BROADCASTING in America has won its first fight against the theory that stations are public utility concerns which must render service to all comers who are prepared to pay. The Inter-State Commerce Command has decided that it has no jurisdiction over the rates charged to radio advertisers, and this decision is considered to be of far-reaching importance, since it settles a fundamental legal issue.

If a prospective advertiser objects to the fee charged, his only course is to refrain from advertising.

Should Newspapers Broadcast?

THE news that American newspapers are buying up the broadcasting stations wherever possible, raises the interesting question as to whether journalists are better qualified than most other people to run broadcasting stations. France has long possessed newspaper stations, and it is several years since William D. Hearst, the American newspaper magnate, began using the ether for widening the scope of his appeal. The Hearst group owns stations in New York, Milwaukee, Pittsburgh, and other big cities. Certainly in the handling of news, journals can surpass other interests, but there is, of course, the temptation to withhold the "plums" for the news sheet.

Broadcast Brevities.

By Our Special Correspondent.

Christmas Day.

THE programme on December 25th opens with a Christmas Morning service conducted by the Rev. Pat McCormick.

The special Christmas feature will occur in the afternoon, when the King's message and the Empire programme will be heard.

"All the World Over."

The programme, which bears the introduction, "All the World over—to and from British citizens, wherever they may be, Christmas greetings and good wishes transmitted from London West—about the World," will be transmitted from 2.0 to approximately 3.8 p.m.

His Majesty's Message.

The King's speech, which will be given at the conclusion of the Empire programme, will be heard by home and Empire listeners, as, in addition to being broadcast from all B.B.C. home transmitters, including the local National and Midland Regional, it will be radiated by the British Empire Broadcasting Station on the Indian beam and on an omni-directional aerial.

Old Year in the New World.

A NEW Year's Eve programme will crown the year's broadcasting achievements. At 11.0 p.m. on New Year's Eve, midnight in Germany will be signalised by a relay from Konigsberg, and will be followed by relays from Warsaw, Berlin, Prague, Vienna, and Milan and Rotterdam.

Home Again.

The B.B.C. then returns to 1932 with a midnight service from All Souls, Langham Place, the church of the parish in which Broadcasting House is situated. Big Ben will announce at midnight the passing of 1932, and at 12.5 a.m. the lingering of the Old Year in New York will be conveyed to listeners.

"America's Ace Organist."

TUNE in the National programme on Thursday next at 7.30 p.m., and you will hear Mr. Harold Ramsay's first broadcast on the organ of the Granada Theatre, Tooting. Mr. Ramsay's playing is said to be "just different"—he is known as "America's Ace Organist"—so I fancy that cinema organ lovers have a treat in store.

The New Governors.

THE appointment of a new Governor and vice-chairman, in addition to two ordinary Governors, is a notable event in the B.B.C.'s history.

Mr. Ronald Collett Norman, who succeeds Lord Gainford as Governor and vice-chairman, was chairman of the London County Council in 1918-19, and has had a long and active career in many administrative positions. He is now vice-chairman of the National Council of Social Service.

A Minister of State.

Viscount Bridgeman, one of the new Governors, needs no introduction. He will bring to the B.B.C. Board Room the accumulated experience of a Minister of State.

The new lady member of the Board, Mrs. Mary Agnes Hamilton, who is no stranger to the microphone, sat in the last Parliament as Labour member for Blackburn. She is a writer of many successful books, and is interested in social and industrial questions.

Wychbold.

WYCHBOLD, a little village in Worcestershire, will wake up one morning very soon to find itself famous, for I understand that it is at Wychbold, near Droitwich, that the B.B.C. engineers have pitched their camp with every appearance of staying there.

Thus ends the search for a suitable site for the new National station, successor to 5XX, and its inseparable companion, Midland Regional.

New Power Maximum.

The biggest power change will occur in the case of Midland Regional, the new transmitter operating on from 60 to 70 kilowatts as compared with the 25 kW. now in use at Daventry.

The new "Nat." transmitter will operate on 100 kW., which, if indications are correct, is to be the maximum permissible power for any European station.

B.B.C. at the B.I.F.

A "HALL of Music and Radio" is to be a happy innovation at the 1933 British Industries Fair, opening on February 20th next. Very appropriately the B.B.C., who are exhibiting for the first time at the Fair, will make Empire Broadcasting the keynote of their section.

The exhibit will show by means of a large map of the world how the various zones will serve all the outposts of the Empire.

A Talk by the Prince.

THE Talks Department will receive a real honour on January 6th, when the Prince of Wales opens the new series of talks, entitled "S.O.S.," dealing with schemes for helping the unemployed to help themselves. His Royal Highness will speak at 9.55 p.m., and subsequent talks will be given on successive Fridays at 9.20 p.m.

In his talk the Prince will appeal to listeners for their support of schemes about to be co-ordinated by the National Council of Social Service, of which he is Patron.

Another Wavelength Conference.

WHEN the Madrid Conference closed its doors on Saturday, December 10th, people were rubbing their hands with delight over the important decision to enlarge the broadcast waveband by 41 kc. on the long waveband. But closer inspection reveals that this is nothing more than a confirmation of the *status quo* which has existed for some time.

Grand Exchange of Wavelengths?

Perhaps there is scope for optimism in the decision of the Swiss Telegraph Department to invite all European administrations to a European wavelength conference to be held not later than June 1st next in Switzerland.

Such a conference, if held, might mean an entire revision of the Prague Plan.

"The Battle for Power."

Years ago I was writing in this column of the "battle for power" which seemed already to be threatening the idea of nation speaking peace unto nation, at least in the etheric sense. Subsequent events have proved that these fears were not groundless, though there is abundant testimony to the wisdom and adroitness of the International Broadcasting Union in its handling of the situation.

Luxembourg in a Fix.

It is largely owing to the good offices of the Union that the Madrid Conference has effectually side-tracked Luxembourg in its attempt to swamp Europe with 200 kW.

The Conference has declined to grant Luxembourg its 1,250-metre wavelength.

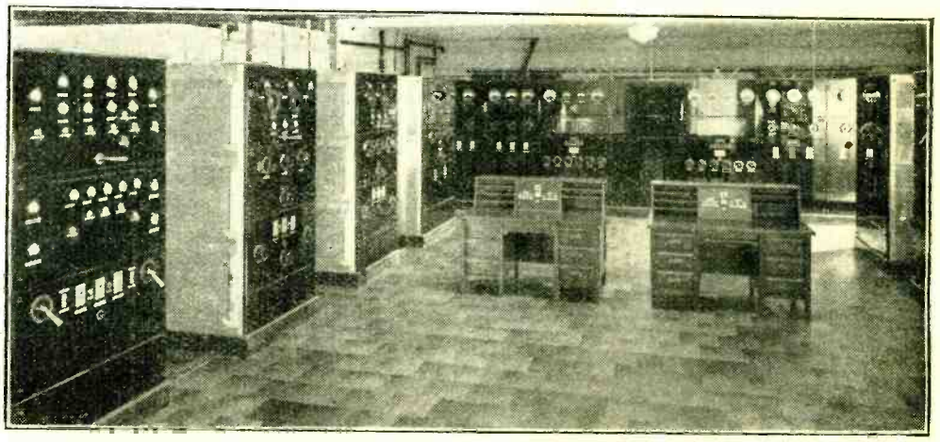
Always the B.B.C.

SOMETIMES I wonder whether other organisations ever envy the B.B.C. Is the Port of London Authority, which is also incorporated by Royal Charter, wondering whether a special symphony will ever be composed in its honour? Sir Edward Elgar, Master of the King's Musick, is bestowing such a mark of favour on the B.B.C.

Painting Pylons.

Could not the Poet Laureate write an ode to the Income Tax Commissioners? If so, the President of the Royal Academy might then be persuaded to paint a few pylons in homage to the Electricity Board while the Astronomer Royal was predicting stellar eclipses for the National Board of Film Censors.

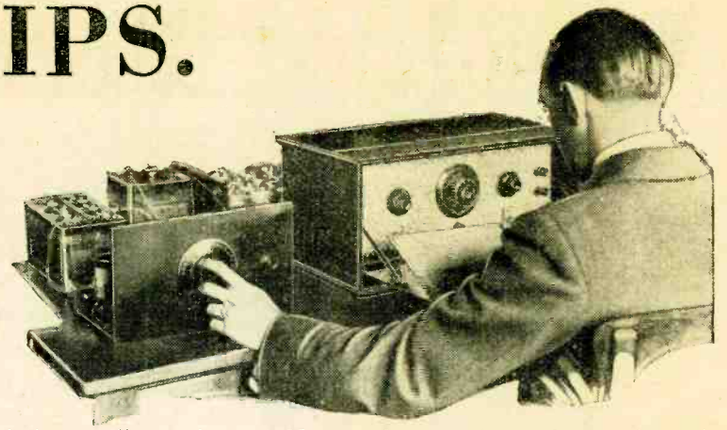
Why should the B.B.C. get *all* the kudos?



THE EMPIRE TRANSMITTERS. A view of the transmitter hall at the new Empire broadcasting station at Daventry. The apparatus has been built to the requirements of the B.B.C. by Standard Telephones and Cables, Ltd.

HINTS and TIPS.

PRACTICAL AIDS TO BETTER RECEPTION.



BEFORE components reached their present state of standardisation the ordinary practice of the home constructor was to arrive at the correct connections of a reaction coil by trial and error. The connections were made at random, and if the valve oscillated when reaction was applied all was well. If it did not, then the connections to the coil, or even the coil itself, were reversed.

Reaction Windings.

The matter is not quite so straightforward nowadays. A modern high-efficiency valve may sometimes be made to give unmistakable signs of self-oscillation, even though the sense of the reaction winding be incorrect. The effect of increasing reaction coupling will, however, not be that desired, as signal strength will not be improved.

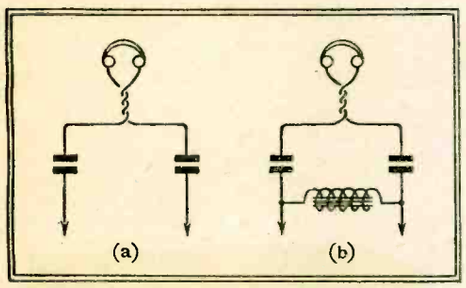


Fig. 1.—Isolating headphones from a source of dangerously high voltage. The protective condensers, for testing purposes, should have capacities of from 0.01 mfd. upwards (preferably much higher) and should be capable of withstanding the highest voltage existing in the receiver.

From this emerges the fact that where the reaction-control system fails to work satisfactorily an experimental reversal of connections to the coil is still worth trying.

ALTHOUGH headphones are little used nowadays for listening to programmes, they still have their uses as an aid to testing. From at least one point of view, phones are actually better than a meter; they help to establish an intimate liaison between tester and set, which is absent when the silent, impersonal, but admittedly much more scientific milliammeter or voltmeter is employed.

Phone Tests.

It is not the purpose of this note to describe methods of using headphones for testing, as these are mostly well known. Instead, it is to be urged that great care should be taken when connecting the phones to a mains-operated set—even to one where anode voltages are relatively low—to avoid risk of shock.

It is an excellent rule to make that the phones should never be connected directly to the receiver circuit without the intermediary of some device which will afford protection.

A step-down transformer of suitable ratio is the ideal isolating appliance, but is seldom available. However, as accurate matching does not matter, a loud speaker output transformer will generally serve the purpose well enough, provided it is designed for use with a high-resistance speech coil.

Failing a transformer, isolating condensers may be employed. If a test is to be made by joining the phones across an existing anode circuit impedance, the simple connection of two condensers in the manner shown in Fig. 1 (a) will be sufficient. Where phones are to be connected in series, and not in shunt with an existing component, some form of impedance through which D.C. can flow must be connected in the manner indicated in Fig. 1 (b). For this purpose an L.F. choke is the most suitable; a compact, inefficient, and inexpensive component will serve well enough.

IT is usual to adjust the trimming condensers of a gang-control receiver at the lower end of the medium waveband. Then, if the receiver be tuned to a station at the upper end of the same waveband, and it is found that signal strength can be appreciably improved by adjustment of any one of the trimmers, it must be concluded that either the coils or the ganged condensers are not properly matched.

Coil or Condenser?

The question is, which? In some cases it is quite a pretty little problem to obtain experimentally a definite answer to the question, and the matter becomes rather too complex for these notes. But if it happens that all the coils used in the receiver are identical, and so interchangeable from one position to another, it is an easy matter to form almost, if not quite, a definite opinion.

Briefly, the scheme is to adjust the trimmers accurately at a given wavelength—preferably a fairly low one—and then, without altering anything else, to interchange the various coils. Still working on the same wavelength, the next step is to see whether signal strength can be improved by readjusting the trimmers. If it can, the coils are definitely at fault. On the other hand, if no improvement can be made, the fact that ganging did not originally hold at the higher wavelength must be ascribed to misalignment in the condensers.

IN a modern receiver where volume is controlled by means of a potentiometer producing variation of an applied voltage, either of grid bias in the case of variable-mu S.G. valves, or of screen voltage in ordinary S.G. valves, it is often found that movement of the volume control sets up crackling noises in the loud speaker owing to imperfections of contact between the sliding arm and the resistance wire. Especially is this noticeable as the control is moved towards maximum volume in sets with more than one H.F. valve or in superheterodyne receivers. It is usually impracticable to improve matters by increasing the pressure of the contact arm.

Crackling Volume Control.

Such a condition was found to exist in a fairly straightforward "superhet," and although different makes of potentiometer were tried the trouble was not entirely overcome.

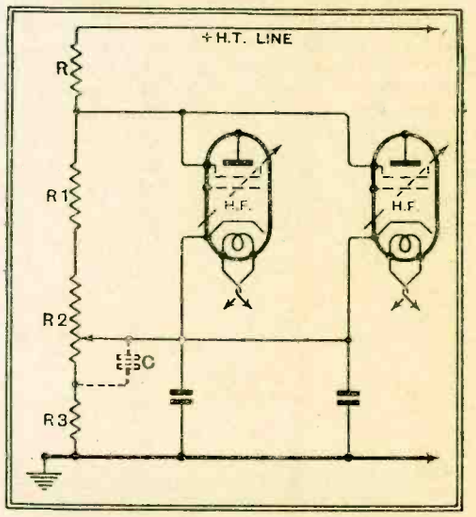


Fig. 2.—The addition of the condenser C will often reduce extraneous noises due to operation of the volume control R, R_1, fixed screening grid potentiometer; R_2, volume-control potentiometer; R_3, bias-limiting resistance.

Eventually it was found that the connection of a 2-mfd. condenser between the contact arm and the "sensitive" end of the resistance winding completely removed the crackling. As the maximum working voltage is low, practically any condenser of 2 mfd. would be suitable. Connections in the case of a standard type of set are shown in Fig. 2.

LABORATORY TESTS.

New Radio Products Reviewed.

CELESTION LOUD SPEAKERS.

THE two loud speakers tested are representative of the current season's range of PPM type permanent magnet units. Both are fitted with diaphragms of the Celestion "Hyflex" material, and are provided with universal output transformers. Four ratios are available, giving a range of loads from 4,000 to 18,000 ohms, suitable for matching all current types of valves from low-resistance triodes to pentodes.

The PPM29 at £3 17s. 6d. is, from every point of view, a quality production. Its principal claim to preference over small and less expensive models lies in the extension of frequency response into the true bass. There is a quite useful output at 50 cycles, and the principal diaphragm resonance at 75 cycles is much less pronounced than is usual. As a result the bass reproduction is full and smooth without the slightest trace of "boom." In the middle and upper registers the only deviations from an aurally uni-

Celestion permanent magnet moving-coil loud speaker units: (left) PPM29, (right) PPM9.

form response are a slight dip at 350-400 cycles and an increased output in the region of 2,500-4,000 cycles. The output in the extreme top up to 8,000 cycles is exceptionally good. The power handling capacity is rated at 9 watts.

In the middle and upper registers the response of the model PPM9 is very similar to that of the PPM29. The quality is clear and brilliant, and the sensitivity appears to be slightly better than that of the larger model. This may possibly be accounted for by the fact that the bass resonance is higher (just over 100 cycles). There is, however, a measurable response at 75 cycles, and the output in the 100-cycle region gives sufficient body of tone to balance the output in the upper register.

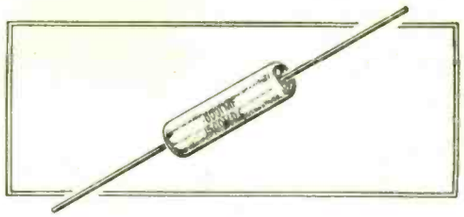
The PPM9 is fitted with a disc on the centre pole piece to limit the excursion of the diaphragm, and will handle more than 4 watts A.C. input. The price is 35s.

Both units are fitted with covers to prevent the ingress of dust to the back of the air gap.

LOEWE TUBULAR CONDENSERS.

THESE small tubular condensers are built up from tinfoil and waxed paper, and enclosed in tubes of bakelised material measuring 1⅜in. long and ⅜in. in diameter. Wire ends are fitted, and as the condenser is exceptionally light they can be suspended in the wiring, thereby conserving baseboard space. Each is tested at 1,500 volts D.C. and although the makers allow a tolerance of plus or minus 20 per cent. in the capacity values, we found a much closer agreement than this with the specimens tested.

They are obtainable in all the usual values from 0.00005 mfd. to 0.02 mfd. The price is 6d. each, and the makers are Loewe Radio Co., Ltd., Fountayne Road, Tottenham, London, N.15.



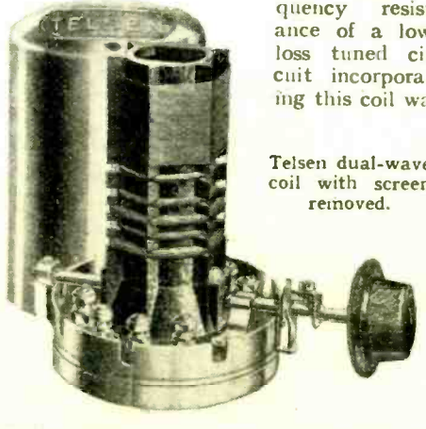
Loewe miniature tubular condensers for suspending in the wiring.

THE TELSEN SCREENED COIL.

THIS coil is at present made in one type only, and is designed to cover all normal requirements. Besides the medium and long-wave tuned windings there are two primaries for connection to an aerial or in the anode circuit of a valve, the switch shorting the long-wave primary simultaneously with the corresponding coil. A reaction winding is also incorporated. The semi-floating switch-barrel in the base is designed to allow easy ganging of the switches, and it is interesting to note that special switch-couplings are available which allow the switches to be operated from a single knob without necessarily having all the coils in the receiver in line.

The inductance of the medium-wave winding is about 165 microhenrys, and that of the long-wave winding 2,300 microhenrys, thus allowing the ranges 200-550 and 900-2,000 metres to be comfortably covered when a 0.0005 mfd. condenser is used for tuning.

We were particularly impressed with the accuracy with which the medium-wave windings were matched; examining a set of three coils intended to be used together we found that any discrepancy between inductance values did not exceed 0.25 per cent. An odd coil, not part of the set, diverged by only 0.6 per cent. from those comprising the set. The largest difference between long-wave windings was found to be 3.5 per cent.



Telsen dual-wave coil with screen removed.

The high-frequency resistance of a low-loss tuned circuit incorporating this coil was measured at a number of wavelengths, and it was found that the coil had practically the same resistance, at all wavelengths, as other screened coils of similar type.

From the standpoint of electrical performance the Telsen coil may therefore be regarded as a satisfactory alternative for use in any *Wireless World* receiver not requiring coils of special design, while those who are designing their own receivers will find the greater freedom in layout permitted by the auxiliary switching equipment very convenient. The price is 8s. 6d. per coil, whether bought singly or in specially matched sets of two or three; in the case of the sets an extra piece of switch-rod of suitable length is included without extra charge.

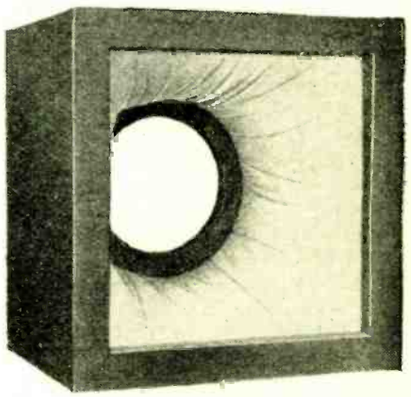
NON-RESONANT BOX BAFFLES.

WE have received from the Weedon Power Link Radio Co., 185, Earlham Grove, Forest Gate, London, E.7, a specimen box baffle made to the specification of the B.B.C.

Independent tests have proved that the lining of absorbent material eliminates all traces of box resonance in the region of 150 cycles, and the result is a compact baffle having all the advantages of a large and rigid flat baffle without the disadvantage of unwieldy dimensions.

The baffle illustrated is leatherette covered, measures 18in. × 18in. × 12in., and is the size used by the B.B.C. at Broadcasting House. It is suitable for super power loud speakers, and the price is £2 5s. This model is representative of a very wide range of types and sizes listed by the firm, which is in a position to supply kits of parts as well as baffles for special requirements such as dual compensated moving coil units.

All types are manufactured under licence, and the prices include royalty.



"Broadcasting House" loud speaker baffle made by the Weedon Power Link Radio Co.

oooo

Trade Notes.

The Bury Felt Manufacturing Co., Ltd., Hudcar Mills, Bury, Lancashire, announce that they have organised a separate department to deal with the requirements of the radio and gramophone manufacturers. Felt cut to any size required can now be supplied immediately from stock for use in wireless and electrical components.

"Plastape" Wire.

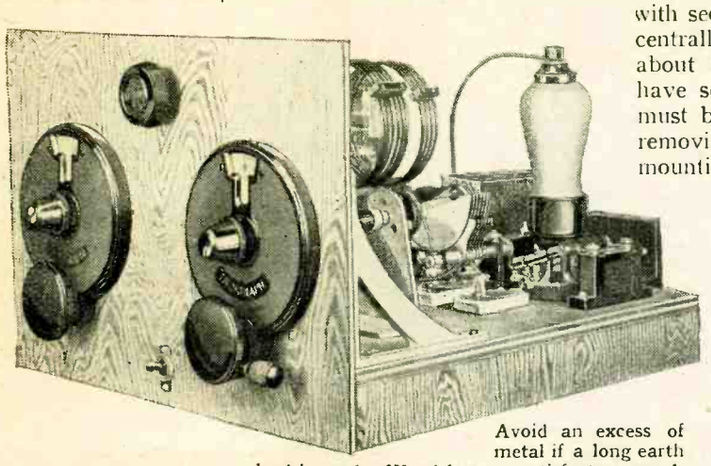
The Kenden Manufacturing Co., 16, Took's Court, Cursitor Street, London, E.C.4, have introduced a novel style of conductor known as "Plastape" wire, which consists of a number of strands of enamelled wire laid flat and kept in position by an adhesive tape ⅛in. wide. This is claimed to be particularly well suited for use as an indoor aerial, earth lead, or as a loud speaker extension, for it lies flat and is easily moulded to conform with any surface. Various colours are available, and samples will be gladly supplied by the makers on receipt of a postcard.

Notes on the Short-Wave Two

Alternative Valves Tested and Some Notes on Operation.

A Receiver for 15 to 80 Metres.

FURTHER tests having been conducted with the "Short Wave Two" receiver, it is now possible to augment the operating notes given in the constructional article published in *The Wireless World* dated November 4th last. It has been definitely ascertained that the performance of the set is not affected to any noticeable extent by the type of screen-grid valve used for the detector; a few specimens were found to be slightly microphonic, but in all cases this difficulty was overcome by fitting a good anti-microphonic valve-holder or mounting the one specified on a small piece of closely knit sponge rubber.



Avoid an excess of metal if a long earth lead is used. Wood forms a satisfactory panel.

This will entail a few minor changes in the wiring of the detector stage, as other anchorage points must be found for the majority of wires joined to the valve-holder. The grid leak can be changed over to the tag on the grid condenser and a short flexible lead used to join this component to the grid terminal on the valve-holder. The H.T. supply for the screen grid, originally terminating at the anode terminal on the valve-holder, should be transferred to the corresponding terminal on the 0.01 mfd. condenser and the stiff lead from this component replaced by a flexible one to the valve-holder. The same procedure should be adopted in the case of the L.T. wiring. If an anti-microphonic valve-holder is employed there will be no need to modify the wiring, and it can conform with the original wiring plan.

The most satisfactory way of mounting the valve-holder on sponge rubber is by the aid of an adhesive, such as seccotine. First clean both sides of the rubber with benzine or petrol, then apply a little of the glue to the baseboard and place the rubber pad in position. The under-side of the valve-holder is then lightly coated with seccotine and mounted centrally on the pad. In about twelve hours it will have set quite firm, but it must be remembered when removing the valve that the mounting will not survive the strain unaided, so that it will be necessary to hold the valve-holder with the free hand on these occasions.

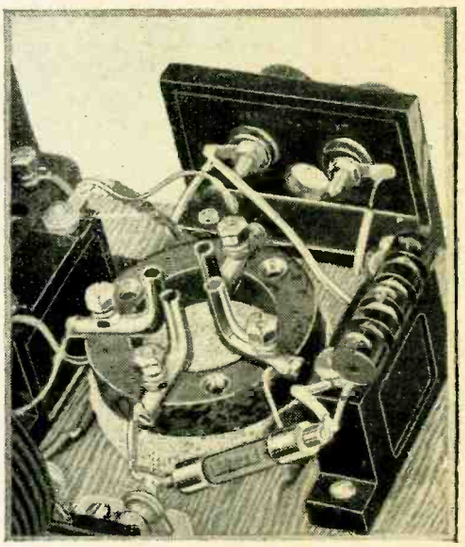
Tests have been made with some twelve different valves in all, and in every case the results were entirely satisfactory, no alterations being made to the set apart from modifying the detector valve-holder mounting as described above for those valves found to be slightly microphonic.

The table gives the essential operating data for every valve used, and where the total anode current was found to be in excess of 8 mA. with the optimum grid bias specified by the makers for the output valve, the order of the increase permissible to reduce this to an economical figure is given.

If headphones are used exclusively a high-tension battery giving about 100 volts will suffice. The sensitivity of the receiver is not impaired by the lower operating voltage; furthermore, loud speaker reproduction is possible under these conditions but, of course, at a lower volume level. With the lower anode voltage the best results were obtained with about 40 volts on the screen grid of the detector valve, this value apparently suiting every type tried in the set. The grid bias for the output valve was adjusted to the optimum value given in the makers' literature, and the total current drawn from the H.T. battery was between five and six milliamps., according to the combination of valves fitted.

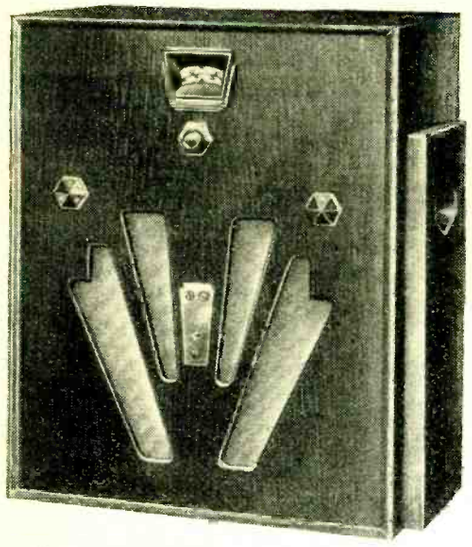
Make.	Detector Valve.	Screen Voltage.	Output Valve.	Grid Bias.	Anode Current at 150 Volts.
Cossor.. ..	220 SG	50	220 HPT	−4½	7.6 mA.
Cossor.. ..	215 SG	50	220 HPT	−4½	7.8 ,,
Lissen.. ..	SG 215	40	PT 225	−6	10.2 ,,
Mazda.. ..	S 215B	45/50	Pen 220	−7½	8 ,,
				−4½	9.9 ,,
				−6	7.2 ,,
Mazda.. ..	SG 215	40	Pen 220	−4½	8.7 ,,
				−6	5.8 ,,
Marconi Osram	S 22	40	PT 2	−4½	9 ,,
				−6	6 ,,
Mullard ..	PM 12A	70	PM 22A	−4½	7.6 ,,

Exhaustive tests have failed to reveal any further matters of interest relating to the operation of this set. The circuit employed is so perfectly straightforward, and the controls so few in number, that its operation can be mastered in a very short time. A little more care is required than when handling a broadcast set, for a small movement of the tuning condenser represents quite an appreciable change in terms of wavelength, but the micrometer attachment on the tuning dial satisfactorily overcomes all these difficulties.



Modified detector stage using a sponge rubber mounting for the valve-holder.

The performance of the set appears to be unaffected by the size and nature of the aerial employed, but a good earth connection is essential. This should be as short and direct as possible, for a long earth lead is inclined to introduce slight hand- and body-capacity effects, which become most marked when maximum reaction is used. Removing the hand from the reaction condenser dial may result in the receiver going into oscillation, but with a short and direct earth lead this disability was not noticed. Substituting a metal panel did not prove at all helpful—on the contrary it somewhat accentuated the effect, and it was in view of this that a plywood panel was chosen for the final model.



Marconiphone

MODEL 252 RECEIVER.

A Battery Set with Mains-set Refinements.

AT the beginning of the present wireless season, and after years of neglect, there was a definite revival of interest in battery-fed sets. Manufacturers had at last realised that potential customers who are prepared to pay for a good broadcast receiver have not always a household electrical supply, and so their designers were given the task of applying to battery-operated sets those refinements which were becoming more or less standardised in mains-driven apparatus.

The Marconiphone Model 252 is a good example of this new type of better battery set. Its design is technically interesting, and performance is thoroughly satisfactory in respect to the essentials of quality, volume, range, and selectivity.

A point to note in the circuit arrangement is the magnetically coupled input filter, in which the component tuned circuits are linked together in the simplest possible way by placing the coils in inductive relationship with each other. Magnification of the succeeding H.F. stage is controlled in a rather unusual way by inserting a rheostat in the negative filament lead of the H.F. valve; increase of resistance reduces sensitivity both by decreasing the mutual conductance of the valve and also by over-biasing the grid.

A double-wound transformer is used in the tuned inter-valve coupling, and it is noteworthy that separate reaction windings are provided for medium and long wavebands, provision being made for shorting-out the latter section automatically by operating the multiple wave-change switch.

Efficient H.F. Filter.

There is nothing unusual about the grid-leak detector, except that it includes a proper H.F. filter in its anode circuit. This refinement seems to be worth while, as the loud speaker leads are virtually "dead," so far as H.F. energy is concerned. After the detector comes a resistance-fed transformer coupling to the output valve, which is one of the new high-efficiency pentodes of the most economical type.

As the loud speaker is specially wound to match the pentode, direct coupling is employed. No obvious form of tone control device is fitted, but, to judge from the total absence of "pentode screech," the tendency of this type of valve to over-emphasise high frequencies has been satisfactorily corrected, both in the general circuit design and in the loud speaker itself.

Although the conventional tone corrector is not fitted, there is a simple form of manual tone control, which actually is in the shape of a 0.007 mfd. condenser, which may be joined by the insertion of a plug across the loud speaker winding. This device is intended mainly for eliminating heterodyne whistles.

For a ganged set of this type the Model 252 is almost unique, in that none of the tuning coils are of the "potted" variety. The medium- and long-wave sections of the filter coils are mounted end-to-end in separate pairs on the underside of the chassis, while the inter-valve coupling assembly is on top. Obviously, a good deal of thought has been given to the relative position of these coils, with a view to avoiding all undesirable interaction, and the axes of windings associated with grid and plate circuits are at right angles to each other.

FEATURES.

General. *—A self-contained 3-valve receiver, with battery feed and for operation with an external aerial-earth system. Balanced-armature loud speaker. Provision for gramophone pick-up and external loud speaker.*

Circuit. *—Input filter, magnetically-coupled. One H.F. stage transformer coupled to grid detector, linked to an output pentode through a resistance-fed transformer. Directly-connected loud speaker.*

Controls. *—(1) Ganged tuning. (2) Combined on-off and wave-range switch. (3) Reaction. (4) Input volume control.*

Price. *—£9 17s. 6d.*

Makers. *—Marconiphone Co., Ltd., 210/212, Tottenham Court Road, London, W.1.*

In view of the somewhat ambitious switching system—there are several more points than in the average three-valve set—it is reassuring to observe that the mechanism is exceptionally substantial and positive in its action. Switching troubles, usually all too common, are most unlikely to arise in this set.

When called upon to comment on cabinet design from the æsthetic point of view, we feel ourselves to be treading on less certain ground. But the cabinet of the Model 252 certainly deserves a word of praise; in appearance it is neat and unobtrusive, and is well built of solid oak, finished in a very pleasing manner.

In spite of the fact that the tuning coils are unshielded—or, at any rate, uncanned—there are no signs of unwanted inter-circuit couplings, and the set is not only completely stable, but handles very nicely indeed. Further, alignment of all three circuits seems to be as nearly perfect as can be expected, and the impression is conveyed that coupling between the band-pass circuits is sufficiently constant for all practical purposes. True, there is an appreciable falling-off in apparent sensitivity at the upper end of the medium waveband, but this is easily compensated for by the application of reaction. This latter control, by the way, is exceptionally constant, and pleasant to operate; here we see the benefits of separate reaction coils for each waveband, and of care in the proportioning and relative disposition of the windings.

The Controls.

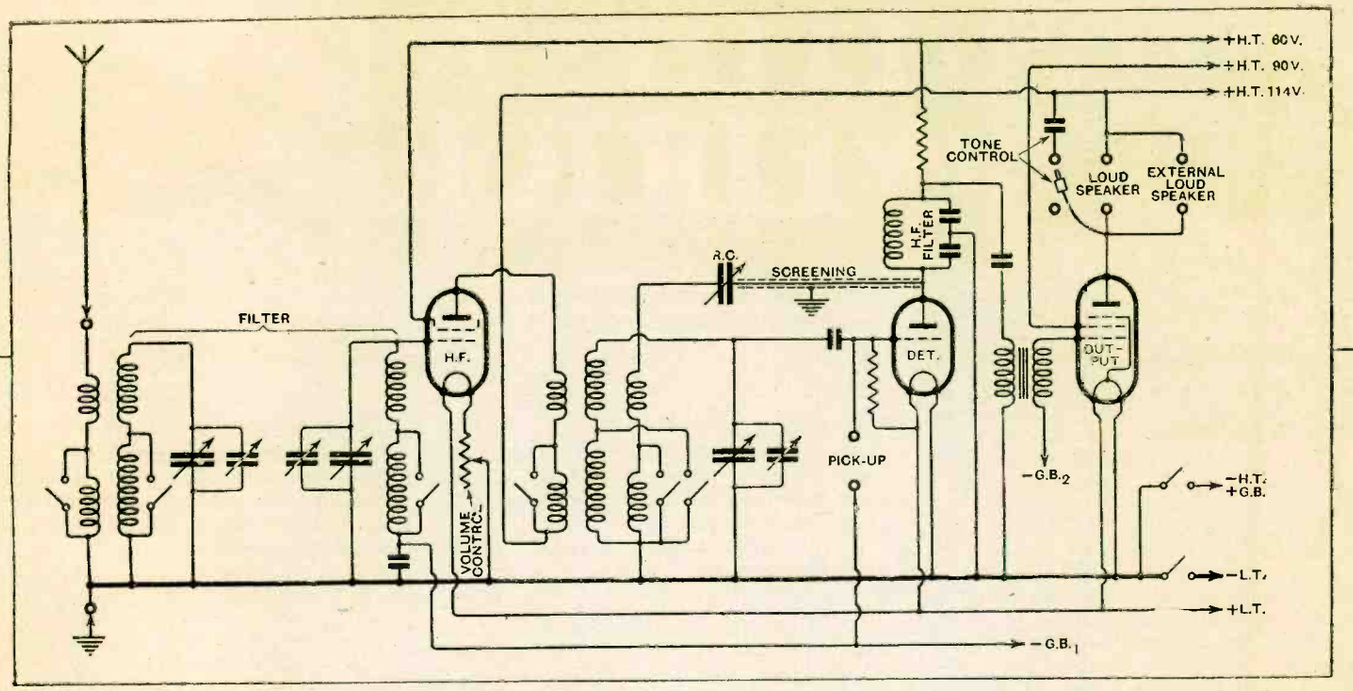
The same can hardly be said about the operation of the input volume control, which has already been described. As a result of the gradual heating or cooling of the H.F. valve filament, one has to wait for an appreciable space of time until the final effect of an adjustment becomes evident. After a little experience, the necessary knack is acquired, but the manner in which this form of control—which is practical enough in itself—is put into operation could be improved upon; the concentric rheostat knob is small, and has a very limited arc of rotation.

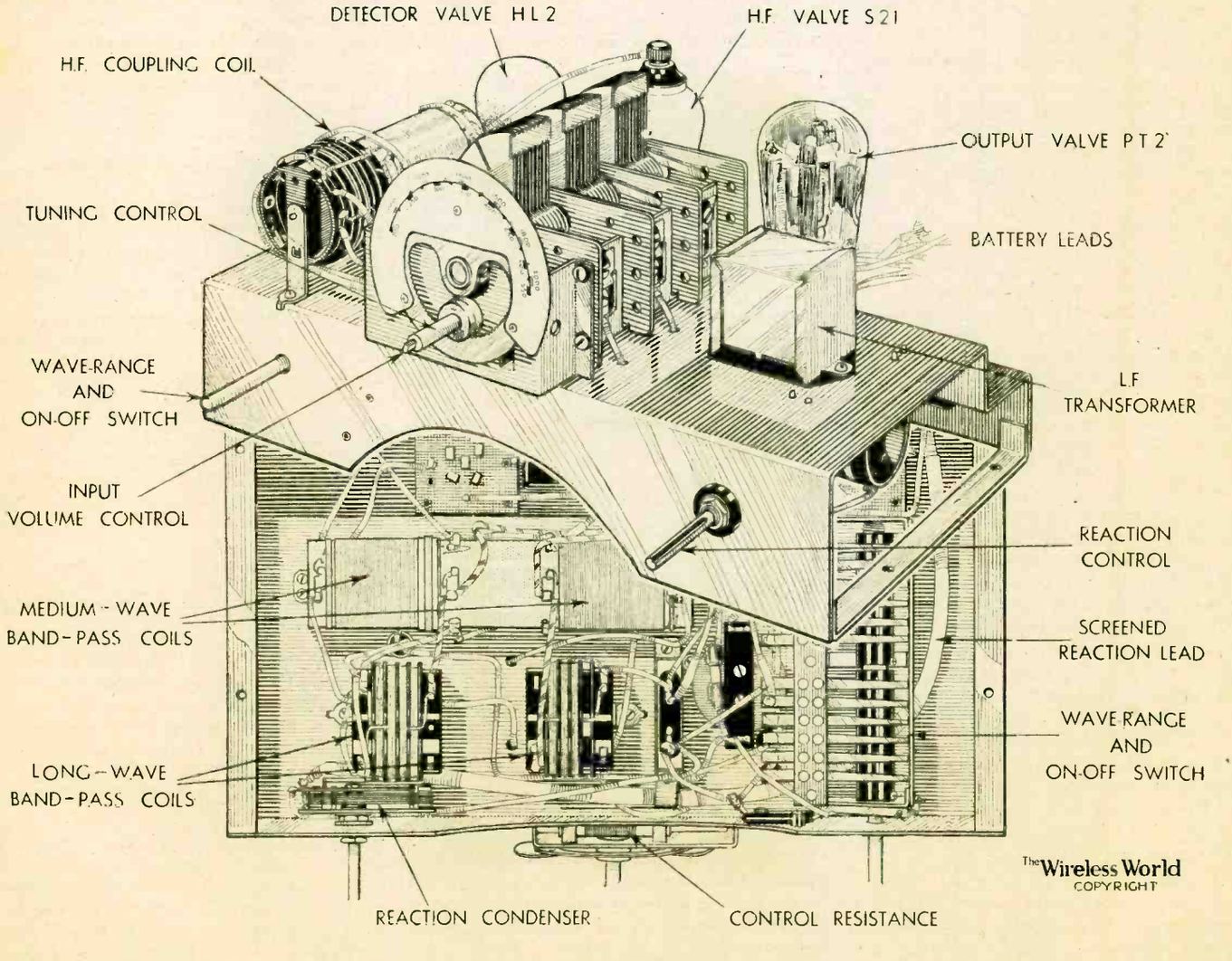
For the fact that sensitivity is extraordinarily good for a three-valve battery set, credit must be given to the exceptional coil efficiency, and to the general "rightness" of design. There is, generally speaking, no need to press reaction, and range is so good that, in receiving conditions which are by no means abnormal, it is possible to get a fair choice of foreign programmes even on the medium band in broad daylight.

Selectivity, though relatively good, is perhaps not so outstanding as the range of the receiver. Still, by operating the input volume control, and making good the consequent loss of signal strength by reaction, it is possible to obtain an extremely satisfying performance, even in difficult conditions. Even without such adventitious aids, interference is seldom troublesome.

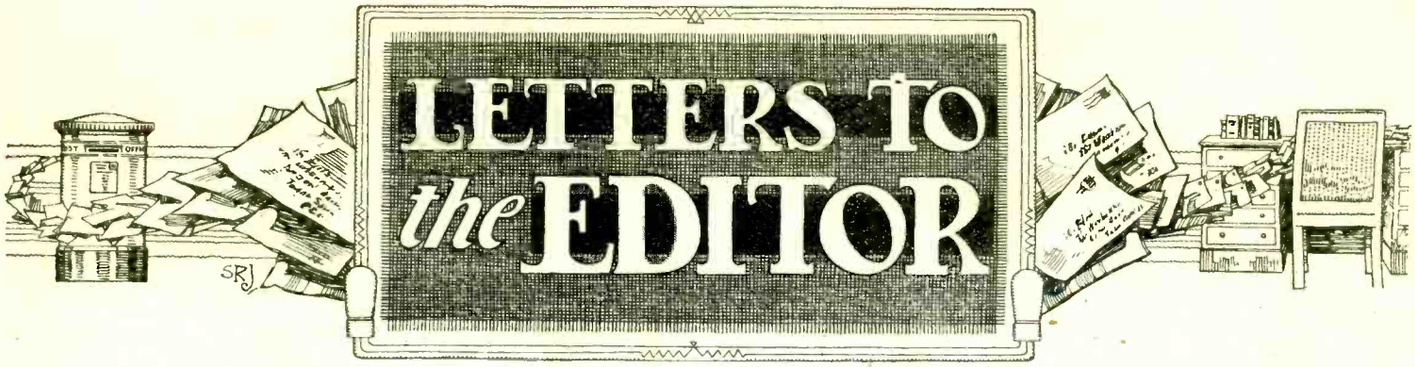
With regard to quality, the bass response has been carried down quite as far, or even rather farther, than in the average battery set, and at the other end of the frequency scale reproduction is bright enough to be really pleasing, without being in any way shrill. Considering the fact that the total consumption of the set averages about 7 milliamperes, the output volume is extraordinary, proving that the pentode is being operated under the best possible conditions, and that the loud speaker is accurately matched to it.

EXCEPTIONAL VOLUME, BUT ECONOMICAL IN BATTERY CURRENT.





An example of the new trend of battery-set design: two views of the Marconiphone three-valve chassis, and (inset) the complete circuit diagram.



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 AM afraid I cannot agree with your recent correspondent, Mr. Sheargold (G6RS), that there has been great improvement as regards the above mentioned nuisance during the last four years, at any rate, in so far as Bournemouth is concerned.

If Mr. Sheargold were to come here and test existing conditions, I think he would have to admit that they couldn't be much worse.

From the interesting letter of G.E.B. of Hampstead it would appear that the self-same station which is responsible for a great deal of the trouble here spreads its blight even so far afield as the suburbs of London, and, in this case, the number of listeners affected must be much greater than I had imagined.

Referring to the letter in your issue of November 18th written by Mr. W. O. Williams, the worst interference in this district is due to a *land* station and not to passing ships as he suggests. I endeavoured to make this clear in my original letter.

The station has an unmistakable note which is always at the same strength. As G.E.B. remarks, "it is never apparently in dock."

Whatever may be the case at Liverpool, this station is *not* sharply tuned. One hundred k/cs is a modest estimate of its breadth.

From a perusal of the findings of the Washington Convention of 1927, one may gather the following comforting assurance.

"The use of damped waves of all frequencies shall be forbidden from January 1st, 1940, except for transmitters fulfilling the conditions as to power in (2) above."

So it would seem that if we possess our souls in patience for another *seven years* we may hope to be able to listen to broadcast programmes in comfort.

Bournemouth. G. G.

How Many Valves ?

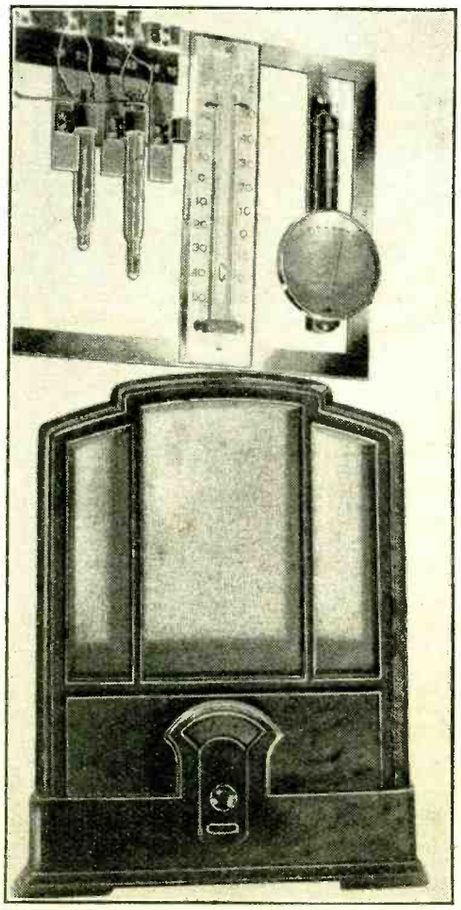
WITH reference to your recent leader in connection with the above matter, and also to the letter dealing with the same question in your issue for December 2nd, whilst there is doubtless something to be said for calling the rectifying valve something else than a valve, anyone who has really had anything to do with the selling of wireless sets and of the demonstrating of them to members of the public will realise that there is a good deal to be said in the opposite direction.

To the initiated the matter is doubtless quite clear; but let me instance the case of a firm who began by placing what was known as a 3-valve A.C. Mains Set on the market, and by sheer weight of public opinion has been forced to include the rectifier amongst the number of valves when specifying that their receiver is a 7-valve Superhet.

The position is really this: namely, that the average buyer of a wireless set has not the slightest idea of the functions of the various valves, and when one says: "This is our 3-valve set," or "our 6-valve set," or whatever number of valves the receiver has, and then when the prospective purchaser looks inside and sees that instead of three there are four, or instead of six there are seven, he immediately turns round and says: "Oh, but you said this was only a 3-valve set; but it has got four valves in it," and then one has to go into lengthy explanation to say that that particular valve isn't really a valve at all, but is something else quite different.

Really, to the writer, the question of whether anyone describes a rectifying valve as a valve, or as something else, seems to be a matter of no very great importance, but by usage the rectifier has always been called a valve, and, therefore, it is up to those people who use rectifiers which are not of the ordinary valve type to decide to christen them as valves. As far as the writer is aware, every manufacturer in his literature states the purpose of the various valves employed.

Manchester. T. BAGGS.



A HINT TO BRITISH MANUFACTURERS. The new demand for special short-wave sets for listeners to the Empire broadcasting station requires that the home manufacturers should study tropical conditions. Here is a German Telefunken receiver in a room at 90° C. The set, which is intended for overseas use, is tested before and after its ordeals.

American Broadcast Reception.

WE are interested by the recent letters in your Correspondence columns relating to American broadcast reception on the 200-500 metres band. Notably those of Mr. Monkhouse in the issue of October 21st, Mr. Crawley in the issue of November 4th, and Mr. Hutchinson in the issue of Dec. 2nd.

Prior to the commencement of this month, we were inclined to view the matter in a sceptical light, but are now in a position to endorse such receptions.

Some of your readers will recall phenomenal receptions of the U.S.A. on broadcast wavelengths about the years 1924-25, since which time there has not, we believe, been a recurrence of similar conditions. WBZ, WGY, KDKA, and WHAZ were regularly received at our station, and only a few months earlier the first transatlantic broadcast was recorded on this side by Mr. J. Ridley, associated at that date with Messrs. Burndept of Blackheath.

It is evident that a cyclic period, favourable to space-wave propagation of stations, distant 3,000 to 4,000 miles, has again presented itself this winter, although it would appear that these waves do not attain reasonable amplitude in all districts simultaneously. One might assume that some of the more distant receptions are directly due to "scattering."

During the past three weeks we have found it possible to receive certain American stations with input voltage sufficient to provide excellent loud speaker entertainment, speech and music being well intelligible at such an early hour as 10.30 p.m. G.M.T.: this being subject, naturally, to immunity from jamming by adjacent European stations. We refer in particular to stations WCAU—Philadelphia, WBZ—Boston, WPG—Atlantic City, and WTIC—Hartford.

On the night of December 7th we decided to identify definitely by the spoken call-signs as many stations as were radiating at good audio level. The following were logged between 23.00 December 7th and 2.30 December 8th; reproduced in every case on a B.T.H. R.K. Senior Speaker, giving approximate outputs of between 300 and 1,000 milliwatts with almost negligible background noise:—

WEAF—New York, WOR—Newark, N.J., WJZ—Bound Brook, N.J., WABC—New York, WBZ—Boston, Mass, KDKA—East Pittsburg, WTIC—Hartford, WPG—Atlantic City, WCAU—Philadelphia, WGY—Schenectady, WLWL—New York, WBT—Charlotte, North Carolina, WRVA—Richmond, Virginia, WHAM—Rochester, N.Y., WTAM—Cleveland, Ohio, WJJD—Mooseheart, Illinois, WHAS—Louisville, Kentucky, and, finally KMOX—St. Louis.

WHAS, logged at 1.30, gave a programme, sponsored by the Recollection Cigar Co., with popular songs.

KMOX, "The Voice of St. Louis," logged at 2.00, gave a programme by Guy Lombardo and his Canadians, sponsored by Burns Cigar Co.

On Tuesday, December 13th, between midnight and 2.00 G.M.T., the entire list of stations was again logged with the addition of the following:—

WNAC/WNAB—Rivere, Mass., logged at 0.50, giving a political speech and a programme sponsored by the makers of "Nuferall."

WWL—New Orleans, logged at 0.20, giving Negro life sketches. This was followed by a recital by a soprano singing "Waters of Minnetonka" as the first item. The announcement mentioned the connection between the station and Roosevelt University, New Orleans.

We are inclined to believe that the stations WWL, KMOX, WBT and WHAS, as well as WJJD have not been heard previously in England, though open to correction. The programme matter given dispels any doubt of unauthentic prevarication!

Out of twenty stations, at least half provided volume equivalent to medium-powered Europeans. Fécamp, radiating until 3.00, was used as a check for comparison.

The receiver used is a GEC "All-wave" Superheterodyne—modified in design. The antenna, of length 15ft., is inside the room. Carriers were found, in most cases, to be weak and unresolvable on a standard 1/V/PEN. broadcast receiver. We would stress the point that this fact, borne out over the course of nine years of practical radio experience, demonstrates the obvious superiority, the sensitivity and the range of a correctly designed supersonic receiver. It demonstrates that the only limiting factors are atmospheric conditions, such as static, background mush and spark harmonics.

It remains to be seen whether, during the ensuing winter, anyone will succeed in recording reception of the American Pacific Coast stations on the broadcast band, during the early hours of the mornings. We believe that this has not yet been done, and we propose making an attempt ourselves between 5.00 and 7.00 G.M.T.

G. G. LIVESEY, A. E. LIVESEY.
Experimental Radio Station G6LI.

I SHOULD like to know what is the earliest time any of your readers have picked up the medium-wave U.S.A. stations.

On December 12th I heard WCAU at 10.10 p.m., accompanied by a great deal of Morse interference. This gradually diminished during the "Boys' and Girls' Hour," 10-15-11 p.m., when the weather report and the old-time songs were heard very clearly.

There was no interference from any European stations on this wave, although it was 11.30 before any other U.S.A. stations could be picked out.

Later, at 12.15. WCAU, WTIC, and WGY could be heard at good strength on an inside aerial in the picture rail round three sides of the room.

The receiver in use was the "Wireless World" Super Selective Six, with an Epoch Super Cinema model loud speaker.

Scarborough. L. TRANMER.

BRITISH ROLA PERMANENT MAGNET SPEAKER.

Simple Conversion for Dual-compensated Speakers.

THE popularity of moving-coil speakers has led to the provision of a suitable field supply in many recent receiver designs. Probably the majority of speakers require a current of 40/50 mA. at 100/125 volts, and have a field resistance of 2,500 ohms. Consequently, receivers such as the Monodial A.C. Super and the Baby Superhet. have been designed to include a field of this type in the smoothing circuit.

Recent months, however, have seen the introduction of dual-compensated speakers, in which balanced pairs with parallel-connected speech coils are employed. The advantage claimed for this type is not so much an extended frequency response as an increased power-handling capacity and an avoidance of marked resonances. That two speakers should be able to handle more power than one is self-evident, but the gain is greater than one might at first expect. It is usually the resonances which place a limit to the power which can be applied before distortion occurs, and if these can be removed each speaker alone will handle an increased input. Two speakers, therefore, will handle more than twice the input of a single speaker, for two similar, but not identical, models act in such a manner that each speaker damps out the resonances of the other.

One Field Supply.

As normally conceived, however, each speaker will have a field resistance of 2,500 ohms, and if they be connected in series will require a total supply of 200/250 volts at 40/50 mA., or if they be connected in parallel, a supply of 100/125 volts at 80/100 mA. They cannot, therefore, be simply employed with receivers designed to feed only a single speaker, and the difficulty has hitherto been met only by the provision of a separate source of field current, or by the use of permanent magnet types.

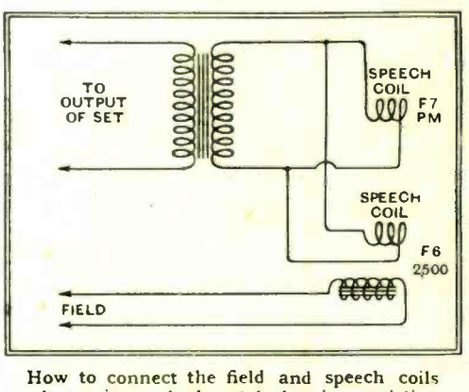
An alternative solution is now offered, however, by the supply of matched speakers of which one only is of the energised type, and the other of the permanent magnet type. The normal advantages of using a speaker field as a smoothing choke can thereby be retained with a minimum of expense.

We have received from Messrs. British Rola a sample of a permanent magnet model intended for use in conjunction with their standard F.6.2500 energised type, which has for some time been sold as a single speaker, and which was specified for the Baby Superhet. The addition to this speaker of the F.7.P.M. permanent magnet model, fitted with a type 00B transformer in the case of a triode output valve, or a type 04B transformer in the case of a pentode, gives a dual matched pair.

The method of connecting this additional speaker will be clear from the accompanying diagram. The output transformer fitted to the existing F.6.2500 speaker must be removed, and the field joined to the usual points on the receiver. The output from the set is then taken to the two primary terminals of the transformer on the F.7.P.M. speaker, and the two speech coil terminals on this speaker are joined to the two terminals on the F.6.2500 model, which were previously joined to the transformer secondary of that speaker.

Correct Phasing.

These leads must be correctly connected so that the two speaker cones move in and out together, otherwise there will be a more or less complete loss of bass. If it be found, therefore, that the bass is lacking, the speech coil leads to one speaker should be reversed. After a single trial there can be no doubt as to the correct connections. It is necessary that the speakers be mounted close together in order that the full benefit may be obtained; it is recommended that they be mounted side by side, or one above the other, as closely as possible.



How to connect the field and speech coils when using a dual-matched pair consisting of one permanent magnet and one energised speaker.

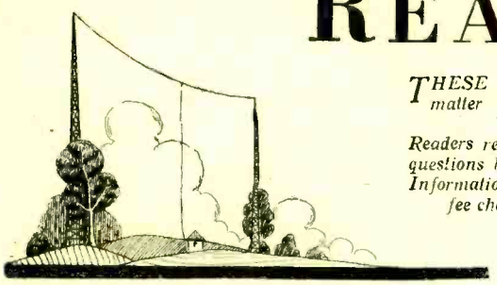
On test, the addition of the F.7.P.M. model to the F.6.2500 type gave a decided improvement to the quality of reproduction. The bass response was considerably increased, and it was noticeable that the reproduction was particularly clean. Judged aurally, there was also a considerable increase in the general level of sensitivity, the effect being similar to that of employing a larger output stage in the receiver.

The F.7 P.M. speaker, therefore, can be confidently recommended for converting an existing F.6.2500 type into a dual-matched pair, and at its price of £3, complete with transformer, it is distinctly attractive.

Where D.C. mains are available, of course, the use of a permanent magnet type would be out of place, for there is then plenty of current available for energising a field winding. For receivers such as the Monodial D.C. Super, therefore, dual energised pairs are available fitted with a suitable triode type transformer.

The makers are British Rola Co., Ltd., of 179, High Road, Kilburn, London, N.W.6.

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.

Series-parallel Valve Groups.

IN the Monodial D.C. Super described in *The Wireless World* for December 2nd there are seven valves in all; the heating elements are connected in series, and as each valve absorbs 16 volts the total voltage needed is 112.

This might seem to rule out the design for use on a 100-volt house-lighting plant, even if a supplementary source of H.T. voltage were used for feeding the anodes. But this difficulty of low voltage might be overcome (but at the expense of a doubled consumption of current) by arranging the heaters in two series-parallel groups.

This possibility is appreciated by a reader whose household electrical supply is derived from a 100-volt accumulator battery; he asks advice as to the order in which the valve heaters should be wired.

We suggest, as the current is obtained from a high-capacity lighting battery, and therefore as the precise order of heater wiring will be unimportant, that the valves might be arranged as in Fig. 1. The first four heaters are wired in one group, and the remaining three in another; separate voltage-absorbing resistances (Rx and Ry) must be inserted in series with each group, and these will take the place of the resistors R21 and R22 in the original set. For a 100-volt supply Rx should have a value of 144 ohms, and Ry 208 ohms.

In all probability our correspondent will find that no smoothing is required, but as the choke CH6 affords a certain amount of decoupling it may be necessary to retain it, or, alternatively, to use a larger by-pass condenser. Similarly, it may be permissible to omit the air-cored chokes CH_2 and CH_3.

Upsetting "Ganging."

IT is worth while to remember that when anything is done to a receiver that is likely to affect the relative alignment of ganged tuned circuits, it will be a waste of time to readjust any of the circuits except those in which the change has taken place.

For instance, a reader who has taken meticulous care to see that all the circuits of his "Monodial Super" are accurately set up, hesitates to install a better aerial than he is at present using, merely because he is afraid that the operation of "ganging" will have to be done all over again.

This is a mistake. The only possible effect, so far as alignment is concerned, of operating the set with an aerial of different capacity is to upset the tuning of the input circuit. A touch on the trimming condenser which is built into the condenser C_1 should restore the original alignment.

To carry the matter a little farther, the same applies when a detector valve is changed; its grid circuit is the only one which will be affected. But when dealing with an H.F. stage it must be remembered that both input and output circuits of the valve are tuned, and so may be affected if the replacement has different characteristics.

Finally, there is the question of ganged band-pass filters. A change introduced in one of the component circuits should not affect the other, but the coupling device, whatever its type, is common to both, and so the need for retrimming may arise if it is altered.

Best Possible Conditions.

IN a "straight" receiver, with single-knob tuning, the total number of tuned circuits that can be employed is virtually limited to four. Admittedly, by taking special precautions and using special components, a greater number might be employed, but it is not easy to do so satisfactorily, if only for the reason that ganged condensers with more than four units are not standardised.

Realising this, a reader who wishes to use four tuned circuits to the best possible advantage, especially from the point of view of selectivity, asks for suggestions as to how they should be arranged.

We doubt if he could do better than employ the circuits as a pair of band-pass filters, the first in the aerial input circuit and the second as a coupling between two H.F. valves. The second H.F. valve would be linked to the detector by means of an aperiodic coupling.

By adopting this plan detector damping will not be applied to any of the tuned circuits, and so all of them will be able to operate at maximum efficiency. This is the plan adopted so successfully in the Philips "2-H.F." set.

Isolating the Diode.

IT is often a matter of some importance that a diode detector should be isolated completely from a gramophone pick-up. If the detector be allowed to remain in shunt with the pick-up serious distortion may be produced. It will generally be sufficient if the switching system be arranged to switch off the detector valve filament.

This is in answer to a reader who submits for our approval a circuit diagram showing the connections of a pick-up to his receiver. We advise him to elaborate the change-over switching system by adopting an arrangement similar to that shown on page 390 of our issue for October 21st.

Matched Condensers.

INDIVIDUAL units of multiple ganged condensers are matched to each other after manufacture, but not of necessity to the units of other condensers of the same type and make.

This explains why we would dissuade a reader from obtaining two 2-ganged condensers instead of one 4-element component for the purpose of tuning his four-circuit receiver. He finds that two separate condensers, with a mechanical link between their rotor spindles, would suit the general layout of his components better than the use of a single component.

In spite of this we feel sure that his plan is not to be advocated, as the odds are strongly against two separate condenser assemblies having the same capacities at all angular settings of the rotors.

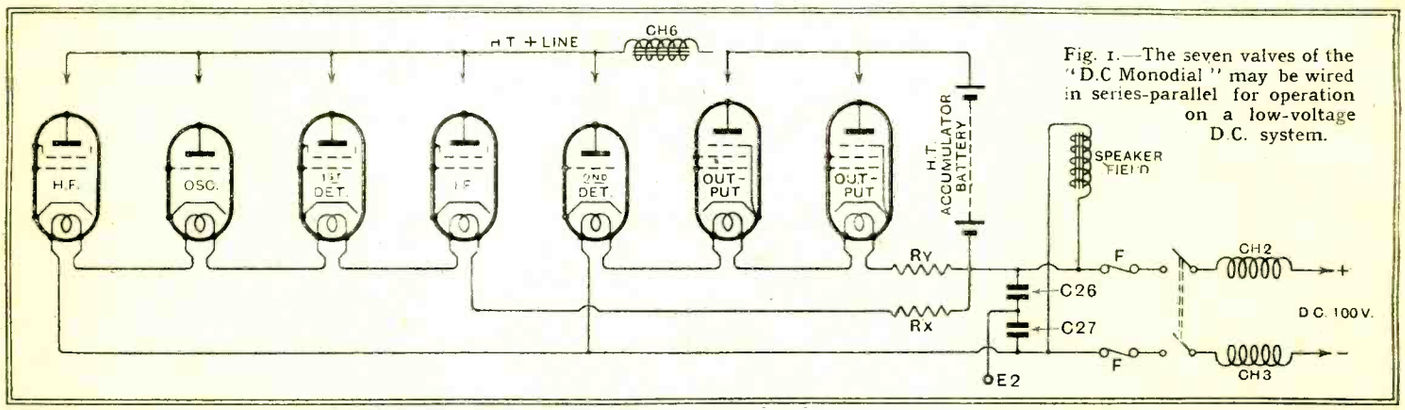


Fig. 1.—The seven valves of the "D.C Monodial" may be wired in series-parallel for operation on a low-voltage D.C. system.

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.

The Wireless World

THE PRACTICAL RADIO JOURNAL

22nd Year of Publication

No. 696. FRIDAY, DECEMBER 30TH, 1932. VOL. XXXI. No. 26.

Proprietors: ILIFFE & SONS LTD.

Editor:
HUGH S. POCOCK.

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 (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: 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.

CONTENTS

EDITORIAL COMMENT

Long-wave Broadcasting

Will We Have an Alternative Transmitter?

WE have repeatedly urged in the past the importance of long waves and the desirability of increasing the influence of the Daventry long-wave station, the power and general efficiency of which we have felt is scarcely in keeping to-day with modern standards.

We now know that the B.B.C. are proposing to move Daventry long-wave station from its present site to the new site near Droitwich, and we may then expect the improvements in performance which are desired, as the station will, we understand, be entirely rebuilt.

Whether or not this removal to a new site has any connection with the establishment of an alternative long-wave station in the North, we cannot yet say, but we do know that the B.B.C. has expressed itself in sympathy with the proposals we have put forward in the past that an alternative long-wave station should be established. The difficulty has always been that of obtaining a second wavelength, in view of the requirements of other European countries. The Madrid Conference has, however, done nothing to check the extension of the long-wave broadcasting band; rather it would seem that the way has been paved for the introduction of some additional bands, provided that agreement between all countries concerned can be reached.

It would give great satisfaction to learn that the B.B.C. was actively pursuing the matter of a second long-wave station. We must not, however, overlook the fact that, to a limited extent, the importance of long waves has diminished as a result of technical progress in receiver design. We refer to automatic volume control. It may be anticipated that in the near future automatic volume control will become a standard fitment to all sets of the more ambitious type, and this will undoubtedly overcome the fading troubles experienced with the large majority of distant stations in the medium-wave band, although, of course, distortion due to fading will still persist. For the present, however, receivers of simpler type are likely to predominate so that the diminution of importance of long waves must not be regarded too seriously—at least for some considerable time to come.

A New Battery Circuit

Quiescent Push-pull

A NEW battery circuit which has recently made its appearance will, we confidently anticipate, remove battery receivers from the category of rather poor substitutes for mains sets and bring them very nearly into line with their more ambitious rivals in the matter of output volume and quality.

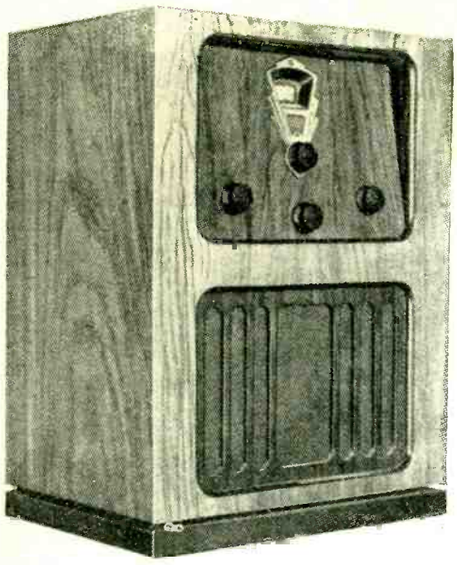
The circuit is known as "Quiescent push-pull" for the reason that two pentode valves are employed in push-pull in the output stage, and the circuit is quiescent because the consumption of battery current remains at a very low value indeed when no signals are coming through. It is only when the carrier wave is modulated that the current consumption rises. The output volume is very far in excess of anything to which we have hitherto been accustomed in receivers where high tension batteries of modest capacity and low voltage are employed.

We shall have more to say on the subject of this circuit in the immediate future.

The MODERN D.C. THREE

A Straight Set with a Number of Circuit Refinements

By W. I. G. PAGE, B.Sc.



SOME time has elapsed since a straight receiver was designed for the benefit of the D.C. mains user, with the natural result that a "modern" receiver of this type takes advantage of several important refinements in technique. Hum, previously the bugbear of D.C. mains operation, is now consigned to oblivion or somewhere near it; the advent of indirectly heated variable-mu valves for D.C. supplies makes possible the design of an H.F. amplifier which is just as efficient as its A.C. counterpart, and there has just appeared on the market a new series of sensitive moving-coil speakers of high flux density especially attractive to the D.C. set designer. The user of this type of supply often finds that with only 160 to 170 volts for the last valve the undistorted output is hardly sufficient for a large room; the new speakers are, therefore, very welcome, for they permit a single D.C. pentode to give a sound output equivalent to considerably more than one watt A.C.

Hum-free Operation

The Modern D.C. Three has been designed for an external aerial and earth, but is otherwise self-contained with built-in energised moving-coil speaker, and provision for gramophone pick-up. The circuit comprises a variable-mu H.F. stage with bias control, a screen-grid detector with reaction and a parallel-fed, transformer-coupled L.F. stage followed by a pentode. The valves belong to the 16-volt 0.25 amp. series, and thus the consumption of the heaters is from 50 to 60 watts, while the speaker field and anode supplies bring the total wattage up to about 75.

With ordinary D.C. mains having either a positive or negative earth the set is practically hum-free, which can be ascribed to the use of chokes of high inductance in both positive and negative leads and to the comprehensive decoupling. With mercury arc systems, on which the set has been tested, the output is free from serious background noise when the negative lead is earthed, but there is some hum with a positive earth. For the unfortunate possessors of this supply some suggested additions to the smoothing circuit will be made in the second instalment of this article.

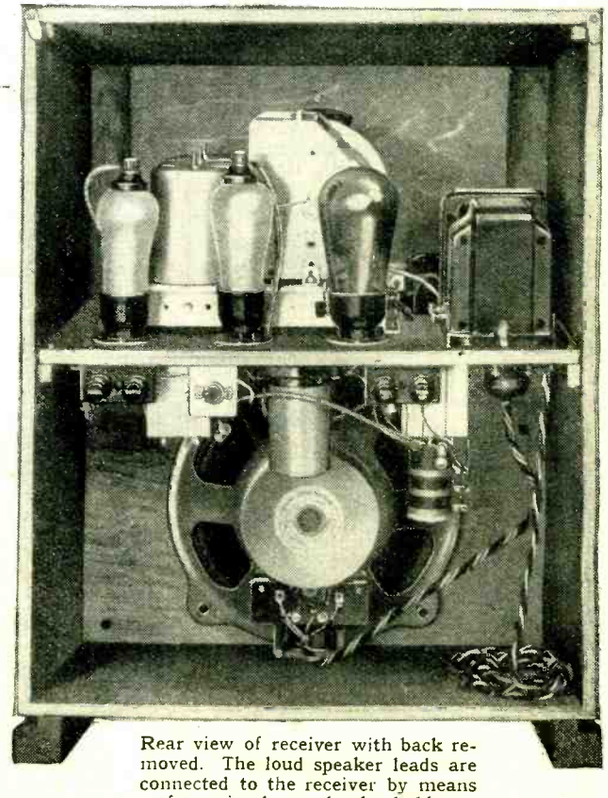
The aerial and earth are isolated from the mains by C1 and C2 respectively to comply with I.E.E. regulations, and the single tuned aerial circuit embodies a new coupling device which, together with the band-pass filter between the valves, prevents the prevalent fault of decreasing sensitivity at the upper end of each waveband. There is a single tuning control with an illuminated dial calibrated in wavelengths.

The regulation of the screen voltage of the VDS valve is maintained satisfactorily by a potentiometer of low value, consisting of R3, R4, and R5, and the cathode of this valve is tied down by a 1-mfd. condenser C8. The properties of the band-pass filter need not be explained here, as they are dealt with later in the article at some length. The detector constants conform to the requirements of power grid detection, and the gramophone switch S2 mounted at the back of the chassis is a single-pole, double-throw type which isolates the H.F. amplifier when a pick-up is in use. In a D.C. set each pick-up lead must be protected by a condenser (C10 and C11), and so that the grid circuit shall be continuous a resistance R8 must be connected as shown. The value of R8 will depend upon the sensitivity of the pick-up, and resistances with values lower than 250,000 ohms should be tried if serious overloading of the output valve occurs.

About 75 volts are applied to the screening grid of the detector by the use of the potentiometer R10 and R11, and in the anode circuit a Benjamin "Transfeeda" unit is included. This parallel-fed assembly contains within its screening case R12, R13, C16, and the transformer proper. It is fortunate that the primary and secondary are separated, for it is possible in these circumstances to decouple the pentode grid thoroughly (C18, R14).

FEATURES.

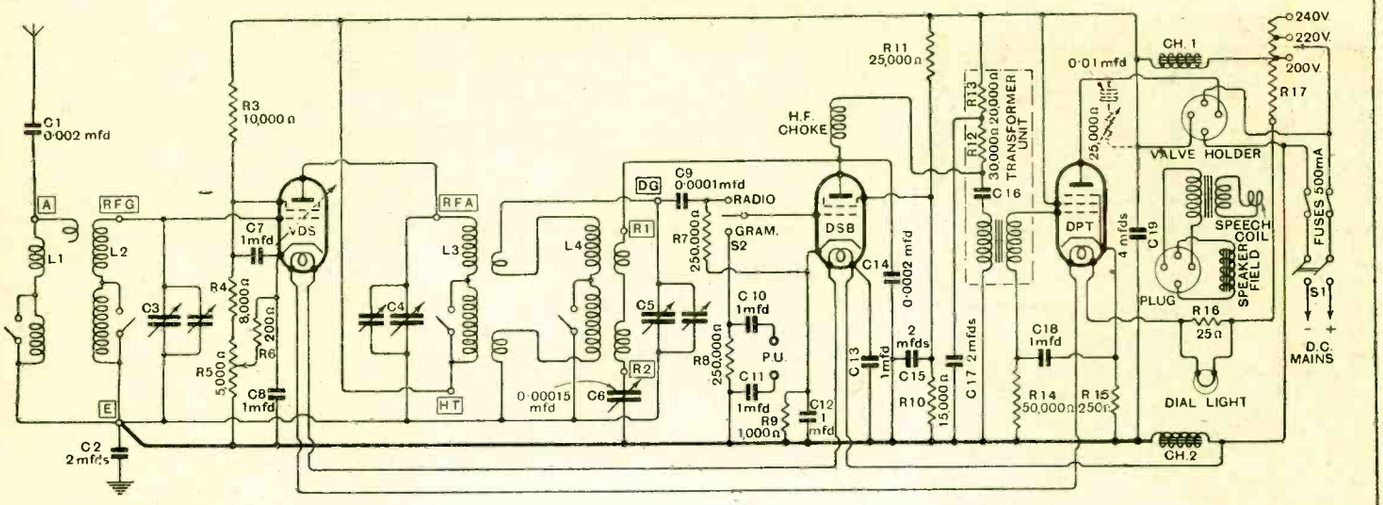
A straight three-valve receiver for D.C. mains embodying the latest circuit technique. The use of a band-pass filter after a variable-mu valve and the inclusion of a screen-grid detector ensure that the maximum selectivity with three tuned circuits is obtained. A new form of aerial coupling gives substantially constant magnification over the waveband. Adequate power output is delivered by the energised moving-coil speaker of high flux density which is built into the cabinet. There is provision for a gramophone pick-up. The four controls consist of (1) single dial tuning with wavelength calibration; (2) reaction; (3) wave-change switch; (4) bias volume control combined with double-pole on-off switch.



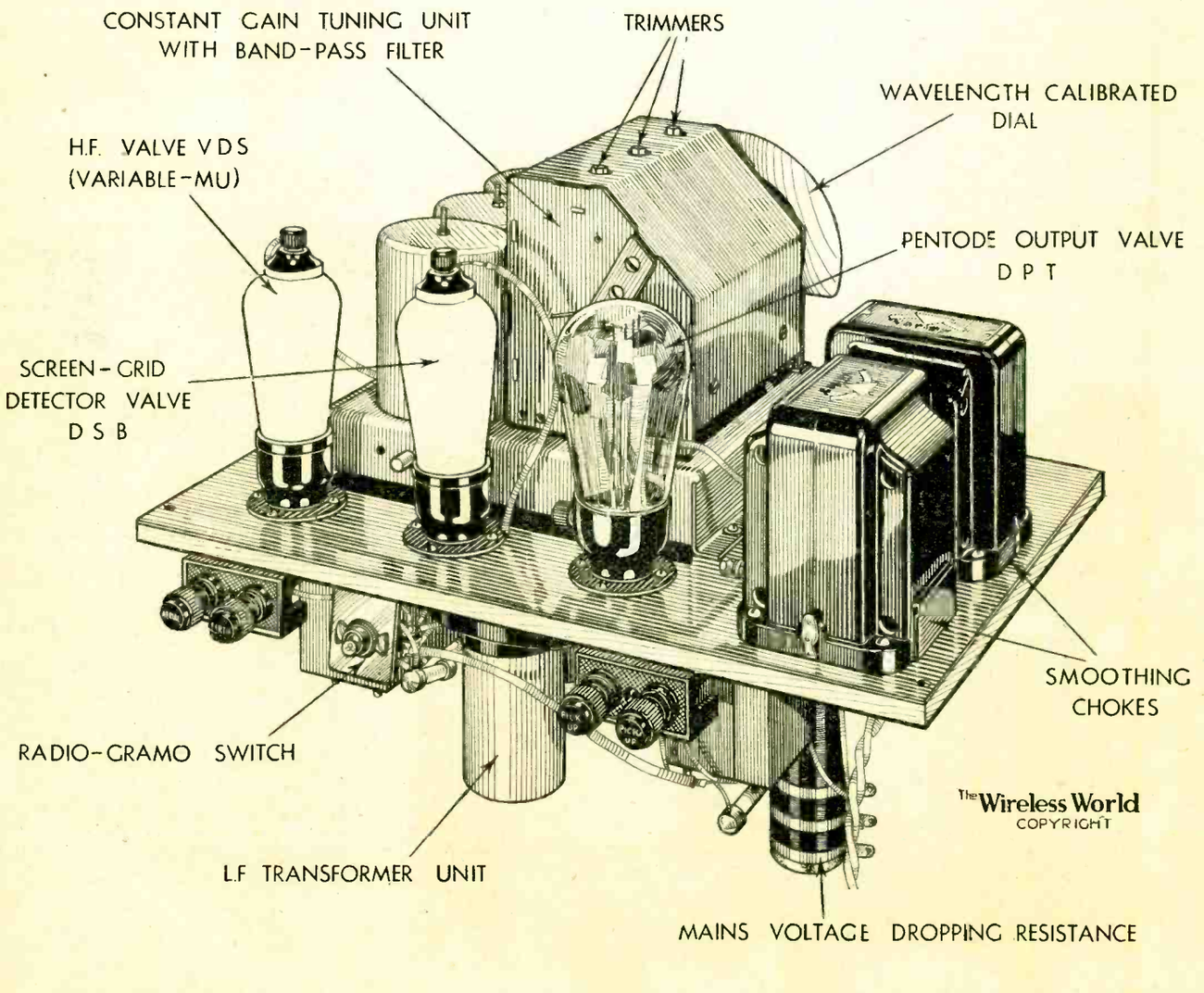
Rear view of receiver with back removed. The loud speaker leads are connected to the receiver by means of a 4-pin plug and valve holder.

To accommodate the set to various mains voltages, the resistance R17 is tapped for 200, 220, and 240 volts, the

High Selectivity and Freedom from Background Noise.



The complete circuit diagram. The "boxed" letters correspond to the terminal labels of the tuning unit. The condenser C13 ensures complete stability with gramophone reproduction.



The receiver chassis viewed from the back. The radio-gramo switch can be seen on the left.

The Modern D.C. Three.—

remainder of the winding dropping 150 volts, thus leaving a balance of about 50 volts for the three 16-volt heaters and the pilot lamp. The latter is shunted across the 25-ohm resistance R.16.

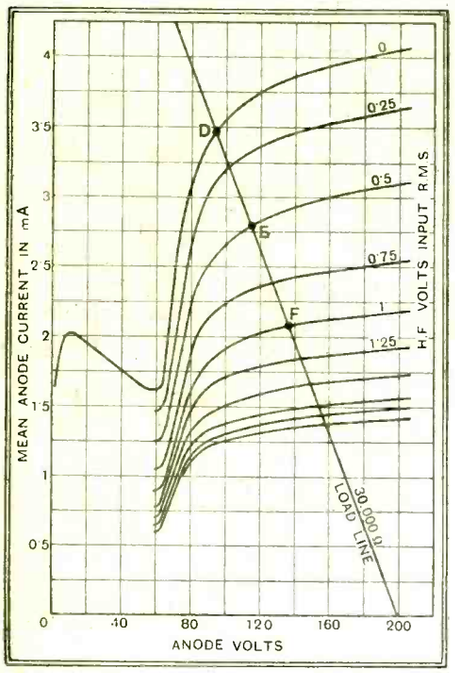


Fig. 1.—Dynamic detector curves for the DSB valve from which a simple calculation can be made, showing the superiority of the screen-grid detector over the triode.

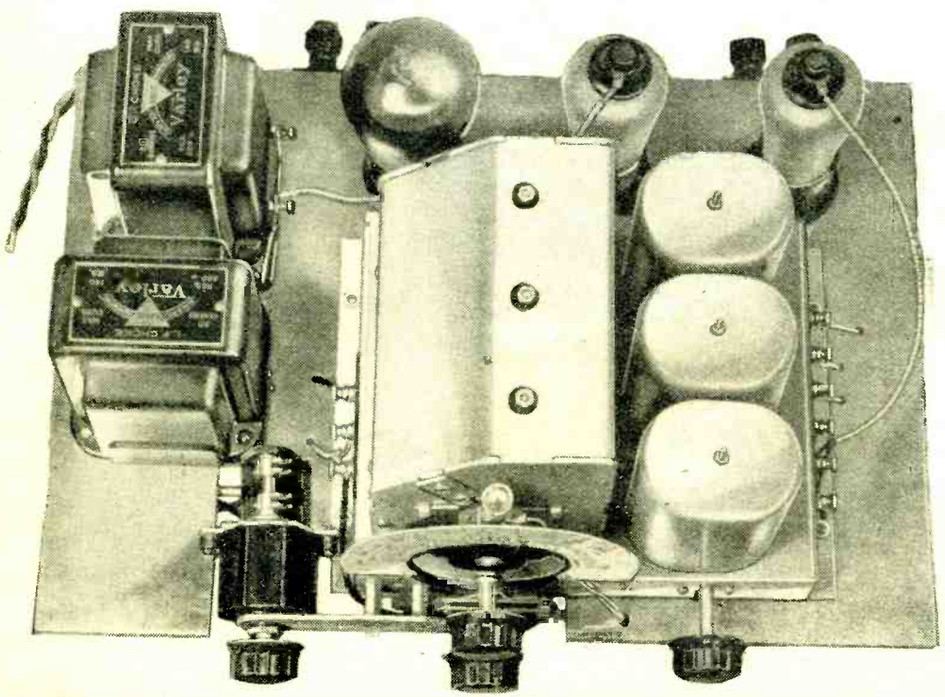
Let us now examine the components and circuit details which merit special description. They are the tuning unit, the screen-grid detector, and the special loud speaker with high flux density.

New Tuning Coil Developments

A new development in the method of coil coupling and a modified tuning scheme are to be found in the Radiophone Radiopak employed in the receiver. This compact unit contains three accurately matched variable condensers together with three tuning coils, two of which form a band-pass filter for the intervalve coupling, and the third a single-tuned aerial circuit.

It is the natural property of an ordinary tuned circuit designed for the medium waveband to discriminate in favour of the wavelengths around 300 metres. Stations between 450 and 550 metres often require the application of considerable reaction to give reasonable loud speaker output, or, if reaction is not included, the volume control would have to be advanced. This disability of decreasing sensitivity at the upper end of the tuning range is eliminated in the Radiopak by the judicious combination of "peaked" aerial coupling and a mixed capacity and negative inductance filter between the H.F. and detector valves.

The conventional way of linking an aerial to a single-tuned circuit is to join it to a small "aperiodic" winding having an inductance of, say, 15 to 20 microhenrys and so resonating, with the incidental capacities present, well below 200 metres. In the unit under discussion, the "aperiodic" winding has an inductance of some 600 microhenrys and peaks at 400 kc. or 750 metres, and gives the characteristic, which usually droops at the upper wavelengths, a substantial rise above the mean level. The small coupling coil shown between L1 and L2 transfers energy by virtue of the capacity between turns, and so favours the higher frequencies or lowest wavelengths where, again, there is normally a slight drop in sensitivity. This type of aerial coupling tends to offset the deganging effect which the aerial load imposes on the first tuned circuit.



It will be seen from this view that practically all the wiring is confined to the under-baseboard. On the left are the two smoothing chokes.

By designing the band-pass filter also with linear characteristics the makers have gained the notable achievement of practically constant overall magnification across both wavebands.

As so much stress has recently been laid on the importance of pre-selection with the screen-grid valve, the reader may question the advisability of arranging the band-pass filter *after* the first valve. It can be said at once that this position is actually superior to that before the first valve now that variable-mu valves have superseded the S.G. type. None of the cross-modulation troubles inimical to selectivity exists,

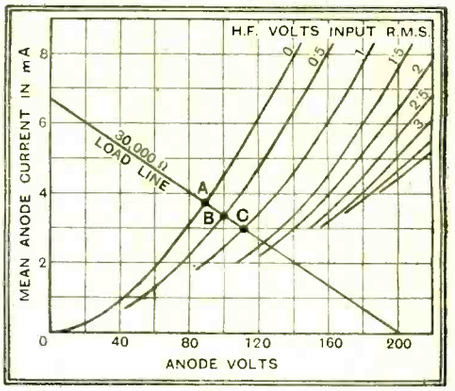


Fig. 2.—Curves under working conditions giving the detector characteristics of the DH valve. To make the readings clear an H.F. input of half a volt is considered, but in practice much smaller signals would be dealt with.

and it is much easier to design a filter which will give a pre-determined performance when it is worked between two resistive loads (anode load of H.F. valve and input impedance of detector) than between an aerial load which is predominantly reactive and the resistive input load of the H.F. valve.

A screen-grid valve has been chosen for the detector stage, as it confers three marked advantages over the triode. First, owing to the absence of "Miller effect," there is no serious damping imposed on the preceding tuned circuit, and selectivity is considerably improved; secondly, we avoid the deganging caused by the alteration of capacity over the waveband, produced by a triode-detector in reflecting back energy from output to input circuit; thirdly, a screen-grid detector is considerably more sensitive than a triode; that is, for a given input, a much greater voltage is delivered to the L.F. amplifier; actually, the output of the DSB (the S.G. valve in 16v. D.C. series) is $2\frac{1}{4}$ times greater than that of the DH (the triode of the series).

Advantages of Screen-grid Detector

To study in detail the relative merits of the two different detectors working under the same conditions of load, H.T. voltage, grid condenser, and leak, curves have been taken for various inputs, and are given in Figs. 1 and 2. This graphical scheme is due to P. K. Turner, who explained the underlying principles of dynamic detector characteristics in an

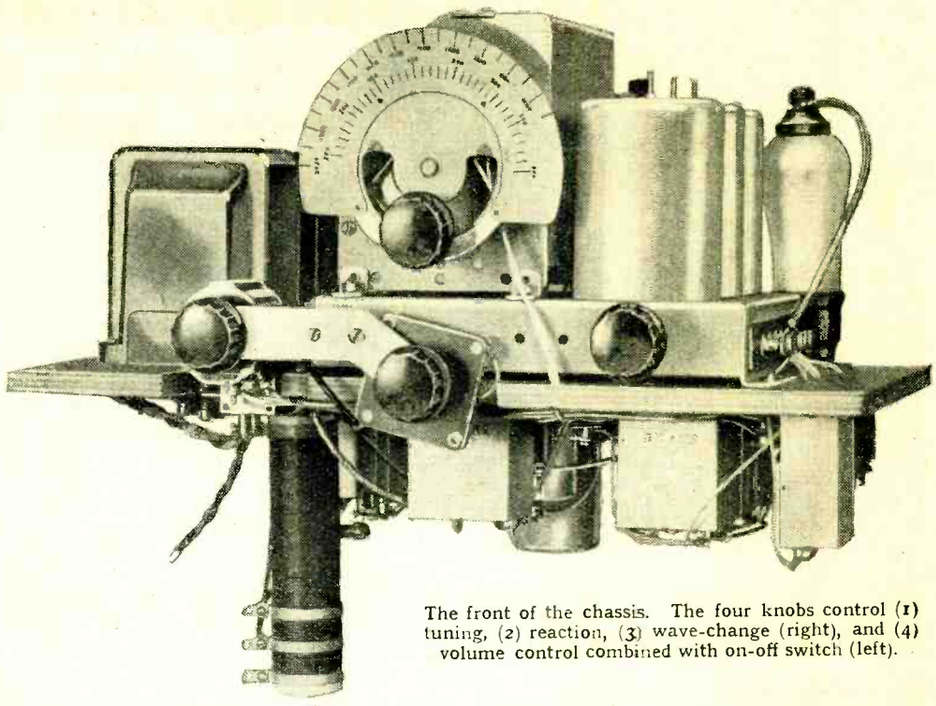
The Modern D.C. Three.—

article entitled "Designing Detector Circuits" in *The Wireless World* dated February 10th, 1932, to which reference must be made for a full explanation.

Assuming an H.T. supply of 200 volts and a parallel-fed transformer with an anode load of 30,000 ohms in each case, a load line of this value must be drawn from 200 anode volts to 6.6 mA. (since $I = E/R = 200/30{,}000 = 0.0066$ amp., or 6.6 mA.). The point of intersection of this line with the various input voltage curves gives the anode current and voltage under working conditions. For instance, an unmodulated signal input of half a volt in the case of the DSB will be represented by the point E, and when modulated to 100 per cent. the signal will swing from 0 to 1 volt, that is, from D to F, representing a change from 93 to 138 anode volts. The difference between these two values, i.e., 45 volts, gives the L.F. signal volts (total swing) which will be handed to the L.F. intervalve coupling. Taking a similar input with the DH valve the 100 per cent. modulation swings the signal from A to C, or from 90 to 110 anode volts, thus delivering only 20 volts to the L.F. amplifier. The statement made earlier that the DSB is 2¼ times more sensitive than the DH is, therefore, substantiated.

Before leaving the question of screen-grid detectors, it should be mentioned that the load is somewhat critical. This can clearly be seen from Fig. 1, where for a load of 30,000 ohms the length of DE nearly equals EF, and distortion is negligible. If, however, the loads were made of much higher value, and consequently the load line more horizontal, the portion EF would be much longer than DE, and serious distortion would result. A lower load value with DEF nearly vertical would unnecessarily reduce the anode volts change, and signal strength would suffer. A screen-grid valve as detector therefore demands a critical load, and in our case the value should not differ widely from 30,000 ohms. With the triode, however, there is no "knee" in the characteristic, and loads which differ in value between fairly wide limits will not cause distortion (see Fig. 2) unless the working anode current and voltage is very low.

The loud speaker, which is built into the cabinet, is one of the new Magnavox "Magna" series of high magnetic field strength, and is of particular interest to the D.C. mains user, for, owing to the limited anode voltage on the last valve of sets designed for this type of current supply, acoustic output is often hardly adequate for large-sized rooms. The "Magna" speaker has a very generous supply of copper and iron, and is capable of giving a surprisingly large output from the DPT valve. As pointed out by Dr. McLachlan in the October issue of *The Wireless Engineer*, a large increase in magnetic field strength leads to the elimination of undesirable resonances and to the livelier response to transients, giving colour and character to music and speech. The field winding has a D.C. resistance of 5,000 ohms and is connected across the mains on the "safe" side of the two fuses and the double-pole on-off switch.



The front of the chassis. The four knobs control (1) tuning, (2) reaction, (3) wave-change (right), and (4) volume control combined with on-off switch (left).

LIST OF PARTS REQUIRED.

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

1 **Radiopak**, less potentiometer, but with two extra knobs and trimming tool — **British Radiophone, Type 535D.**

1 **Potentiometer, R.5, S1** — 3 watts, wire-wound, 5,000 ohms and two-pole switch, with ¼in. spindle bush, supporting strip and distance piece. — **Wearite, 5,000 ohm/G42 ganged Q.V.C.**

3 **Valve holders**, 5-pin — **Clix, chassis-mounting type**

1 **Valve holder**, 4-pin — **Bulgin, Type VH4**
(Benjamin, Burton, Eddystone, Radiophone, W.B.)

1 **H.F. screened choke** — **Peto-Scott "Keystone"**
(Bulgin, Kinva, Wearite.)

1 **L.F. transformer** — **Benjamin "Transfeeda"**
(Bulgin, Formo, R.I.)

1 **Fixed condenser**, 4 mfds. 250 v. D.C. working. **C19** — **Wego, Type ALU**

3 **Fixed condensers**, 2 mfds. 250 v. D.C. working. **C2, C15, C17** — **Wego, Type ALU**

7 **Fixed condensers**, 1 mfd. 250 v. D.C. working. **C7, C8, C10, C11, C12, C13, C18** — **Wego, Type ALU**

1 **Fixed condenser**, 0.002 mfd. mica, **C1** — **T.C.C., Type 34**

1 **Fixed condenser**, 0.0001 mfd. mica, **C9** — **T.C.C., Type 34**

1 **Fixed condenser**, 0.0002 mfd. mica, **C14, T.C.C., Type 34**
(Dubilier, Ferranti, Formo, Graham Farish, Peak, Telsen.)

1 **Strip resistance**, 25 ohms. **R16** — **Claude Lyons, Type FW.25**

1 **Strip resistance**, 200 ohms. **R6** — **Colvern**

1 **Strip resistance**, 250 ohms. **R15** — **Colvern**

1 **Strip resistance**, 1,000 ohms, **R9** — **Colvern**

1 **Strip resistance**, 8,000 ohms, **R4** — **Colvern**

1 **Strip resistance**, 10,000 ohms, **R3** — **Colvern**

1 **Strip resistance**, 15,000 ohms. **R10** — **Colvern**

1 **Strip resistance**, 25,000 ohms. **R11** — **Colvern**

2 **Metallised resistances**, 250,000 ohms, 1 watt. **R7, R8** — **Dubilier**

1 **Metallised resistance**, 50,000 ohms, 1 watt. **R14** — **Dubilier**
(Erie, Claude Lyons)

2 **Fuses**, 500 milliamps, and holders — **Microfuses**
(Belling-Lee, Bulgin, Ferranti, Goltone)

1 **Single-pole change-over switch** — **Bulgin, Type S.81**
"Radio and Gramo" **S2**
(Peto-Scott, Claude Lyons)

1 **D.C. mains resistance**, skeleton type. **R17** — **Bulgin, Type M.R.8**

2 **L.F. chokes**, 250 ohms, 20 henrys — **Varley, D.P.10**
CH.1, CH.2
(Ferranti, R.I., Savage, Sound Sales, Wearite)

1 **Reaction condenser**, 0.00015 mfd. solid dielectric. **C6** — **Graham Farish "Lit-los"**
(Peto-Scott, Telsen)

4 **Terminals**, aerial, earth, pick-up (2) — **Belling-Lee, Type "B"**
(Barton, Clix, Eelex, Igranic)

2 **Terminal mounts** — **Belling-Lee**
(Goltone, Junit, Lissen, Telsen)

1 **Bulb**, 6-volt. 0.15 amp. — **Bulgin, Type OB**

1 **Plug**, 4-pin — **Peto-Scott "Keystone"**
(Bulgin, Eelex)

1 **Loud speaker** — **Magnavox "Magna" Model 142, 5,000 ohms**

3 oz. No. 22 tinned copper wire, 6 lengths Systoflex, etc.

1 length screened sleeving — **Harbros**
(Goltone, Lewcos)

Screws: 31 ½in. No. 4 R/hd.; 14 ⅝in. No. 4 R/hd.; 8 ½in. No. 4 R/hd.; 14 ⅝in. No. 4 R/hd.; 2 ¾in. No. 4 R/hd.; 4 ¾in. No. 6 R/hd.; 4 1in. No. 4 R/hd.; 4 6BA ¾in. R/hd. with nuts and washers; 4 4BA washers for speaker fixing screws

Plymax baseboard, 9in. × 14½in. × ⅜in., and bracket for Radio-gramo switch — **Peto-Scott**

Cabinet — **F. W. Edwards, 15, Clerkenwell Green, London, E.C.1**

Valves: Osram VDS metallised. Osram DSB metallised. Osram DPT
(Marconi)

Approximate cost, £9 10s. (excluding valves, loud speaker and cabinet).

Pentode Compensation

To ensure proper matching of the output stage a multi-ratio transformer is attached to the speaker, and to give well-balanced reproduction the wander-plug should be put into the red socket. The four-point plug and socket connection to the speaker allows the receiver proper to be removed in the minimum time as the chassis is held to the battens by two wood screws only.

The reproduction, especially when using a gramophone pick-up, may be a little shrill, but the simplest compensation circuit across the primary of the output transformer—shown in dotted lines in the circuit diagram—will rectify this. The 25,000-ohm variable resistance, which can be mounted at the back of the set, will give sufficient range of "top" cut-off, when used with a 0.01-mfd. condenser, to suit all tastes.

Notes on the construction of the set and initial adjustments will be given in the concluding instalment to appear in next week's issue.

New Milestones *in* Commercial Wireless

Sea, Land, and Air Developments during 1932

By LT.-COL. CHETWODE CRAWLEY, M.I.E.E.

DESPITE economic restrictions, commercial wireless has made some notable advances during the past year. Important events included the début of the League of Nations station in Switzerland, the opening of the England-South Africa wireless telephone service, the extension of the telephone service to ships and important developments in the use of very short waves.

THE international regulations dealing with commercial wireless communication have been under review throughout the year, and during September, October and November, were under discussion at the International Telegraph and Radiotelegraph Conference at Madrid. The previous international radiotelegraph conference was held five years ago at Washington, and this is the first time that the telegraph and radiotelegraph conferences have been combined. The convention resulting from the conference, which will be called the International Telecommunications Convention, will come into force in a year's time, but will not materially affect present practice so far as commercial wireless communication is concerned.

Long-range Telegraphy

The economic situation has prevented any striking developments in long-range wireless telegraph services, and, indeed, few of even the present circuits can have been working at full capacity. The station of the League of Nations was perhaps the most interesting development in this category during the year. This station, or, rather, group of stations, was completed in February, and within an hour of opening was in use for important communications with Japan. The transmitting station is at Prangins, about 15 miles from the receiving station, which is in a suburb of Geneva. It was quite an international affair. The buildings and some of the masts and machinery were of Swiss manufacture, and the wireless apparatus was supplied by British, French, German, and Dutch companies. Provision is made for beam transmission and reception on short waves, and all-round communication on long waves, so that the station is able to communicate with all parts of the world. A telephone circuit between this station and Japan has just been established.

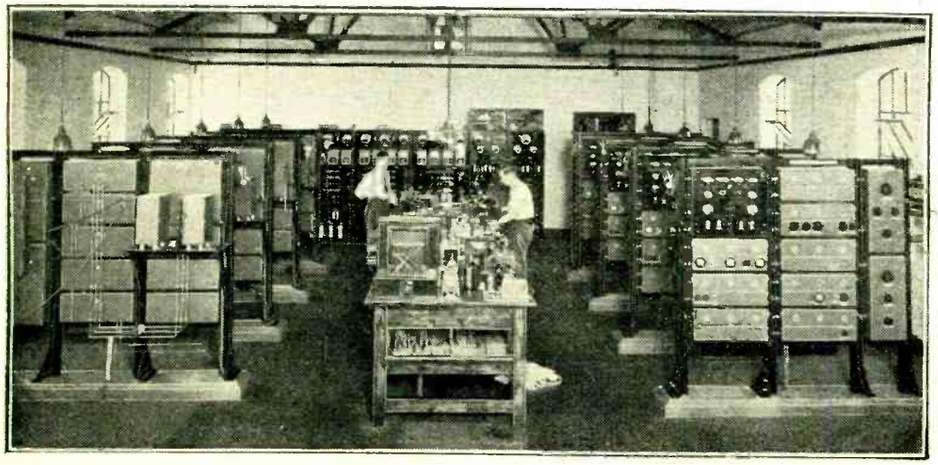
Another service of interest was opened in May, when a new imperial wireless telegraph link was established between this country and the Central African territories, by the inauguration of a service with a beam station at Salisbury, in Southern Rhodesia.

Wireless telephony, being of such recent growth compared with telegraphy, has had a better chance of expansion, even under the present adverse conditions, and its development for communication over great distances has progressed satisfactorily throughout the year, though, of course, much of this development has consisted in the extension of wireless channels by land lines and cables.

At the end of 1931 this country was connected telephonically with the Berlin-Siam wireless circuit, and on January 1st this year with the Berlin-Venezuela circuit. On January 1st, too, the wireless telephone circuit between England and New Zealand was extended by line to practically the whole of Europe.

In February the England-South Africa wireless service was opened, and in March the transatlantic service was extended to Bermuda and the Sandwich Islands, the former being a wireless extension from New York, the latter a land-line extension from New York to San Francisco, and thence by wireless to the Sandwich Islands.

The telephone service to ships at sea was extended during the past year. The photograph shows the Marconi telephony receiver on the White Star liner Homeric.



The receiving room of the Imperial and International Communications Company's station at Somerton.

England-Canada Direct

In April the England-Australia service was extended by line to Perth in Western Australia, and in May the England-South Africa service was extended by line to Europe.

A wireless service was opened in June between this country and Egypt (Cairo and Alexandria), and was extended by line to Port Said in October.

In July the direct England-Canada service was opened. Up till then the service with Canada had been made by way of New York.

A month later the England-South Africa service was extended from the Cape Province by line to Johannesburg and Pretoria, and later to other cities. In September it was extended by wireless to transatlantic liners.

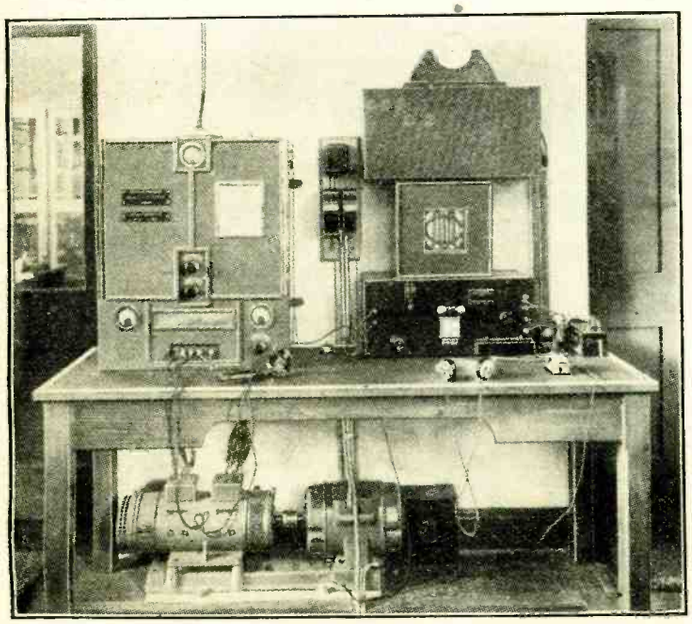
New Milestones in Commercial Wireless.—

In December most of the wireless telephone services were extended by line to Lisbon.

The following is a summary of the long-range wireless telephone circuits now in operation from this country, and most of them can be connected together in London, which may be looked on as the switching centre of the world: London-New York (four channels), connecting Europe with the United States, Canada, Cuba, Mexico, Bermuda, and the Sandwich Islands; London-Sydney (one channel), connecting with Australia and New Zealand; London-Cape Town (one channel), connecting with South Africa; London-Buenos Aires (one channel), connecting with Argentina, Uruguay, and Chile; London-Rio de Janeiro (one channel), connecting with Brazil; London-Montreal (one channel), connecting with Canada direct; London-Cairo (one channel), connecting with Egypt. There are also other services available by line to foreign countries, and thence by wireless, e.g., Java *via* Amsterdam, French Indo-China *via* Paris, Siam and Venezuela *via* Berlin.

Ships' Telephony

The telephone service with Atlantic liners has made some progress during the year, and there are now fifteen ships which partake in this service. Newcomers include the Bremen, Albert Ballin, Columbus, Deutschland, Europa, Hamburg, New York, Resolute, Cap Arcona, and Cap Polonia. To make the service more attractive, charges have been reduced to 12s. a minute when the ship is within 500 miles of Land's End, and 24s. at other times, with a minimum of three minutes. In September a similar service with Italian liners was opened from Coltano Radio in Italy.



The new Marconi telephone equipment at Land's End, a typical Post Office coast station.

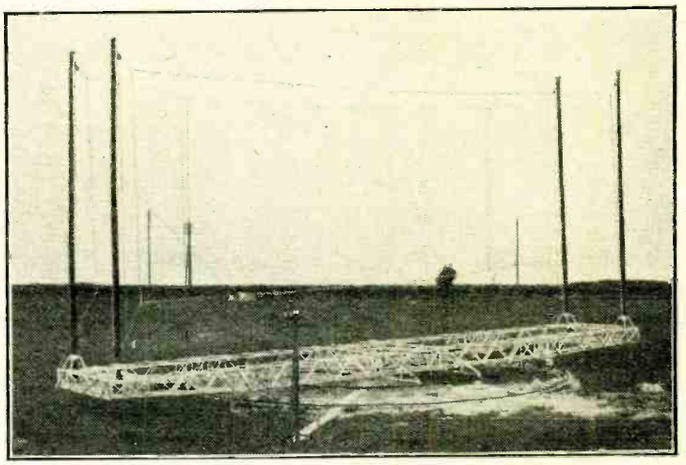
The telephone service with small ships, such as fishing craft and coasting vessels, has made great strides; in fact, it may be considered as having made its *début* in 1932, and has probably been the most important commercial development of the year in wireless communication. Important, that is to say, not as a commercial gold mine, but for its possibilities as a new means of communication with ships at sea.

All the stations round the coasts of Great Britain and Ireland, eleven in all, are now fitted with wireless telephone apparatus, as compared with three last year, and can communicate with ships suitably equipped up to ranges of about 250 miles, or more under favourable conditions. Waves of 177.5 and 162.6 metres are used for this service. About 200 British fishing craft and other small vessels have already been equipped, and this number will no doubt increase largely as the facilities available become more generally understood. The charge for messages to or from small ships by this service is 3½d. a word, the same as if they were sent by telegraphy. The messages are dealt with in exactly the same way as in the telegraph service, except that they are exchanged between the coast station and the ships by wireless telephony instead of wireless telegraphy, which means that it is unnecessary for the ship to carry a trained telegraphist as would be the case if wireless telegraphy were used. That is the great attraction of the service for the owners of small ships, but the system suffers, of course, from all the technical disabilities of wireless telephony compared with wireless telegraphy.

Ships' Telegraphy

The amount of wireless telegraph traffic carried out with ships has suffered from the economic blizzard just as all other telegraph traffic has suffered, but it is clear that as soon as conditions improve the amount of long-range traffic carried out on short waves, which even now is increasing, will develop rapidly. At present only 115 British ships out of a total number of 3,650 fitted with wireless installations are equipped with long-range short-wave sets.

The station used for this long-range communication with ships is the Portishead-Burnham station, the former for



The rotating beam aerial at the Portishead P.O. radio station.

transmitting and the latter for receiving and operating. The station uses long waves in the 2,000-2,400-metre band, and short waves in the 17-, 26-, and 36-metre bands. The short-wave equipment for communication with ships all over the world has been much improved during the year, both at Portishead and at Burnham, and further improvements are now in progress.

At present there are two short-wave transmitters at Portishead, one for all-round transmission on any of the three bands, and the other for beam transmission east and west on the 36-metre band, west on the 17- or 24-metre band, and for directive transmission by a rotating aerial on the 17-metre band. This aerial is rotated so as to be directive on a ship at any place, and rotates in unison with a similar receiving aerial at Burnham, the motion being controlled electro-mechanically by the operator on watch on the corresponding receiving point at Burnham. This rotating aerial, and the fixed beam aerials, are of great value for communicating with ships in distant parts of the world. At Burnham there are three short-wave receivers working on three beam aerials, three dipoles, and the rotating aerial.

Land's End, one of the most important of the short-range coast stations which work on I.C.W. in the 600-800-metre band, has been completely re-equipped during the year and calibrated for D.F. work, in addition to being fitted with telephony. This station now carries out the ships' D.F. work, formerly handled by the Lizard station, which, for reasons of economy, was closed during the year.

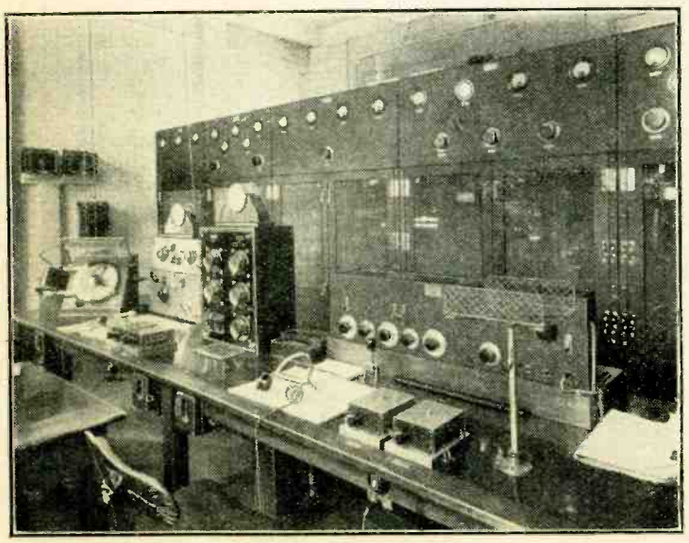
As regards the safety communications of ships, an Act of Parliament, known as The Merchant Shipping (Safety and Load Line Conventions) Act, 1932, was passed during the year, and will come into force on January 1st next. This Act gives effect to the provisions of the International

New Milestones in Commercial Wireless.—Convention for the Safety of Life at Sea, which was signed in London in 1929. Nine other European countries and Canada have taken similar steps to bring its provisions into force on that date, but the U.S.A. have postponed action for the moment. Nearly all the technical requirements of the Convention have been complied with in this country for many years, but the new Act will make D.F. apparatus compulsory in passenger ships of 5,000 tons gross and upwards, and will affect slightly the number and qualifications of some of the wireless personnel, the hours of watch and details regarding the inspection of ships' installations.

Air Services

No commercial wireless services with aircraft—that is to say, services open to the public—have yet been started in this country, but the development of wireless telegraphy and telephony in connection with the operation of aircraft has continued to advance; indeed, wireless signalling is so much a part of air-line services that development of the latter involves development of the former.

Early in the year a new directional wireless beacon was installed at Croydon aerodrome. This beacon enables a pilot whose aeroplane is suitably equipped, to see immediately, at ranges up to 100 miles from the station, if he is on his correct course. The apparatus in the machine is automatic and interferes in no way with the ordinary wireless equipment. The accuracy of the D.F. apparatus at aerodromes is naturally of first importance for aircraft working, and the Adcock aerial system has been proved during the year to be as reliable during the worst periods of night effect as the Bellini-Tosi apparatus is under normal conditions.



The operating bench at Land's End station with the transmitter in the background.

Many wireless stations have been erected during the year in connection with the development of air services as well as at training centres such as Heston and Hambledon, and at the moment the first fully equipped wireless station to be erected in this country at a municipal air port is being installed at the Manchester Corporation Aerodrome at Barton Moss.

Very Short Waves

Last year very short waves made their first appearance as a practical means of wireless communication, and this year they have made their *début* in commercial practice, although the whole subject is still in the experimental stage. At the close of last year the one thing apparently certain about these waves was that they were useless for communication beyond optical range; at the close of this year Marchese Marconi announces that he has established successful communication over a distance of 168 miles on a 57-centimetre wave. So we must wait and see.

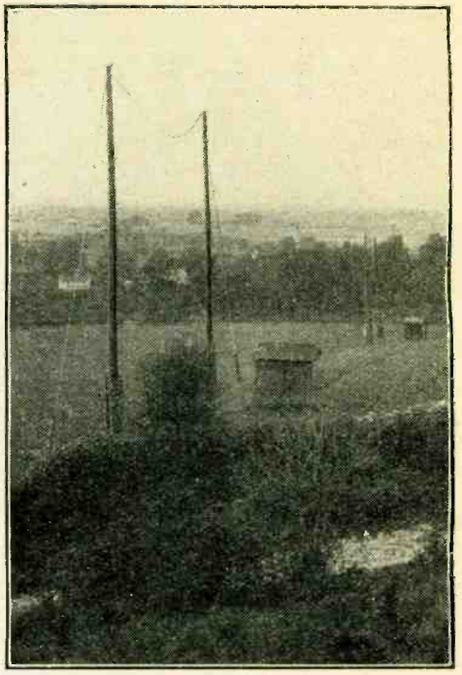
Meanwhile, a commercial wireless telephone circuit has been in operation for several months on a wavelength of about five metres, across the Bristol Channel between Lavernock, near Cardiff, and Hutton, near Weston-super-Mare, a distance of twelve miles. This wireless circuit is linked in to the telephone land lines at each end, and at night works unattended.

A very short wave service was established between France and Corsica in October, and one is now being installed between the Vatican and the Pope's summer residence.

Equipment, too, has recently been ordered for Lympne airport for working telegraphy on a wave of about 15 centimetres with St. Inglevert aerodrome, which is about seven miles S.W. of Calais.

In April the first demonstration of television on a very short wave, 6.1 metres, was given by Mr. Baird in London, and the possibility of the use of television for transmitting news was demonstrated (on a medium wave) at the meeting of the British Association in September. At the receiving end the letters appeared travelling across a screen somewhat similar to the well-known electric light bulletin signs. The year, however, has not yet come when television can be reported as having entered the stage of commercial communication.

As will be seen from this short summary, the year just closed has produced less spectacular progress than has been the case for several years past, but much has been done in the way of steady advance, especially in telephony and in the introduction of the use of very short waves for commercial communications, both by telegraphy and telephony.



The sending and receiving huts of the very short-wave station of the Post Office at Weston-super-Mare. Communication is maintained across the Bristol Channel.

CLUB NEWS

The History of H.F.

THE evolution of the high-frequency amplifier from pre-broadcasting days was outlined by Mr. Carter, of the Mullard Wireless Service Co., Ltd., at a recent meeting of the Southall Radio Society.

Full particulars of the Society can be obtained from the Hon. Secretary, Mr. H. Rayner, 114, North Road, Southall.

Pre-selection

THE Philco Baby balanced unit was demonstrated at a recent meeting of the Tottenham Wireless Society. Among the interesting features of the unit was the elaborate and careful design of the pre-selector circuits.

Hon. Secretary: Mr. W. B. Bodemeaid, 29, Pendennis Road, Tottenham, London, N.17.

Transformers in the Making

SNAGS in the construction of transformers were interestingly described by Mr. F. G. Sawyer, of Messrs. Partridge Wilson and Co., manufacturers of Davenset transformers, lecturing before the Coventry Short Wave Radio Club on December 8th.

Hon. Secretary: Mr. C. Taylor, 37, Kingsland Avenue, Coventry.

A Convincing Demonstration

BUENOS AIRES was received at loud-speaker strength on a 3ft. aerial during a recent meeting of the Slough and District Radio Society, at which Mr. Hall, representing Messrs. Philips Lamps, Ltd., demonstrated a two-valve short-wave converter.

Hon. Secretary: Mr. S. Becket, 3, Melbourne Avenue, Slough.

New Northern Society

AMATEURS in the North will welcome the North Eastern Amateur Transmitters' Society, which has just been formed in Newcastle. We understand that the Society's activities will not compete in any way with those of the Newcastle-on-Tyne Radio Society.

The Hon. Secretary is Mr. H. C. D. Hornsby (G5QY), 7, Lansdowne Terrace, Newcastle-on-Tyne 3.

Permeability Tuning

Coils with Movable Iron Core

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

THE use of a special iron core for tuning coils has already been noted in these pages. Another application of iron in high-frequency circuits, having even more revolutionary possibilities, has been receiving attention in America. It is perhaps premature to pass judgment on it, but it is interesting to compare it with existing methods of tuning.

In low-frequency circuits iron cores are freely used to increase the inductance of coils by taking advantage of the property of iron known as permeability—a sort of multiplying effect. At radio frequencies, however, the useful permeability falls off so seriously, and such large losses are introduced, that ordinary iron offers no advantage. By a special process for reducing the iron to infinitesimal grains of powder, each separately insulated from the other, a permeability is obtainable which, if not as good as that at low frequencies, is at least useful.

The coils already described in *The Wireless World* utilise this idea for the purpose of reducing the number of turns of wire necessary to provide a required inductance; thus reducing also the resistance, increasing the sharpness of tuning, and so improving the selectivity. The core is fixed; the inductance of the coil is constant, and it is tuned with a variable condenser in the usual manner.

If, however, the core is made to slide in and out, the inductance is varied, and the wavelength to which it is tuned consequently varies also. As the inductance with the core in position is claimed to be nearly nine times as great as that with it right out, and the wavelength depends on the square root of the inductance value, a band of wavelengths in the ratio of nearly three to one can be covered, say, 200-600 metres.

Condenser Tuning Defects

Is there anything to choose between capacity and inductance tuning? It will be admitted that the present condenser tuning leaves something to be desired, for at the low-wave end reception is lively—too much so, in fact, for selectivity is relatively poor—and at the upper end of the scale selectivity improves at the expense of sensitivity. This effect is a conspicuous obstacle to band-pass tuning, and has called forth much ingenuity and complexity of design.

That is because the "Dynamic resistance," which determines the sensitivity, is $\frac{L}{RC}$; hence, as L is fixed and C increases, the sensitivity goes down. R, the loss resistance of the tuned circuit, decreases somewhat as the wavelength rises, and helps to compensate; but the compensation is generally not complete. The "magnification factor," which decides the selectivity, is $\frac{1}{R}\sqrt{\frac{L}{C}}$, and R may well decrease more rapidly than the square root of the capacity increases, leaving a tendency for the selectivity to increase as described.

IS there anything to choose between capacity and inductance tuning? Readers whose interest has been aroused by the new Ferrocart iron-cored coils will be specially intrigued by a method of tuning which, dispensing with the variable condenser, utilises a movable iron core within the tuning coil.

If C is imagined to be fixed and L is increased by inserting an iron core the precise effect on the sensitivity depends on whether or not the resistance R increases at the same rate. Tests with various forms of magnetic core, including powdered "mumetal," tend to show that, with cores of the type necessary for effective tuning, the resistance will not go up rapidly and there may be a tendency to the defect opposite to that of condenser tuning—relative insensitivity at the *lower* end of the wavelength scale.

The effect on selectivity depends still more on exact data on the coils and cores used, but it would appear to be fairly constant for such a system.

The method of controlling the position of the core and linking it to a tuning scale is a matter for mechanical ingenuity, and it is obviously quite easy to control a number of cores simultaneously for ganging purposes.

An interesting point arises in connection with ganging. With condenser tuning it is quite a difficult matter to ensure that all the circuits are sufficiently well matched at all wavelengths, for no fewer than three requirements must be fulfilled: (1) each coil must have exactly the same inductance, (2) each section of the gang condenser must have the same capacity at all settings, and (3) the initial capacity of each circuit must be the same. It is impossible to compensate for inequality in one of these by adjustment of another, for though it may be effective at one part of the scale it fails elsewhere.

As the effect of permeability tuning is to multiply the inductance by a certain amount—no matter what that inductance is, within certain limits—it is possible for the coils to be only roughly the same, and yet to obtain perfect ganging by adjusting the trimmers at only one point.

It is assumed that the cores themselves are all equally effective. Whether it is possible to obtain sufficient uniformity in manufacture, at a reasonable cost, remains to be seen.

If it is, then we have an undoubted step forward in simplification of ganging. Moreover, it becomes possible to choose the most suitable inductance for each circuit in the set; for example, the aerial coil would generally be better with lower inductance than the anode-circuit coils.

Interesting Possibilities

Such a thing is not permissible with condenser tuning unless the condenser sections are unequal and each specially designed for its own coil, which is rather too much to expect.

Another claim is that much more compact construction of sets is rendered possible, because the variable coils may be actually smaller than the familiar canned type now used, and, of course, the rather bulky ganged condenser is entirely eliminated.

It is stated that permeability tuning is not satisfactory below 150 metres, so it would not be suitable for an "all-wave" receiver unless a small tuning condenser were used for the short waves.

There may be other difficulties that do not appear until production on a large scale is attempted. But the possibilities are more than usually interesting.

CAR RADIO. With the new Philco-Transitone car set nothing is visible except a switch, dial, tuning knob and volume control.

PRACTICAL HINTS AND TIPS

Simplified Aids to Better Reception

IT often happens that the ordinary "straight" type of potentiometer, when used for regulating volume, provides too fine a control in the neighbourhood of maximum loudness.

Artificially graded Potentiometers

In such cases the control may be coarsened to approximate to that provided by the so-called "graded-track" potentiometers by connecting a fixed resistance of suitable value between the potentiometer slider and the low-potential end of the resistance track (see Fig. 1).

The effect of the arrangement is to increase the resistance variation for a given slider displacement near the high-potential end at the expense of the resistance variation over the remainder of the slider travel.

If R be the resistance of the potentiometer and R_1 that of the added resistance, it can be shown that the resistance variation near the high-potential end is $1+R/R_1$ times that of the original potentiometer.

A generally suitable value of the above ratio may be taken as 2.5, which leads to making R_1 equal to two-thirds of R.

It must be borne in mind, however, that the effective resistance of the arrangement is only that of R and R_1 in parallel or $R \times R_1$ divided by $(R+R_1)$.

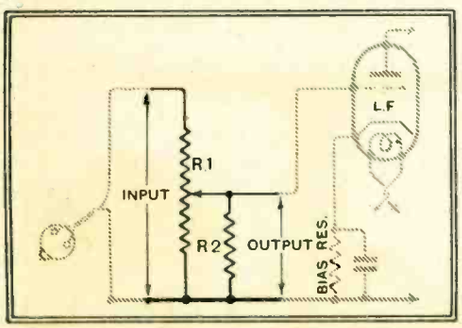


Fig. 1.—By shunting an un-graded potentiometer with a fixed resistance R_2, in the manner shown, control of volume can be made smoother and less abrupt.

With the relative value of R_1, as above, the effective value of the arrangement is only 2/5 R, hence if the load on the input circuit is to remain the same a potentiometer having a resistance 2.5 times greater should be selected.

Thus, if a pick-up requires a 20,000-ohm volume control a plain potentiometer of 50,000 ohms would be suitable, together with a fixed resistance of 33,333 ohms, or, in practice, 30,000 or 35,000 ohms, whichever is available.

For controlling the screen-grid potential of an H.F. or detector screen-grid valve, where 50,000 ohms is a suitable value, a potentiometer of 125,000 ohms should be selected, the added fixed resistance being of 80,000 ohms.

At its best the arrangement is, of course, only a makeshift, but in many cases it will enable "spares" to be made use of quite effectively.

SECOND-CHANNEL interference, which manifests itself by a tunable heterodyne whistle of a similar nature to that ordinarily associated with instability, is almost the sole remaining drawback of the superheterodyne. In any case, the trouble is not a very serious one, and is usually encountered only in the immediate vicinity of a station.

Estimating Intermediate Frequency

It is fortunate that the phenomenon of second-channel interference can be turned to good account in affording a rough-and-ready means of estimating the value of the frequency to which the I.F. amplifier is actually tuned, without the use of instruments.

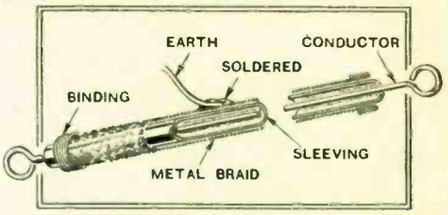
Having identified the distant station upon whose wavelength the interference occurs, the frequency of this transmission should first be ascertained (it will be found in the list published in *The Wireless World*). This figure is then subtracted from the frequency of the local station which causes the interference, and the result is then divided by two. This will give the intermediate frequency within about 5 kilocycles.

IT would seem that the practice of shielding wires carrying H.F. currents in metallic braiding is sometimes carried too far, and, further, that sufficient care is not always exercised in the choice of material for making such connections.

Screened H.F. Leads

The primary object of this shielding is to prevent stray inter-circuit couplings which might cause instability, and when once stability has been obtained it is useless to add to the number of screened leads. At the best, this course is bound to restrict the wave-range covered by the set, and it may also be responsible for the introduction of unnecessary losses, which will manifest themselves by reduced sensitivity and selectivity.

Screened leads consisting of wire with a covering of solid rubber with external metal braiding should never be used in H.F. circuits. These are intended solely for such purposes as the wiring of filament and heater circuits, etc. The best



Showing the construction of a screened H.F. lead with reasonably low self-capacity.

form of shielded connector which is commercially available consists of insulated sleeving with a fairly large bore, encased, of course, in a flexible metallic shield. For the internal conductor the finest wire that can be used, consistent with mechanical strength, should be chosen.

THROUGH one of those unfortunate verbal inversions which are apt to occur even in the best-regulated journals, a totally erroneous idea was conveyed of the effect of reducing the cross-sectional area of a moulded carbon resistor. The paragraph dealing with this subject appeared in the "Hints and Tips" section of *The Wireless World* for December 16th; the original statement should be amended to read, "The resistance of the element may be *increased* to any reasonable extent by reducing the cross-sectional area of the rod."

"Adjusting Resistances": A Correction

This method of adjusting resistance value can on occasion be extremely useful, and so it is all the more regrettable that the original paragraph was marred by a misstatement. Of course, the only way of *reducing* the resistance of these components is to shorten them, and even this is hardly practicable.

When the ohmic value of a moulded resistance rod is to be adjusted by reducing its cross-sectional area with a file, its initial resistance rating should be appreciably higher than the value ultimately required.

DESIGNERS of commercial sets spare no efforts to reduce the number of external control knobs on their products. Indeed, it might be argued that they sometimes go too far, and it could certainly be urged that two separate controls do not become one merely because they are operated by concentric knobs carried on the same spindle.

The Control-knob Fetish

Even if we ignore the lapses from grace of certain designers, whose efforts have been none too happy, and award all due praise to those who have been successful in making one knob do the work of two or even three, it seems rather illogical for the amateur to emulate these efforts. So far as the uninformed general public are concerned, simplicity at all costs is a good slogan, but the amateur constructor who can appreciate the function of his controls should not omit provision for any adjustment that may be technically desirable, merely for the sake of simplicity.

When planning a set which is occasionally to be operated by the unskilled, it is a good plan to mount all essential controls close together, and in the most accessible position possible, and then to arrange a sort of sub-control panel, from which those adjustments which are in the nature of refinements may be made It may be impressed on non-technical users that they need not concern themselves with anything but the main controls.

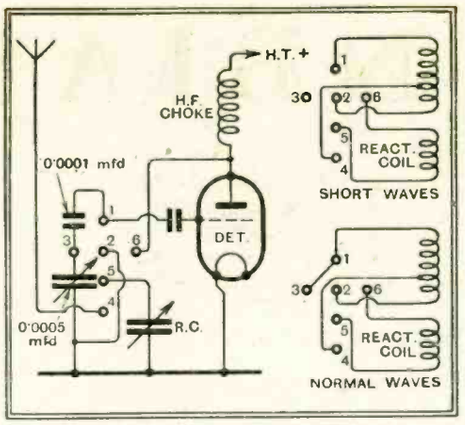


Fig. 3.—Wiring a coil base for an "all-wave" receiver, and appropriate connections of the coils. A fixed condenser, which limits tuning capacity to a suitable value for short-wave reception, is automatically short-circuited when the normal broadcast-band coil is inserted.

HERE is a suggestion that should be useful to those using interchangeable six-pin coils in the construction of "all-wave" receivers. Without any switching complications, it enables the most suitable value of tuning capacity to be used on both broadcast and short wavelengths. The arrangement can be applied equally well to aerial-grid, or, where H.F. amplification is used, to H.F. coupling circuits.

All-wave Sets

The coil base is wired as in Fig. 3, which also shows the appropriate connections of the coil windings to the pins. It will be seen that when a short-wave coil is plugged into the holder, the tuning condenser consists of a fixed capacity of 0.0001 mfd. in series with a variable condenser having the normal value of 0.0005 mfd.; this gives an effective maximum capacity of slightly under 0.0001 mfd. When a coil for the normal broadcast band is plugged in the fixed condenser is short-circuited, and so the circuit is tuned by the 0.0005 mfd. condenser alone.

This scheme offers the advantage of a more "open" tuning scale on the short waves, and more efficient circuits.

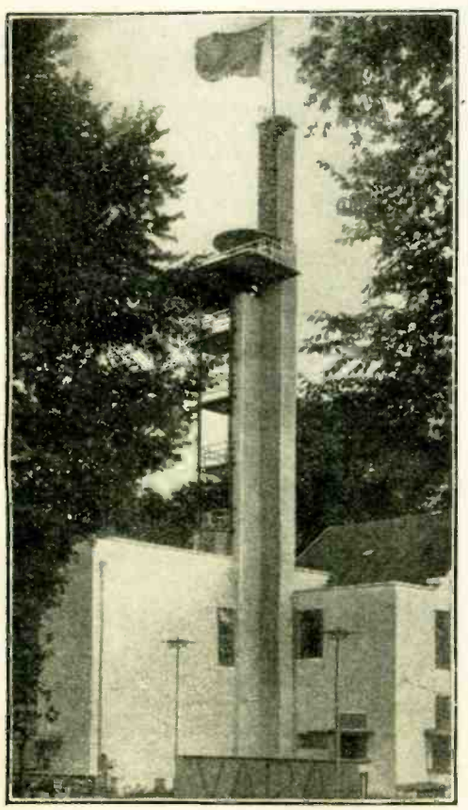
ON THE SPOT

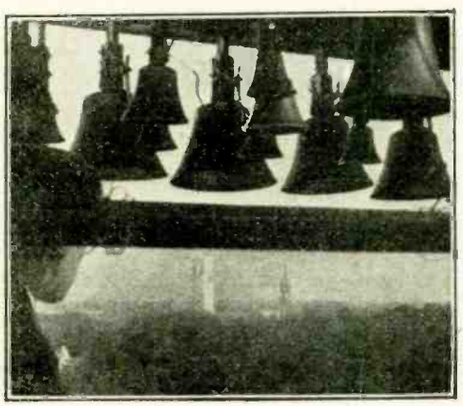
Visits to Foreign Broadcast Stations

IV.—HILVERSUM

(160 kc., 1,875 m., 7 kW. until 8 p.m., then 20 kW. unless when relaying NCRV, programme which continues with the low power.)

AS I write Huizen has just appropriated the name of Hilversum under an arrangement which is less complicated than appears at first sight. Most readers know that four main broadcasting organisations operate in Holland. The Catholic and Protestant companies, respectively KRO and NCRV, own the NDO, the company operating the Huizen transmitter. The other two companies, AVRO (neutral) and VARA (Socialist) rent their transmitter, Hilversum, from the NSF (Philips). Now for the explanation. Hilversum has a short wave and Huizen a long wave, and as the service areas of the two differ greatly the Dutch Government decrees that complete equality between the four companies must be ensured by an exchange of stations, which takes place once a quarter.





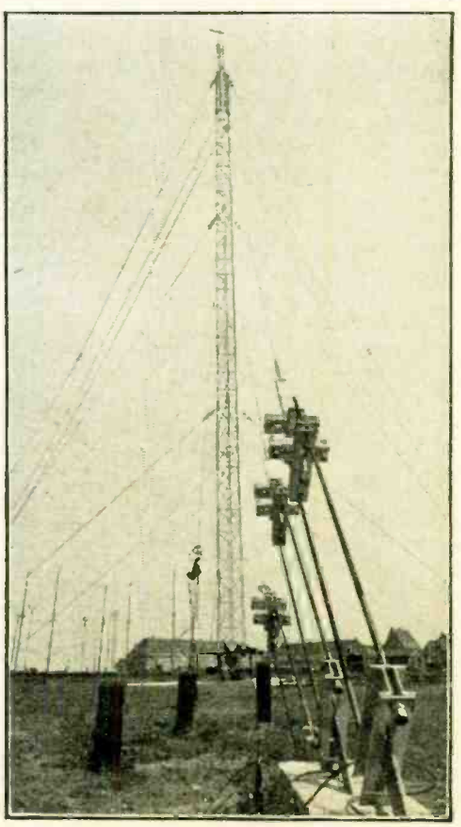
(Left) The VARA (Socialist) studio building at Hilversum, opened in May last. The architecture is distinctly "modern."

(Above) A peep over the town from the carillon tower of the VARA building.

(Right) The new Hilversum mast is a self-contained "aerial," with a small adjustable portion at the top for slight variations in wavelength.

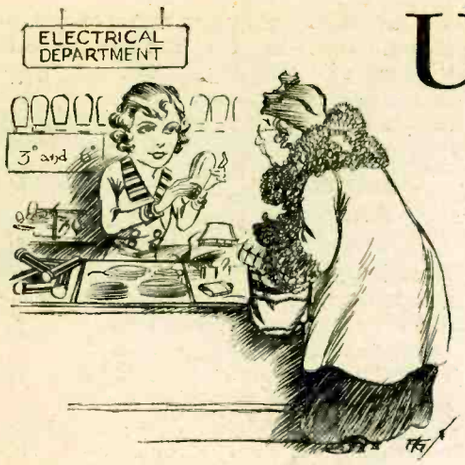
Under the new aerial mast of Hilversum a large receiver factory is in full swing. All the Dutch companies have their studios at this place, which, incidentally, is a town of some 60,000 inhabitants, half an hour's express train journey from Amsterdam. The neutral company AVRO have now started work on what promises to be a wonderful new studio building, replacing the rather antiquated accommodation which has been used since about 1926. AVRO needs some consolation of this sort, for they are frequently sore over not having a transmitter of their own.

WANDERING WAVE



UNBIASED

By
FREE GRID.



Explaining to an inexperienced theorist.

Don't Interfere.

THE faith of the non-technical public in the electrical knowledge of people entrusted with the sale of lamps and other electrical appliances is truly touching. I am moved to make this remark by an incident which I witnessed the other day in one of those large emporiums which cater so admirably for the needs of what the B.B.C. terms the *οἱ πολλοι*.

A benevolent-looking old lady had handed to a girl in charge of the electric bulb counter a piece of paper bearing what I imagine were technical details of a purchase she had been asked to make. The presiding damsel, after consulting the paper, informed the old lady in loud tones that there were no more 240-volt lamps in stock, but suggested that a 210-volt bulb would suit her purpose. The old lady, with touching faith, was about to agree when a bespectacled youth, carrying a copy of *W.W.* under his arm, butted in to say, quite rightly, that if she used the lamp on 240-volt mains it would have a short life and a gay one.

To my astonishment, the old dame, instead of being grateful, rounded on the youth and rebuked him soundly, telling him that electricity, being a dangerous thing to dabble with, should be left to the people who understood it, like the young lady behind the counter.

I must say that, in my opinion, the youth had only himself to blame; I myself have frequently found that to attempt to advise people is as dangerous as trying to separate a married couple in a domestic squabble.

Oh, to be in England . . .

I OFTEN wonder whether listeners in this country who constantly grumble at the jamming between various stations appreciate how fortunately they are situated as compared with those who dwell in Central Europe. As you may remember, I was in that part of the world quite recently and had ample opportunity of listening to broadcasting on high-class selective sets.

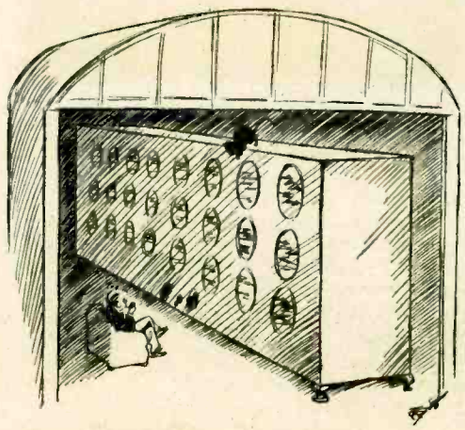
In spite of the selectivity the interference was simply appalling. The trouble is, of course, excessive power, and, to a certain extent, wavelength poaching. The net result is that those who are able to afford only the cheaper grade of set simply do not know what it is to listen to a programme which is not spoilt by an insidious background from another station.

Why Stop at Six?

I AM very glad to notice that more and more firms are following the lead given by *W.W.* a few years ago in using a couple of loud speakers to cover the whole musical register. The Duo-speaker seems to be a perfectly logical arrangement; as a distinguished violinist said to me the other day, it was the limitations of the one-string fiddle which finally led to the introduction of the violin.

Certain modern radio designers of American origin, however, are evidently under the impression that just because a violin has four strings a wireless receiver must have four loud speakers; such, at any rate, is my impression, judging from the specifications of a receiver which has just been sent to me for criticism by a large firm of importers. I gather from a covering letter that the worst is yet to come, however, as they have on the stocks an instrument in which there are no fewer than six loud speakers.

It is, I think, perfectly absurd to stop at six. On the piano, to name one instrument, are there not eighty-two notes? Surely a far better plan would be to have a loud speaker for each note, since it would be easier to make eighty-two instruments to give sharp resonances at the requisite frequencies than to attempt to cover the whole gamut of musical frequencies with a mere handful! Naturally,



Homely little listening-in shed.

a good set embodying such an arrangement would be rather large and, in all probability, a special listening-in shed would be needed; but surely we wireless enthusiasts are not daunted by such trifles as this? The idea would, at any rate, sell some loud speakers.

Interference at the Source.

THERE is nothing more exasperating, in my opinion, than to hear the faint tintinnabulations of an interfering station during a silent period at the station to which one's set is tuned. For some time past I have been troubled with this sort of thing in the case of the two Brookmans Park transmitters, and since I knew that it was quite impossible for the trouble to be caused by any lack of selectivity in my own receiver, I naturally concluded that the interference was occurring in Broadcasting House. Possibly, I reasoned with myself, it might be due to induction between the various cables passing up from the studio to the control room. In

Unbiased.

order definitely to confirm this, I solicited and obtained a kind invitation to the listening halls which the B.B.C. provides for the use of journalistic music critics.

To my delight, I was lucky enough to have both listening halls at my disposal, and since they are adjacent I was soon dodging from one to the other comparing programmes. Alas, my induction theory was soon confirmed, for the military band performance being given on the National programme was faintly but distinctly audible in the loud speaker in the Regional hall.

Out of courtesy to my hosts on this occasion I will refrain from commenting on what can only be regarded as an unhappy state of affairs in the headquarters of British broadcasting. It is of little use our attempting to strain after distortionless selectivity in our receivers if the B.B.C. permits interference at the source.

To-morrow Night.

WELL, the New Year is hard upon us. If all goes well I hope to be in the foyer of Broadcasting House to-morrow night to greet 1933, and incidentally any of my readers who may care to come along. I shall be holding a lily.

NEWS of the WEEK

Current Events in Brief Review

Wireless in School

A VOLUNTARY wireless class has been opened at Eltham Central School.

Brussels Sprouts

WE understand that the two Brussels broadcasting stations will shortly increase their power to 70 kilowatts.

Nyiregyhaza Calling!

THE new Hungarian broadcasting station at Nyiregyhaza is testing on a wavelength of 267 metres. The power is 6.5kW.

Radio Novelties at the B.I.F.

TWENTY-NINE radio firms have already booked space in the "Hall of Music and Radio," which is to form a novel feature of the British Industries Fair in February, 1933.

The B.B.C. exhibit will be largely devoted to Empire Broadcasting.

New 120 kW. Station

RUMOURS chase each other concerning the new 120 kW. broadcasting station at Bisamberg, near Vienna. Despite reports that the station may not operate before Easter or Whitsun, news from an authoritative source indicates that the station will be testing towards the end of January. The transmitter, which is being built by the Telefunken Company, will be the first in the world to use the new 300 kW. water-cooled valves with indirectly heated cathodes.

The aerial will consist of a single steel mast some 500ft. in height.

End of Power War?

DEFINITE power limitations for European broadcasting stations were instituted at the Madrid Conference. No stations working on wavelengths of less than 600 metres are to employ more than 100 kW. in the aerial, with certain exceptions, which include stations projected or at present in operation. Among these favoured transmitters are Leipzig, Vienna (Bisamberg), Prague, and Budapest, which may use 120 kW. Three French stations, Toulouse P.T.T., Paris and Rennes, come under the same category.

A special provision, however, enables stations in certain geographical positions to use more than 100 kW. so long as the field strength during the day time does not exceed 100 milliwatts per metre beyond the national frontier.

It is understood that Breslau and Heilsberg may take advantage of this concession.

Does Craciunelo Care?

WHILE the delegates' chairs at Madrid are still warm a report reaches us from Craciunelo, a village in Roumania, to the effect that a 150-kilowatt broadcasting station is under construction there. The wavelength will be 1,980 metres.

Lwow's New Interval Call

DURING programme pauses, the Lwow (Poland) broadcasting station transmits notes on the zither. According to the Oxford Dictionary, a zither is a stringed instrument with a flat sounding-board played on a table.

1,000-kilowatt Broadcasting from Russia?

TEN more 100-kW broadcasting stations, in addition to the five already in operation, are provided for in the Soviet's new Five Year Plan, according to the well-known American radio engineer, Dr. Louis Cohen, who has just returned from a trip to Russia to give technical advice to the Soviet radio authorities. In an interview with our Washington correspondent, Dr. Cohen said that Moscow will shortly possess a 500-kW broadcasting station—the highest powered in the world—while plans are under consideration for a 1,000 kW station, though such a power would not be employed unless it were warranted by a sufficiently large increase in service area.

In the realm of short waves Russia is planning a 1,000-kW station to cover the world.

Sweet are the Uses of Adversity

LISTENERS in a Vienna suburb were recently disturbed by a mysterious form of interference which was ultimately traced to an electric beer pump in a local saloon. The publican had a ready explanation. "When my saloon grows empty," he remarked, "I turn on the beer pump. People then grow dissatisfied with their radio reception and flock in for a drink."

Light at Last!

A CHILDREN'S "spoken journal" which the Soviet stations are shortly to broadcast at regular intervals will, according to a correspondent, "discuss all current political and economic problems." The talks will be edited by the "kiddies" themselves.

Sponsored Programmes from Athlone

SIGNALS at good strength on 413 metres are now available to listeners in this country from the new Irish Free State broadcasting station at Athlone.

A new company, known as the International Broadcasting Company (Ireland), Ltd., has been formed to handle the advertisement side of the station's activities. The company has a nominal capital of £10,000.

SHORT-WAVES FOR MOUNTAINEERS. The value of portable short-wave equipment has been recognised by the German-Austrian Alpine Club, members of which are here seen practising Morse reception. The apparatus is invaluable to search parties.

Talking Artificially

ARTIFICIAL larynges, permitting speech in cases where the vocal cords have been broken or paralysed, are dealt with in a fascinating brochure issued by the Western Electric Company.

During normal speech, air is expelled from the lungs and passes through the trachea to the larynx. The larynx contains vocal chords which convert this current of air into sound waves. When the artificial larynx is used, the sound is introduced externally into the mouth through a flexible rubber tube, and the air current from the lungs is converted into sound waves by a metal reed which is enclosed in the sound box provided. The sound generated enters the mouth and is moulded into articulate speech by the resonating action of the mouth, throat and nasal cavities.

R.S.G.B. Appoints a Secretary

MR. JOHN CLARRICOATS (G6CL) has been appointed Secretary of the Incorporated Radio Society of Great Britain. For the past four years Mr. Clarricoats has served amateur interests in the capacity of Honorary Secretary to the Society.

I.E.E. Wireless Section

"ELECTRONIC Oscillations" and "An Investigation of the Magnetron Short-Wave Oscillator" are the titles of two papers to be read by Mr. E. C. S. Megaw, B.Sc., at a meeting of the Wireless Section of the Institution of Electrical Engineers on January 4th at 6 p.m.

Bristol Lectures on Wireless

ON January 11th next Mr. W. A. Andrewes, B.Sc., A.I.C., will resume the winter course of lectures on wireless which are being given on Wednesdays from 7.30 to 8.30 p.m. at the Merchant Venturers' Technical College.

The lectures, which deal with magnetism and electricity, and their applications to radio communication, are illustrated with experiments, demonstrations, and lantern slides. Particulars can be obtained from the Principal of the College.

Listen for Marseilles . . . in 1936!

HAPPILY for French listeners, the fall of the Herriot Ministry is not considered likely to delay to any serious extent the passing of the Wireless Bill. Apparently, before leaving office, the ex-Postmaster-General, M. Queuille, had signed the necessary papers authorising the construction of the 120kW. station at Marseilles.

This is no indication that listeners should attempt reception of the test signals in the near future for, according to a correspondent, the preliminary trials are timed for the beginning of 1936!

Radio at the Physical Society's Show

A PHOTO-ELECTRIC cell device for recording smoke discharges will be included in the apparatus on view at the twenty-third annual exhibition of the Physical Society, which will be held on January 3rd, 4th, and 5th at the Imperial College of Science and Technology, South Kensington, London, S.W.7. Another exhibit of exceptional interest will be the wireless apparatus used on aeroplanes when flying along a fixed air route served by a wireless beacon.

Admission to the exhibition is free without ticket on Thursday, January 5th. Tickets for admission on the other days may be obtained from the Exhibition Secretary, 1, Lowther Gardens, Exhibition Road, London, S.W.7.

Varley

SUPERHETERODYNE

A Compact A.C. Mains Receiver

IN spite of the greater number of valves which must necessarily be employed, the superheterodyne lends itself to a compact construction more readily than the straight set. The fact that the Varley superheterodyne is housed in a cabinet of the same dimensions as that used for the same maker's three-valve receiver, therefore, does not mean that performance has been in any way sacrificed for the attainment of this desirable feature. The sensitivity, in fact, reaches a very high level, and is ample for all ordinary requirements, even when local conditions necessitate the use of a small and inefficient aerial; there is, moreover, no trace of instability. For the reception of even the less powerful of continental transmissions, a few feet of wire hung on the picture rail will provide sufficient pick-up of signals.

A total of six valves, including the H.T. rectifier, is employed, and variable-mu types are used for the preliminary H.F. and for the single I.F. stages. The power grid second detector is a triode, and it is transformer coupled to the output pentode. A single valve frequency changer is fitted, and this is of the pentode type, oscillation being maintained by coupling between the anode and space charge grid circuits.

High Sensitivity

The H.F. valve is coupled to the aerial by a single tuned circuit, and to the frequency changer by a transformer; here a departure is made from the usual practice, in that this transformer has its primary tuned instead of the secondary. There are thus two signal frequency tuned circuits to discriminate against second channel interference, and these are tuned by two similar sections of the three-gang variable condenser.

The intermediate frequency couplings are both by means of band-pass filters, giving a total of four I.F. tuned circuits, in order to secure a maximum of adjacent channel selectivity with a minimum of sideband cutting. The voltage supplies to the various circuits are decoupled with an unusual thoroughness, and in addition to the field winding of the moving-coil loud speaker a choke is included in the smoothing circuit; mains hum is consequently a negligible factor. For this the use of large capacity electrolytic condensers is undoubtedly partly responsible.

The components are assembled on a steel chassis, and a number of unusual features is to be found in connection with the controls. The wavechange switch, for instance, is operated by sliding the escutcheon of the station calibrated tuning scale vertically, and this serves also to reveal the appropriate scale on the illuminated dial. The gramophone switch is linked to the tuning knob, and when the dial is fully rotated in a clockwise direction, a switch on the end of the condenser spindle is operated to connect a pick-up in circuit. The remaining two knobs are thus confined to the mains on-off switch, and the volume control, which operates by controlling the bias voltage applied to the two variable-mu valves.

It is intended by the makers that the trimmers on the two pre-selector circuits be adjusted by the user to suit his particular aerial, and two holes beneath the cabinet allow of easy access to these. The procedure is simple, for it is merely necessary to tune in a station on a wavelength below 300 metres and to adjust each trimmer in turn for optimum signal strength.

FEATURES.

Circuit.—*Five-valve superheterodyne with variable-mu H.F. and I.F. stages, single-valve pentode frequency changer, power grid second detector, and pentode output stage. Band-pass I.F. couplings, and two-circuit pre-selector.*

General.—*Built-in moving-coil loud speaker with field winding included in the smoothing circuit. Provision for external speaker and the connection of a gramophone pick-up. H.T. supply by valve rectifier.*

Controls.—*(1) Single-tuning control with calibrated and illuminated dial, combined with radio-gramophone switch. (2) Mains on-off switch (3) Volume control. (4) Wave-change switch.*

Price.—*26 guineas.*

Makers.—*Messrs. Varley, Ltd., Kingsway House, 103, Kingsway, London, W.C.2.*

The receiver has been tested at about nine miles from Brookmans Park, and it gave a good account of itself, stations being receivable at almost every degree on the dial. The sensitivity, as already mentioned, is ample for all requirements, and the adjacent channel selectivity is high enough to satisfy all but the most ardent D.X. fiend. The selectivity shows that the tuning curve is somewhat asymmetrical, for interference due to a station on a wavelength lower than that of the desired transmission is rather easier to eliminate than that caused by a station on a higher wavelength. Thus, the spread of the London Regional did not extend more than two channels on the higher wavelength side, but about four channels on the lower wavelength side.

Background Hiss Absent

The usual points of second channel interference due to the two locals were found, as is only to be expected; and due to the proximity of the London stations, a number of other whistles were found while they were working. In spite of the use of variable-mu valves, a slight tendency to cross-modulation became evident. The use of a smaller aerial entirely removed this tendency without leading to any sacrifice in the number of stations obtainable, and such an aerial is desirable in cases where the set is to be used close to modern high-power transmitters. Background hiss is commendably low, and the quality of reproduction reaches a satisfactory standard. The highest musical frequencies are somewhat attenuated, but there is no trace of boominess, and on both speech and music the tone is well balanced.

The external appearance of the set is pleasing, the cabinet being walnut finished, and the operation is extremely simple. A disappearing carrying handle is fitted, and concealed air vents are fitted in the top of the cabinet to ensure adequate ventilation. Sockets are provided at the back of the set for the connection of an additional loud speaker, and a switch allows of the internal speaker being cut out of circuit if desired. Sockets for the connection of a gramophone pick-up are also fitted, and clips carried on the rear of the cabinet allow of the mains flex being tidily coiled up when the set is to be carried about.

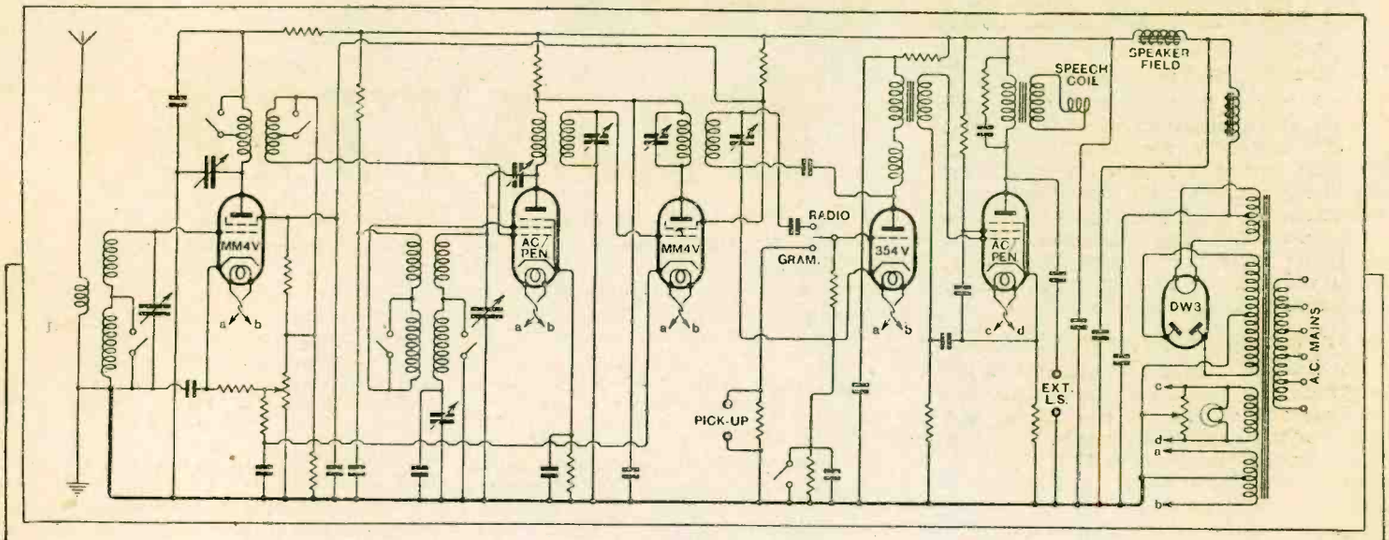
oooo

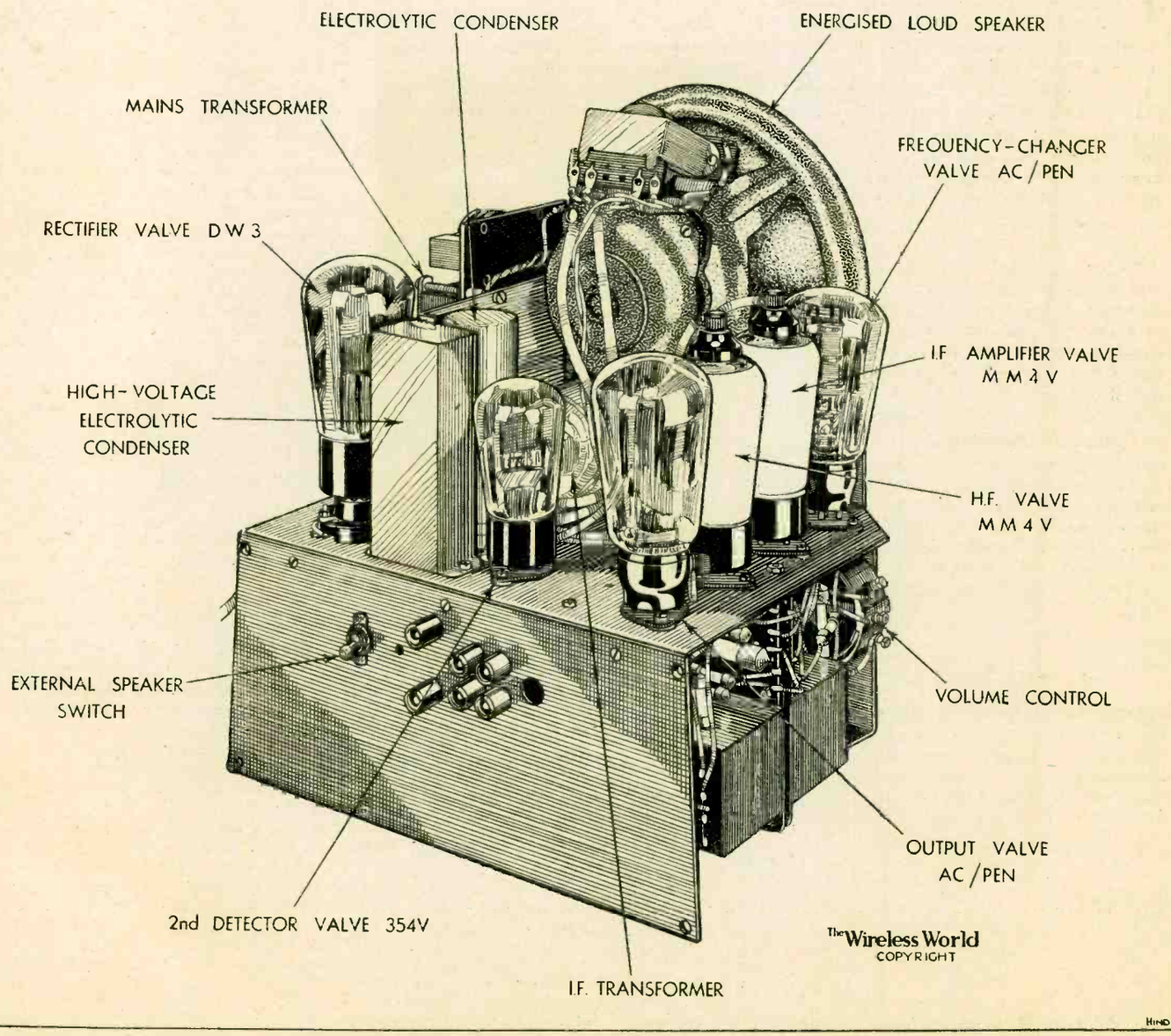
TRADE NOTES.

Lotus Radio Co., Ltd., Lotus Works, Mill Lane, Liverpool, announce the opening of a depot at 26, Fountain Street, Belfast, Ireland. This is under the charge of Mr. Robert Scott, whose activities in connection with the annual exhibition held by the Ulster Radio Traders' Association are well known to all wireless dealers in Northern Ireland.

The Clayton (Rubber Sales), Ltd., Progress Works, Clayton, Manchester, have completed arrangements for amalgamation with H. B. Potter & Co., Ltd., Rochdale, well known as makers of ebonite. The pooled facilities of the two companies will assure a more efficient service at competitive prices. The latter firm's ebonite is now marketed under the name of the Clayton (Rubber Sales), Ltd.

Sensitive Five-valve Mains Receiver





Showing the chassis and circuit details of the Varley superheterodyne. The internal speaker can be switched out of circuit when not required.

BROADCAST BREVITIES

By Our Special Correspondent

"A Great Research Centre"

IT is a pity to have to explode the story that Daventry is to become a great research centre for the B.B.C., and that the 5XX masts are to be retained for special experiments. The true story is very different and much briefer, for it boils down to the plain fact that Mr. Ashbridge is wondering what to do with the masts, which will soon be nothing more than an encumbrance to the Empire station.

Mr. Ashbridge's Dilemma

To dismantle them for transfer to the Droitwich site would cost more than the purchase and erection of new masts, and to leave them standing would entail a maintenance service to save them from disintegration and collapse. They might, of course, be used for short-wave tests, but the engineers are not enthusiastic.

Souvenirs ?

The B.B.C.'s best course, to my mind, would be to melt down the masts and manufacture metal souvenirs. What could be a more acceptable present than a Daventry paperweight or a "Broadcasting House" mug?

Empire Revolt

THAT Empire listeners should be lodging objections to the use of "canned" or Blattnerphoned programmes from Daventry is a little surprising, but is nevertheless a fact.

I think the trouble is due to the innate honesty of the B.B.C. If the word Blattnerphone had never been mentioned, not an overseas listener would have complained. Reception is not so pure and clear-cut at two or three thousand miles that a listener can detect whether the programme is first hand or not.

The Canadian Problem

The Indian zone seems the happiest of all in its reception of the Empire programmes. Very soon after the opening ceremony cables of congratulation were received from all corners of India. A satisfying response has also come from the other zones, with the exception of Canada. After two days' service, not one Canadian acknowledgment had been received at Broadcasting House.

This obviously points to the unsuitability of the chosen wavelengths.

Skipping Over the Dominion

The 49.6- and 31.3-metre transmissions to Canada are simply not touching the Dominion, but are coming down to earth in the Pacific Ocean. I wish Mr. Ashbridge success in his efforts to get a special 70-metre wavelength with a shorter skip distance.

War Clouds

ANOTHER ugly quarrel seems to be breaking out between the B.B.C. and the music halls. What a start for 1933!

Layton and Johnstone, Norman Long and, I believe, several other popular broadcasters, have suddenly been barred from the microphone for an indefinite period by reason of their music-hall contracts.

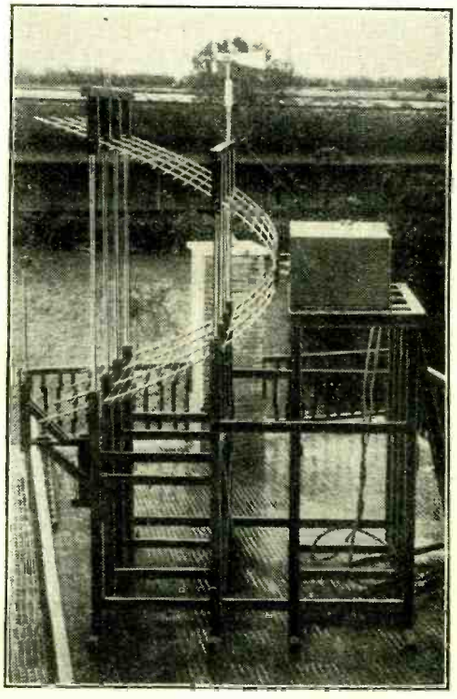
Odd . . . Queer . . . Strange . . .

There is something inscrutable about these happenings. I believe I am correct in saying that many of the vaudeville artists who broadcast are tied by similar contracts but that the music hall interests, until such time as it suits their purposes, put the telescope to the blind eye.

Why are they now doing otherwise?

But They Don't

The music halls ought to have realised by now that no artists are more popular on "the boards" than those who are known to all as broadcasting stars.



IN THE VATICAN GARDEN. Marchese Marconi's latest type of ultra-short wave combined transmitting and receiving aerial, which has been erected in the grounds of the Vatican at Rome. To the rear of the aerial is the remotely controlled apparatus.

B.B.C. Broadcasting the Test Match

IF you are reading these lines at the breakfast table pause for one moment to tune in Alan Kippax broadcasting an eye-witness account of the Second Test Match. He begins at 8.5 a.m.

You Heard It?

LET Mr. C. Whittaker-Wilson have his due meed of praise for "Mozart"—the narrative play broadcast last week. Restricted to the period of one hour, the play was necessarily episodic in character.

It was not Whittaker-Wilson's fault, I hope, that we were given such maddeningly brief moments of the thing that mattered most in Mozart's life—his music.

Christmas "Proms"

TO-MORROW evening Sir Henry Wood mounts the rostrum at the Queen's Hall for the umptieth time, on this occasion to inaugurate a musical experiment. The Christmas Season of Promenade Concerts will run until Saturday, January 14th, and each concert will be broadcast from one or other of the B.B.C. stations.

A Pioneer

SID FIRMAN, who died last week at the age of 36, was a radio pioneer in that he directed the first official broadcasting dance band. Formed early in 1926, this was known as the London Radio Dance Band, and its evening performances from "2LO" had a large following of listeners.

"The Country of the Blind"

THE first broadcast of an H. G. Wells story, specially adapted to the microphone, is an important event. "The Country of the Blind"—one of the most plausible of Wellsian improbabilities—is to be given Nationally on January 9th and Regionally on January 10th, under the direction of Mr. E. J. King-Bull.

A considerable amount of new dialogue has been found necessary for the broadcast version of the tale, and although "H. G." has not written this himself, he has given it a plenary blessing.

"Pieces of Tape"

IT is a solemn thought that already thirty miles of Blattnerphoned programmes are reposing in the archives at Broadcasting House. On January 13th, the B.B.C. will resurrect some of the tape in order to give us a news narrative covering the year 1932.

The excerpts will consist principally of outside broadcasts which cannot be repeated. Some of them are therefore of great historic interest, and will probably be considered priceless fifty years hence; that is, if the steel tape retains its magnetism for so long!

Publicity for Public Houses

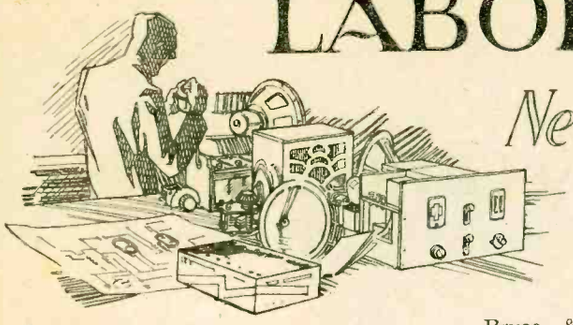
PUBLIC houses are figuring in the wireless news. A test case is shortly to be heard in the High Courts to decide whether public houses with wireless sets should pay copyright royalties to the Performing Rights Society.

Hard on the heels of this news comes a note from a Turin friend to the effect that the Italian Broadcasting Company (E.I.A.R.) has sent a dignified letter to the National Federation of Public Houses pleading that sets in bars shall be switched off during religious services.

Apparently the public-house and café proprietors of Italy had contracted the bad habit of switching on "Matins" so that their clients could slake their thirst and salve their consciences simultaneously. "One at a time," says the E.I.A.R.

LABORATORY TESTS

New Radio Products Reviewed



BRYCE POWER PACK, MODEL AB.2.P

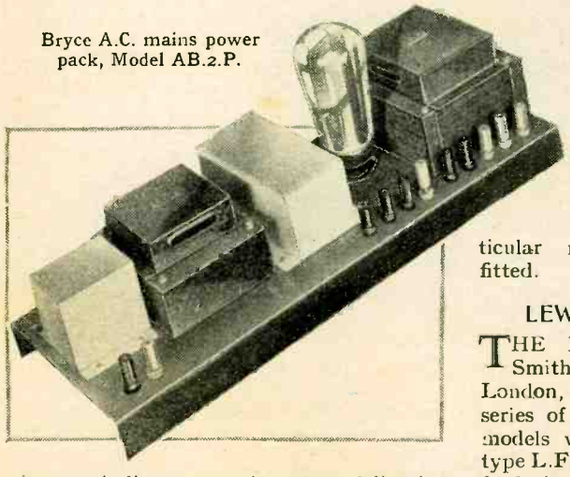
THIS is a complete A.C. mains power unit, and consists of a metal chassis, measuring 16¾in. × 6¼in., on which is assembled, ready for wiring, a mains transformer, rectifying valve socket, a L.F. choke and smoothing condensers. Input and output sockets are fitted, and each is clearly marked.

The model AB.2.P is intended for use with a "C" class rectifying valve, such as the Mazda UU120/500, and, in addition to providing a perfectly smooth H.T. supply of over 500 volts at 100 mA., two separate L.T. supplies are available, one rated at 4 volts 5 amps. and the other at 4 volts 2 amps.

The first mentioned would be employed as the heater supply for the earlier valves in the set or amplifier, while the latter is apparently intended to feed the output valve. Only the 5-amp. L.T. winding is provided with a centre tap.

All the components employed are well suited for the parts they have to play; indeed, the specification is most generous. The reservoir condenser is tested at 2,400 volts D.C., while the main smoothing condenser fitted after the choke is a 1,500-volt D.C. test type, and in each case the capacity is 4 mfd. The smoothing choke is a Bryce model AB.105A, which has a rated inductance of 50 henrys and is designed to carry 120 mA.

The measured output on load was 683 volts at 10 mA.; 595 volts at 50 mA.; 518 volts at 100 mA., and 490 volts at 120 mA. Both L.T. supplies are well regulated, and do not vary to any appreciable extent with the H.T. load. With 100 mA. flowing the 2-amp. winding gave 4.04 volts, and the



Bryce A.C. mains power pack, Model AB.2.P.

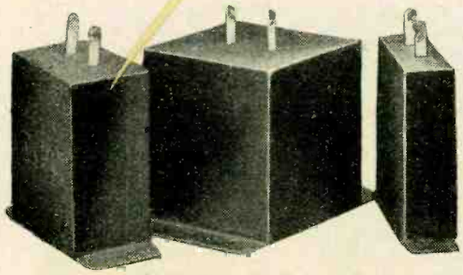
5-amp. winding 3.99 volts when delivering their rated output currents. The hum level is very low indeed, and is attributed to the generous nature of the smoothing equipment employed.

This unit forms an ideal power pack for incorporating in the design of a mains set or radio-gramophone, for there is ample power available to meet the requirements of the most ambitious design.

The makers are Andrew Bryce & Co., Woodfield Works, Bury, Lancashire, and the price is £5.

T.C.C. TYPE 87 CONDENSERS

THE Type 87 condensers made by the Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3, are especially well suited for use in modern mains receivers, for although they are rated at 400 volts D.C. working they are designed to withstand peak pressures of 600 to 650 volts. This clear statement is of far more value than a test voltage figure, since it indicates without ambiguity the actual maximum potential it is safe to apply to the condenser under working conditions. It must be borne in mind that if the D.C. output from the



T.C.C. mains condensers rated to withstand 650 volts peak value.

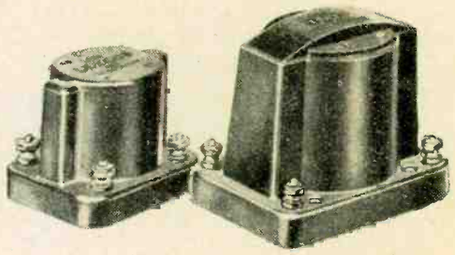
mains rectifier is 400 volts after smoothing at the working load, the reservoir condenser immediately following the rectifier may be subjected to peak voltages of the order of 600 volts, and this fact has been taken into consideration in the design of the Type 87 condensers.

We have verified by test with some specimen condensers that an adequate factor of safety is allowed; for although a considerably higher voltage than the working peak value was applied to each specimen, there was not a single failure.

This type is made in five different sizes, from 0.1 to 4 mfds., the prices ranging from 2s. 3d. to 8s. They are mounted in the familiar green metal cases distinctive to this particular make, and soldering tags are fitted.

LEWCOS L.F. TRANSFORMERS.

THE London Electric Wire Co. and Smith's, Ltd., Church Road, Leyton, London, E.10, have now augmented their series of L.F. transformers with two new models wound on nickel-iron cores. The type L.F.T.4 is intended for use in a parallel-feed circuit, as the core is not designed to withstand the magnetising effects of even small amounts of D.C. current. On test we found its primary inductance to be a shade over 80 henrys, so that a good overall response may be assured with an amplifier fitted with this model. It has a nominal step-up ratio of 1 : 4, and the price is 6s. 9d. The model L.F.T.6A is appreciably larger in size, and will carry up to 2 mA. of D.C.; if a current of greater magnitude than this flows in the anode circuit of the valve it would be best to employ the parallel-feed



Two new Lewcos L.F. transformers, the L.F.T.4 and L.F.T.6A.

system of connection. The step-up ratio of this model is 1 : 6, and its measured primary inductance was found to be 21.5 henrys with no D.C. flowing. The price is 10s. Both transformers are housed in cleanly moulded bakelite cases, with the terminals placed in the most convenient position for wiring.

AMPLION M.C.22 LOUD SPEAKER

HAVING regard to the generous dimensions of the permanent magnet—in particular the exceptional length of the magnetic circuit—it might reasonably be predicted that this unit would have an overall efficiency rather better than the average of its class. Our tests confirmed this view, and the sound output for a given power was found to be between 3 and 4 decibels above the average for its class.

The quality of reproduction is excellent, and compares favourably with the most expensive moving-coil types at all parts of the musical scale, with the exception of the extreme bass below 100 cycles. A resonance at 150 and a small one at 2,500 cycles are

Amplion type M.G.22 permanent-magnet moving-coil loud speaker.

the only aural deviations from a smooth response from 100 to 6,000 cycles. Further tests at 8,000 and 10,000 cycles showed the response at these frequencies, although below the general level, to be very much better than the average. The general effect

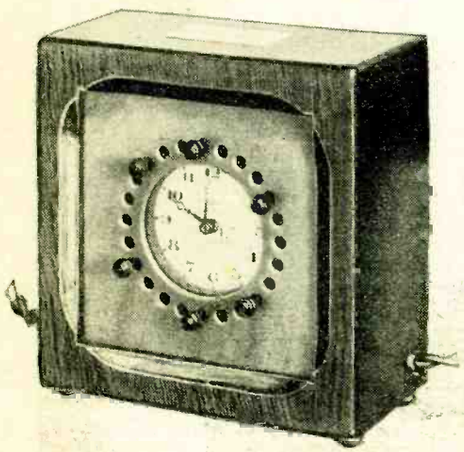
is one of exceptional clarity, while the enhanced output in the region of 150 cycles provides sufficient bass for the majority of transmissions.

Mechanically, the unit is soundly made and very well finished. The diaphragm is moisture-proof, and the five concentric corrugations give a free suspension at the edge; the centre spider appears to provide the principal control for the movement of the coil.

A three-ratio transformer, adaptable also for push-pull valves, is fitted, and the price of the complete unit is 39s. 6d. The makers are Amplion (1932), Ltd., 82-84, Rosoman Street, London, E.C.1.

NEW PROGRAMME SELECTOR.

AN automatic programme selector consisting of a reliable time-piece, in which is incorporated a switch mechanism for switching on the receiver at any pre-arranged time is now obtainable from Fredk. J. Gordon and Co., Ltd., 92, Charlotte Street, London, W.1. Known as the Electone, it



Electone automatic programme selector for mains and battery sets.

is provided with twenty-four contact sockets spaced at half-hour intervals round the circumference of the dial. Special plugs are supplied which are fitted into the sockets adjacent to the time at which the particular items in the broadcast programme are required. Each socket covers a period of half an hour, so that if the set is required to be operative for one hour continuously, two plugs would be inserted into adjacent sockets. At the end of the pre-arranged period the clock switches off the receiver, and the process is repeated for the next item selected.

As the selection covers a period of twelve hours only, it must be reset for morning and afternoon sessions. It is applicable either to mains sets or to battery-operated receivers, the switching being capable of handling the wattage taken by the average mains set without sparking at the contacts. The price is 27s. 6d.

DISTANT RECEPTION NOTES.

THE remarkable variations in temperature that began shortly before Christmas were accompanied, as might have been expected, by some atmospheric interference. Atmospherics, though, were of such a mild kind that it cannot be said that they were sufficient to spoil reception, except possibly when attempts to receive American stations were in progress with the set in its most sensitive condition. Atmospherics apart, conditions continue to be remarkably good.

The number of medium-wave stations that can now be received two full hours before darkness falls is very large—it would probably be larger still but for the fact that a good many foreign stations have long intervals in the afternoons during which no transmissions are made.

At the time of writing, Toulouse's new 60-kilowatt transmitter is still not in regular operation, though the testing period must now be drawing to a close, and within a short time the new plant will naturally supersede the old. Readers who have heard the new transmitter at work will have noticed the greatly improved quality. Another high-powered newcomer is the 80-kilowatt Athlone, which replaces the old 1.2 kilowatt Dublin transmitter. Though Berlin Witzleben is coming in strongly at the moment, I am afraid that readers will find it almost completely blanketed by the Irish Free State station. Katowice, too, enters the category of stations difficult to receive, owing to its position between Söttens and Athlone. But for the occurrence of sideband splash a good superheterodyne could separate these and other high-powered stations upon adjacent wavelengths; this, unfortunately, is a kind of interference which ruins all pleasure in listening to transmissions which it affects.

Fading: A Test Station.

I have seldom known a time when fading was less in evidence. In my locality Fécamp is an excellent test station for fading. When it is at all bad, reproduction of this station's transmissions varies from a roar, which demands instant and full use of the volume control to complete silence. For several evenings now I have been able to receive Fécamp quite steadily. A milliammeter placed in the plate circuit of the detector valve shows that there is some fading, but it is not violent enough to be annoying.

In the absence of serious fading, the lower part of the medium band is well worth attention, though there are times when spark transmissions are more than a nuisance. Magyarovar, or Budapest No. 2, on 209 metres, continues to be very well received, and I have recorded this station many times early in the afternoon. Kiel also comes through with surprising strength at times on 232.2 metres. When spark interference is absent, Nürnberg provides first-rate reception. Both Trieste and Turin are in excellent form, but I have not yet heard the 20-kilowatt Bari on 269.8 metres. Possibly I have been unlucky in the times at which I have tried for it. Valencia, which was so well heard not long ago, is seldom to be picked up nowadays.

The Best Transmitters.

I am rather wondering whether Leipzig was using Frankfurt's wavelength on one recent evening owing to the amazing strength with which the transmission on 259.3 metres was received. As a simultaneous broadcast was in progress, identification by call-signs was not possible.

A selection of first-rate stations at the present time includes Huizen, Radio-Paris, Zeesen, and Kalundborg on the long waves, and on the medium wave band Budapest (the relay on 840 metres should be good, by the way, if either set of coils will tune up to or down to this wavelength), Munich, the two Brussels stations, Florence, Prague, Langenberg, Rome, Stockholm, Katowice, Leipzig, Strasbourg, Brno, the Poste Parisien, Breslau, Göteborg, Bordeaux, Lafayette, Hilversum, Bratislava, and Heilsberg.

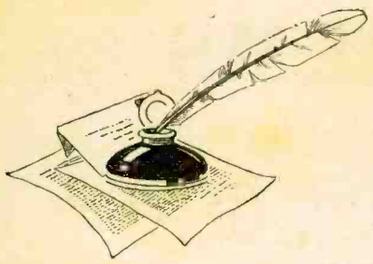
D. EXER.

PRINCIPAL BROADCASTING STATIONS IN AMERICA.

Metres.	Kc/s.	kW.	Call-sign.	Station.
468	640	50	KFI	Los Angeles, Cal. (E. C. Anthony, Inc.).
455	660	50	WEAF	New York (Nat. Broadcasting Co., Inc.).
429	700	50	WLW	Cincinnati, Ohio (Crosley Radio Corp.).
417	720	25	WGN	Chicago, Ill. (The Tribune Co.).
395	760	30	WJZ	BoundBrook, N.J. (Nat. Bcg. Corp., Inc.).
390	770	25	WBBM	Chicago, Ill. (W.B.B.M. Bcg. Corp.).
380	790	50	WGY	Schenectady, N.Y. (General Electric Co.).
366	820	10	WHAS	Louisville, Ky. (Courier Journal Co.).
361	830	12.5	KOA	Denver,Colorado (Nat. Bcg. Corp., Inc.).
349	860	50	WABC	New York (Atlantic Broadcasting Corp.)
349	860	50	WBOQ	New York (Atlantic Broadcasting Corp.).
375	800	50	WBAP	Fort Worth, Texas (Carter Publns. Inc.).
375	800	50	WFAA	Dallas, Texas (Dallas News and Journal).
345	870	50	WLS	Chicago, Ill. (Agricultural Bcg. Co.).
345	870	50	WENR	Chicago, Ill. (National Bcg. Corp. Inc.).
306	980	50	KDKA	Pittsburg, Pa. (Westinghouse Co.).
303	990	25	WBZ / WBZA	Boston, Mass. (Westinghouse Co.).
300	1000	50	WOC	Devonport, Iowa (Central Bcg. Co.).
300	1000	50	WHO	Des Moines, Iowa (Central Bcg. Co.).
283	1060	50	WTIC	Hartford, Conn. (Travellers Bcg. Service).
280	1070	50	WTAM	Cleveland, Ohio(National Bcg. Corp., Inc.)
275	1090	50	KMOX	St. Louis, Mo. (Voice of St. Louis Inc.).
265	1130	20	WJJD	Mooseheart, Ill. (Loyal Order of the Moose).
261	1150	25	WHAM	Rochester, N.Y. (Stromberg-Carlson Telephone Mfg. Co.).
256	1170	50	WCAU	Philadelphia, Pa. (Universal Bcg. Co.).
254	1180	20	KOB	State College, New Mexico (College of Agriculture).
252	1190	50	WOAI	San Antonio, Texas (Southern Equip. Co.).

SOUTH AMERICA.
Argentina.

303	990	10	LR4	Buenos Aires (Radio Splendid).
316	949	7.5	LR3	Buenos Aires (Radio National).



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

Electrical Interference

I SHOULD like to testify to the enthusiasm and thoroughness of the P.O. engineers in tackling this problem.

Having suffered moderate interference in a very disturbed area for many months, a new and unknown terror suddenly overwhelmed my reception, and I accordingly adopted the constitutional method required by the B.B.C. to enable them to deal with the matter, and filled in and rendered the form which they ask complainants to complete. Frankly, I expected nothing to happen, and I was agreeably surprised to receive frequent visits from most competent people from the P.O. engineering staff, who, by patience and persistence, eventually traced the source of my trouble and induced the owners of the interfering mechanism to apply a gadget which has put *finis* to the disturbance.

It is right that the public should know that the authorities when approached are not only willing to assist in every way, but do actually achieve results.

EUSTACE BAYNES.

London, W.1.

Are There Too Many Operators?

I HEARTILY agree with "Wordaw" that there are too many operators, and that something ought to be done to control the number of new wireless students. This, however, is not for the shipping companies, but I think it is for the Association of Wireless and Cable Telegraphists to publish the true state of affairs. Some of the colleges advertise extensively, and in their prospectus guarantee positions with marine wireless service companies, on the student obtaining the first-class P.M.G. certificate. This guarantee states no time limit, and, consequently, the student may have to wait many years for his "guaranteed" appointment. I have experienced this, having been waiting two years now, and a recent enquiry elicited the reply that there will be no positions for some time yet. The result is I have lost about £200 in expenses and two years' work, and will probably have to start on another career. QUENCHED.

I QUITE agree with "Wordaw" that the supply of trained operators by far exceeds the demand.

"Wordaw" further states that there are several operators holding the old first-class tickets with berths, but he should remember that most of these men have had several years' experience, and the man from the college with his new first-class P.M.G. is, after all, inexperienced as far as actual working conditions go.

I can see no prospect of employment at all for the man from the college, as even with a first-class P.M.G. certificate the manufacturing and other employers in the radio industry consider him of little or no use unless he has had other experience.

I went to one of the colleges, but on learning the true facts "packed in," and would advise other young men desirous of entering the operating profession to think well before throwing good money down the drain.

F. C. VIZE.

Marlborough, Wilts.

Tuning Scales

WITH reference to the recent correspondence on tuning scales appearing in your columns, the following description of the micrometer dial as fitted to the Philips Super Inductance Five Type 630A, may be of interest:—

The wavelengths are approximately indicated on the main dial by two concentric scales with divisions every 25 metres for the medium waveband and every 50 metres for the long waveband. The scale which is not in use is masked automatically.

For the purpose of accurately logging the position of each station, the condenser travel is divided into one thousand equal divisions, as follows:—

A micrometer disc mounted concentrically with the main scale is equally divided into one hundred numbered divisions, and is geared to make ten complete revolutions as the condenser is rotated. Each revolution of the micrometer disc therefore covers one-tenth of the condenser travel, and is indexed by a different letter on the main dial.

The position of each transmitter is logged by an index letter and micrometer number. For example: London Regional—E.52. A station identification chart supplied with each set shows a list of the European transmitters with their wavelengths. Against each station most likely to be received in this country is printed the corresponding index letter and micrometer number. The exact tuning positions of 70 stations are indicated in this way.

The advantages of the micrometer scale are obvious. Under the most unfavourable conditions from the point of view of crowding of stations, namely, at the lower end of the medium waveband, two channels separated by 9 k.c.s will still be separated on the micrometer dial by 4 degrees (6 mm. of scale); to quote an exacting example: Cork on 224 metres will be received at, say, B.43, and Fécamp at B.40. These two stations are only separated by 8 k.c.s, but have a separation of 3 complete scalar divisions.

In order to obtain a similar scale on a single disc, the circumference would need to be over five feet.

PHILIPS LAMPS, LTD.,
A. B. CALKIN.

BRITISH PATENTS AND DESIGNS STATUTES, as Amended and Consolidated to 1932, by H. J. Bliss, B.A., F.I.C. (Barrister-at-law). Pp. viii+126. Stevens & Sons, Ltd. Price 4s. 6d.

A SHORT summary is given of the principal changes in patent practice brought about by the Act which came into operation on the first of November last. This followed by a consolidation of the Patents and Designs Acts from 1907-1932, set out section by section, with short footnotes indicating the effect of the new Act in each case. An extensive index completes a work which is undoubtedly a useful guide to those interested in patent matters. The fact that publication comes hot-foot on the new Act has unfortunately made it impossible to cover the provisions of the Statutory Rules and Orders (No. 873) just issued by the Board of Trade.

W1WV.—A very well known American station owned by Mr. Miles W. Weeks of Brookline, Mass., whose activities in amateur radio date back as far as 1909. In his time he has travelled round the world in more senses than one. Mr. Weeks is a member of the A.R.R.L. and R.S.G.B. and is Section Communications Manager for East Massachusetts.

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.

Plotting a Calibration Curve

WHEN calibrating a receiver by the usual method of preparing a curve in which condenser readings are plotted against the wavelengths of a few well-known stations, it is a matter of some importance that the line which links together the various points on the graph should be properly drawn.

These remarks are prompted by a letter from a reader who has attempted to calibrate his set in this manner, but finds that over certain sections of the tuning scale there are serious discrepancies. He submits a copy of his calibration chart for our comments.

We offer the following suggestions as a guide to this querist, and to others who are proposing to adopt a similar plan. In the first place, an extra "point" or so should be taken at both the upper and lower ends of the tuning scale. Secondly, the various points should be joined together by a smooth flowing line, and not by straight lines. Thirdly, any point which obviously does not fall on the line should be ignored, as it probably represents an error in reading or in identification.

We have reproduced our correspondent's chart in Fig. 1, and, as it is on a smaller scale, the errors have been exaggerated in order to make them more clearly evident. His own curve is shown in a dotted line,

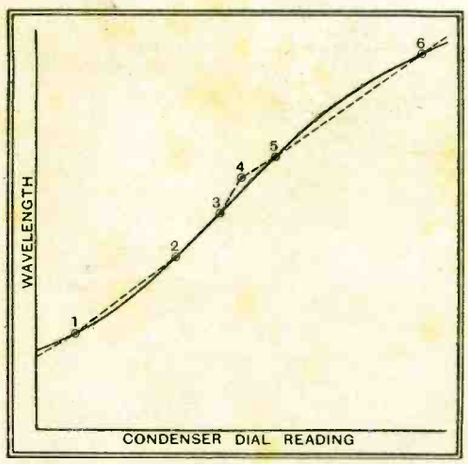


Fig. 1.—When preparing a calibration chart, the "points" should be joined together by easily flowing lines.

our correction being represented by a full line. Point No. 4 is almost certainly incorrect, as it does not lie on the straight line which links points 2, 3, and 5. Point No. 5 should be joined to No. 6 by a gently curving line instead of by a straight line. The same applies to the line between 1 and 2; point No. 1 does not lie on the straight line which unites points 2, 3, and 5.

Rather Unsatisfactory

IT is mildly disquieting to find that the effect of removing the earth connection is to improve signal strength, and not to decrease it, as might be anticipated. A reader who is using a "2-H.F." set, fed from A.C. mains, has noticed that this actually happens, and asks for our comments.

It should be remembered that an earth connection has an important effect on the stability of a sensitive set, and that, by removing it, uncontrollable self-oscillation is often provoked. In all probability, there is a slight tendency towards instability in our reader's set; this is increased by removing the earth, and the nett result is that the gain in sensitivity by increased stray reaction is greater than the loss brought about by removal of the earth. In any case, a more-or-less effective earth connection is provided automatically through the mains connection.

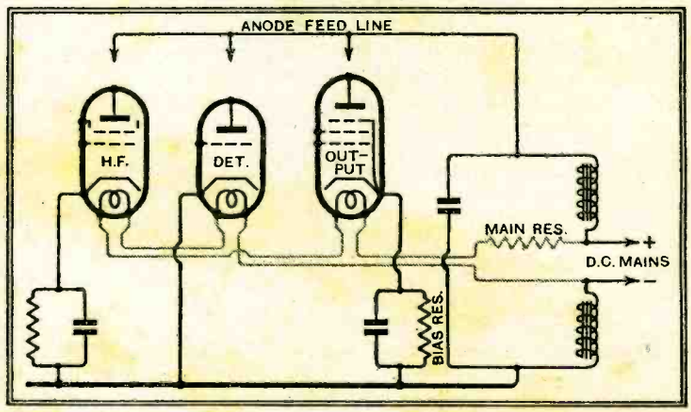


Fig. 2.—With indirectly heated D.C. valves, smoothing chokes may be connected in both positive and negative H.T. leads without being called upon to pass current for the valve heaters.

This is not an effect about which one need be unduly perturbed, but it would perhaps be slightly more satisfactory to try to increase normal sensitivity, with an "earth," to the level at present obtainable without one.

Too Automatic

THE owner of a Murphy A.8 complains that the absorption wavemeter discussed in these pages a few weeks ago gives no indication of the wavelength to which his set is tuned. The meter is known to be in order, as it behaves perfectly satisfactorily when used with a "straight" set with which it has been calibrated.

But surely this is exactly what one would expect. The Murphy set includes automatic volume control, and so the effect of absorbing energy from the aerial circuit into the wavemeter will be immediately masked, because the receiver will automatically make itself more sensitive, and signal strength will be restored. There is such a short time lag that the momentary reduction will be unappreciable to the ear.

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.

A radiating wavemeter (buzzer or valve) is, practically speaking, the only type suitable for use in conjunction with a set having automatic volume control.

Negative Smoothing

AN inaccurate circuit diagram, submitted by a reader, would suggest that the principles of "negative smoothing" are not fully understood. This matter, so far as it affects D.C. mains sets with modern indirectly-heated valves, was discussed in *The Wireless World* of Nov. 18th.

A smoothing choke in the negative H.T. lead, in addition to that usually fitted in the positive lead, is only likely to be necessary when the mains are unusually "rough." It should be made quite clear that neither choke should be in series with the heater supply circuits, and the easiest way to visualise the arrangement is to regard this circuit and the anode supply system as separate parallel branches. A consideration of Fig. 2 will help to make this clear; the wiring associated with the heater circuits is "faded" in order to throw into prominence the rather more complex smoothing and anode supply system.

In this diagram the sequence of heater wiring is so arranged that the detector valve is at the negative end of the chain.

Both negative and positive smoothing are included in the new D.C. set described this week.

D.C. Monodial: Detector Anode Voltage

THE question is asked whether it would not be an advantage to increase the anode voltage applied to the second detector of the Monodial D.C. Super; the valve is actually fed through a decoupling resistance of fairly high value, and the reader who raises this point is prepared to substitute a high-inductance choke if this alteration is likely to confer any advantage.

It should be realised that the detector feeds through a step-up transformer a pair of parallel connected high-efficiency pentodes which require a comparatively low input voltage. Consequently there is no advantage in legislating for a large detector output. On the contrary, it is beneficial to limit its maximum output to a value which makes serious overloading of the output pentodes a virtual impossibility. The arrangement of the original set acts to a limited extent as an automatic volume control, and no improvement whatever in quality is to be expected as a result of making the change suggested by our querist.