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OPTIMISTIC PERFORMANCE CLAIMS.

THE question of what performance can be legitimately expected from a three-valve receiver consisting of detector with reaction followed by two low-frequency stages forms a subject for heated debate in our correspondence columns. The interest attaching to the matter is clearly indicated by the enormous volume of correspondence which we have received on the matter. We have only been able to find room for a selection of the letters in our correspondence columns, but these are sufficient to enable us to draw conclusions, since they have been chosen so as to put both sides of the argument as fairly as possible.

There should really be no mystery about the performance of such a receiver. A straightforward receiver of this type used on an outside aerial is unquestionably not the receiver to be used where selectivity is desired, nor is it by any means an ideal arrangement for the reception of distant transmissions, because, to bring up a weak signal to a strength suitable for operating a loud-speaker it is necessary to use reaction beyond the limit which is permissible if satisfactory quality is to be obtained. But for simplicity this circuit probably has no equal, and, provided that it is used in a location reasonably remote from the local station, one may expect to get a choice of quite a number of British and Continental stations. We think the correspondence which has been provoked from those who look upon this circuit with disfavour is prompted by two considerations : (1) dissatisfaction because this receiver is prone to produce very serious oscillation interference, especially in the hands of unskilled users, and (2) because receivers employing this circuit have recently been very extensively advertised to the general public with no caution against mishandling nor any intimation that the set will be found unselective in the vicinity of a broadcasting station, which it will not be possible to cut out with an outside aerial.

An examination of the correspondence we have had on this subject indicates that those who are champions of this type of circuit are almost invariably users who are located well away from a broadcasting station. Those who grouse, on the other hand, are situated within the "swamping" area of a local station, and, consequently, are disappointed because, in spite of the statements which they have read as to the capabilities of the receiver, they find they are unable to cut out their local transmitter.

If the oscillation nuisance increases, it will not be difficult to put our finger on the cause, and it is very unfortunate that, whilst in most directions every effort is being made to reduce this trouble in order to improve the standard of reception, that manufacturers themselves should be responsible for undermining the good work that has been done. Unfortunately, we cannot even exonerate the B.B.C. from responsibility in this matter, for they themselves, on the occasion that they produced designs for three B.B.C. receivers which they recommended for good reception, each employed reaction on the aerial. Surely the B.B.C. and the manufacturers can do better than set such an example, for they have little to gain and everything to lose if the oscillation nuisance grows and the quality of reception is impaired.

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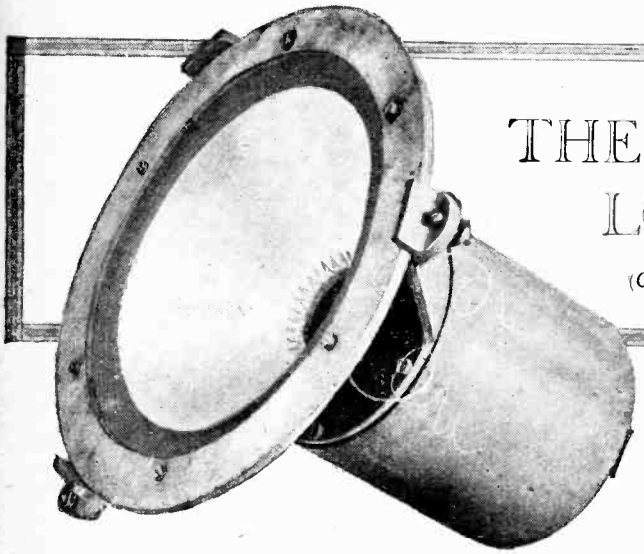
CHEAPER VALVES.

UNDER Correspondence in this issue we publish a letter from Dr. G. I. Finch in reply to our editorial comments in the issue of January 18th.

Our article criticises a newspaper report of the work done by Dr. Finch, and was certainly not intended to detract from the importance of any new developments in connection with the technique of valve manufacture due to Dr. Finch, who claims that, whereas the use of either sodium or potassium in the connection under discussion was known, the originality of his work consists in the employment of an alloy of the two metals which he claims gives results which are very definitely superior.



THE MOVING COIL LOUDSPEAKER.

(Concluded from page 95 of previous issue.)

Final Construction and Assembly. Battery Eliminators for Field Coil and H.T. Current.

BY F. H. HAYNES.

NO difficulty will be encountered in completing the construction of the moving coil loud-speaker after having reached the stage where the moving coil is wound, covered with its protective wrapping, and tested for continuity.

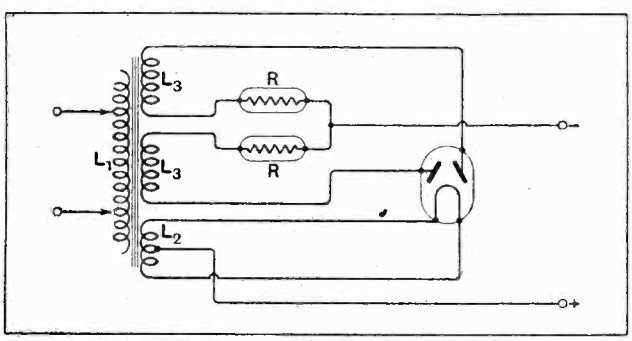
The diaphragm is cut from Bristol board having a thickness of 0.010in. The nature of the paper used has a marked effect upon the quality. If it is too supple waves will be set up across the diaphragm at moderately low frequencies instead of the diaphragm moving as a whole. At the same time excessive weight must be guarded against. Several forms of paper have been examined, and Bristol board of the thickness which is known as "two-sheet" was found to be the most satisfactory. It was observed, on purchasing various specimens of paper to this description, that it varied between 7 and 14 mils. (thousandths of an inch). It should have a thickness of about 10 mils., and when measured with a micrometer care must be taken not to compress the paper.

Before making the seam with the aid of "Seccotine" the faces to be joined should be roughened with glass-paper. While the diaphragm is still flat the surface should also be glass-papered along the curved edge to which the serrated pieces are to adhere. When sticking the diaphragm a little further adjustment can be made so that the inside rim clinches tightly round the moving coil former. It is better, at this stage, after the seam has thoroughly dried, to turn over the front flange with the aid of a piece of smooth slotted wood, the depth of the slot being exactly $\frac{3}{16}$in. To avoid fracturing the paper the turnover should be made by degrees.

Having carefully clipped out the serrations with a sharp pair of nail scissors the coil is attached to the diaphragm preferably with the aid of a circular piece of wood mounted exactly vertically on to a flat board. By this means the axis of both coil and diaphragm will coincide. It must, of course, be again removed for bending over the points from which the shellac must have been previously removed by scraping so as to facilitate sticking. It is useful to remember that "Seccotine" dries rather than sets. The points should be pressed down until they firmly adhere, and this will take place quicker in the open air. The attachment here must be exceedingly strong owing to the mass and rapid acceleration of the diaphragm when in operation. Buzzing on particular frequencies, or a "comb and paper" effect may result if even one of the points becomes slightly detached.

Material for Mounting Ring.

Sheet indiarubber as a mounting ring will not be a success as it perishes after a while, and, being stretched, the tension appreciably changes with the amplitude of the diaphragm's movement. Moderately thin sheep-skin is probably the best material, and it must not be overlooked that many of the white varieties contain free alum, so that in a moist atmosphere the deliquescent nature of the skin will cause the "Seccotine" fixing to become tacky. A specially selected brown variety of skin is suitable, for as well as being supple it possesses equal stretch in all directions. A skin which stretches more readily in one direction than in the other, and this is the general property of thin leather, will, after a while, cause buckling of the diaphragm. The piece of skin is laid out on the drawing board and, with a drawing pin in the centre, is carefully spread out flat by working outwards from the centre, taking points diametrically opposite in turn. In no circumstances must the skin be stretched, for when the circle is marked out and the drawing pins removed the circumference will



Heavy duty rectifier for supplying field current from A.C. mains.

The Moving Coil Loudspeaker.—

be found to be no longer round. To allow for slight discrepancies in this respect, however, the hole is made $\frac{1}{16}$in. less in radius than the diaphragm measured at the point where the bend over is made. The circle is best marked out with ink compasses and then cut away with a sharp knife. The superfluous skin is not removed until the diaphragm is secured to its outer plywood ring.

Another method is to apply "Seccotine" to the edge of the diaphragm, and having previously laid the skin out flat on the board used earlier, with its centre upright piece in position, to press skin and diaphragm tightly into contact with the blade of a screwdriver. When the adhesive has set the centre piece is cut away, preferably with a pair of curved bladed scissors. Last, the skin is attached to the under face of the plywood ring.

Unless a centring device is used "bagging" of the flexible rim must be avoided, and damping at the edge of the diaphragm by a moderately tight mounting does not appear to be altogether objectionable, tending to prevent a definite period of swing and strengthening the higher note frequencies. Strips of paper on the reverse side of the diaphragm and opposite to the seam protect the leading out wires.

Centring.

Centring devices, necessary in the case of the smaller gap, are easily arranged. It must be remembered that the centre of gravity of the edgewise mounted diaphragm is about 1in. to the front of the moving coil former. With the aid of a needle a cotton can be placed through the diaphragm at a point where it will hang with a horizontal axis. Three cottons may be arranged to pull out to posts on the face of the flange, terminations being made at the one end by means of a knot, and at the other by passing the cottons under elastic bands around the posts. Alternatively, and to provide easier adjustment, a $\frac{1}{4}$in. split brass rod may pass into the hole provided in the centre of the pole. This similarly carries an elastic band, under which the three cottons spaced 120° apart are terminated and readily adjusted. Such a form of centring creates slight damping on the diaphragm, so that it may tend slightly to bend when driven at lower frequencies than would normally be the case. It has been tried, however, and appears to give very satisfactory results. The cottons are arranged to be at right angles to the axis. When centring is employed, and it is almost essential in the case of the smaller gap, the edge of the diaphragm should be mounted in a more supple fashion, so that the centring strings are more effective in bringing the coil to the required position.

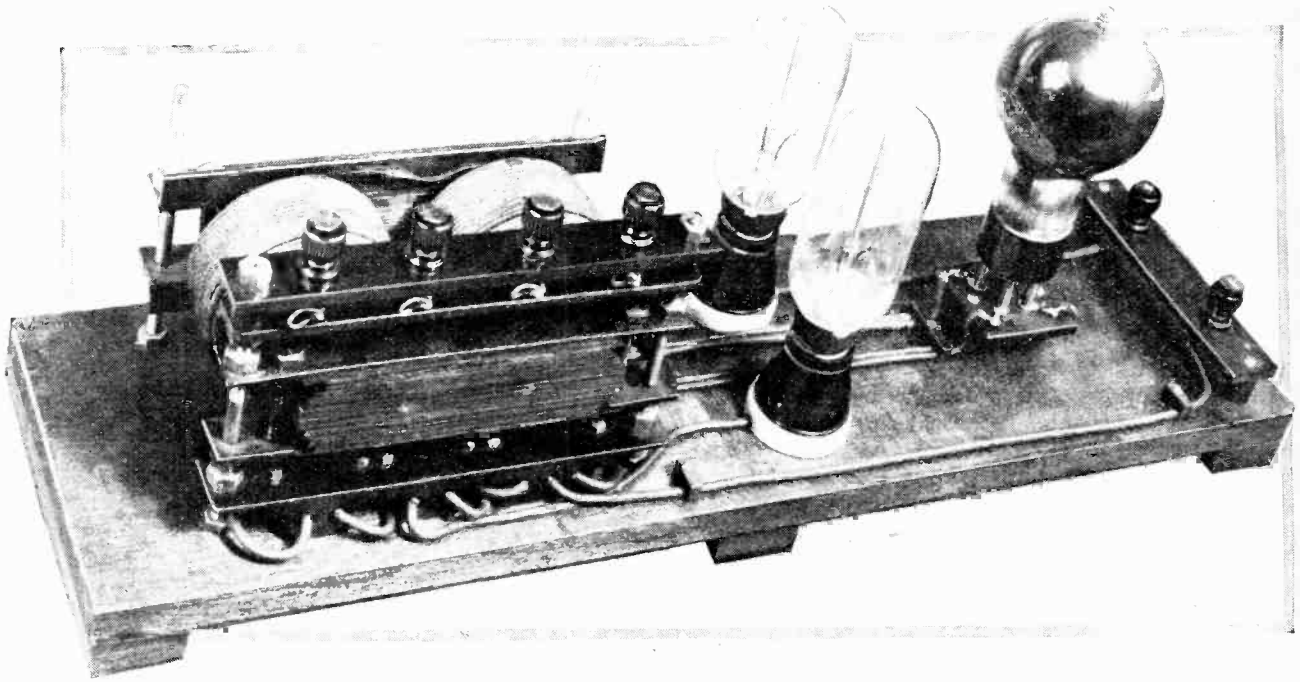
A re-entrant cone sometimes fitted as a stiffener to the moving coil former is scarcely considered necessary and

A.C. BATTERY CHARGER FOR FIELD CURRENT SUPPLY.

Components required.

1 Transformer giving output voltages of 20+20 and 2.
2 Batten screw type lamp-holders (G.E.C. pattern S.1190).
4 Valve legs for making holder for rectifying valve. Full wave rectifying valve Philips type 367 rated at:—Rectified current 6 amperes, transformer voltage 2×19.5, heater voltage 1.75, heater current 8.5 amperes.
2 Resistance lamps, type 340.
$\frac{3}{8}$in. Planed mahogany for baseboard and battens.
Input and output terminals.

Approximate cost £6:15:0, including valves and resistance tubes.



Battery charger for supplying field current. The charging rate is 7 amperes at 4 or 6 volts and the transformer input is 170 watts. With a field winding of No. 14 S.W.G., a current of 7 amperes will be passed at a voltage of 4.2 when the field winding is shunted with a 4-volt battery. This battery is neither on charge nor discharge and 30 watts is supplied to the field. A 4-ampere load is taken from a 6-volt floating battery and the watts fed to the field magnet approach 60. The flux density across the gap falls short of the calculated value owing to the considerable magnetic leakage.

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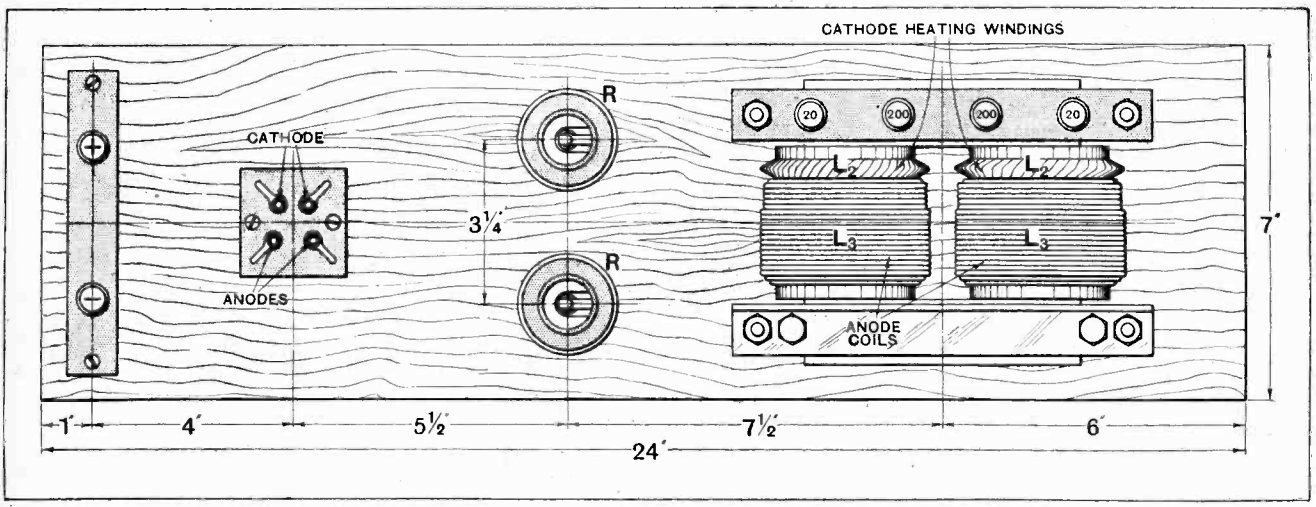
impedes the fitting of the centring device. If it serves as a barrier to seal the passage of air by a short path between the two sides of the diaphragm, it, at the same time, forms a rather dangerous pocket in which the air is cushioned. The purpose of a baffle is to create a long path between the two sides of the diaphragm, so that the bass frequencies involving considerable air displacement are not weakened by the neutralising of the compression current limiting resistances. Actually the output from the rectifier can be fed directly to the field winding of No. 14 D.C.C., though it is better both with a view to limiting the possibility of ripple as well as relieving the load on the arc rectifying valve, to float a 6-volt accumulator across the rectifier output. If this is done the field winding may then consist of No. 14 D.C.C., supplementing the charging of the battery by giving the rectifier a short additional run during intervals between the period



Layout of the components for constructing the heavy duty A.C. battery charger. The valve holder is constructed by enlarging the holes in valve pins. L_2 is series connected and give 2 volts. The two sections L_3 each give 20 volts.

and rarefaction simultaneously taking place on opposite sides of the diaphragm.

Field Windings.

For use on a D.C. supply of 200 to 250 volts the field coil, which measures $4\frac{3}{8}$in. in diameter by $3\frac{3}{4}$in. in length, the spool having a $1\frac{7}{8}$in. hole, may be wound full with No. 34 enamelled wire. It will accommodate nearly $3\frac{1}{2}$ lb., giving 20,000 turns with a resistance of 1,650 ohms. On 200 volts it will pass a current of 0.12 amperes, giving 2,000-ampere turns and consuming some 25 watts. With A.C. mains the winding should consist of 7 lb. of 14 D.C.C., giving 580 turns with a resistance of 0.7 ohms. If a 6-volt accumulator is to be used where no mains are available, the winding should consist of 5 lb. of No. 18 D.C.C., giving just over 1,000 turns with a resistance of 3 ohms passing a current of 2 amperes, thus producing over 2,000-ampere turns and consuming 12 watts. The gap in this instance should not exceed $\frac{5}{64}$ in. Another good winding for use with the small gap consists of $4\frac{3}{4}$ lb. of No. 20 D.C.C., giving 1,900 turns with a resistance of 9.5 ohms, and passing a current of 0.85 ampere from an 8-volt battery, producing 1,600-ampere turns and consuming 7 watts.

Field Current from A.C.

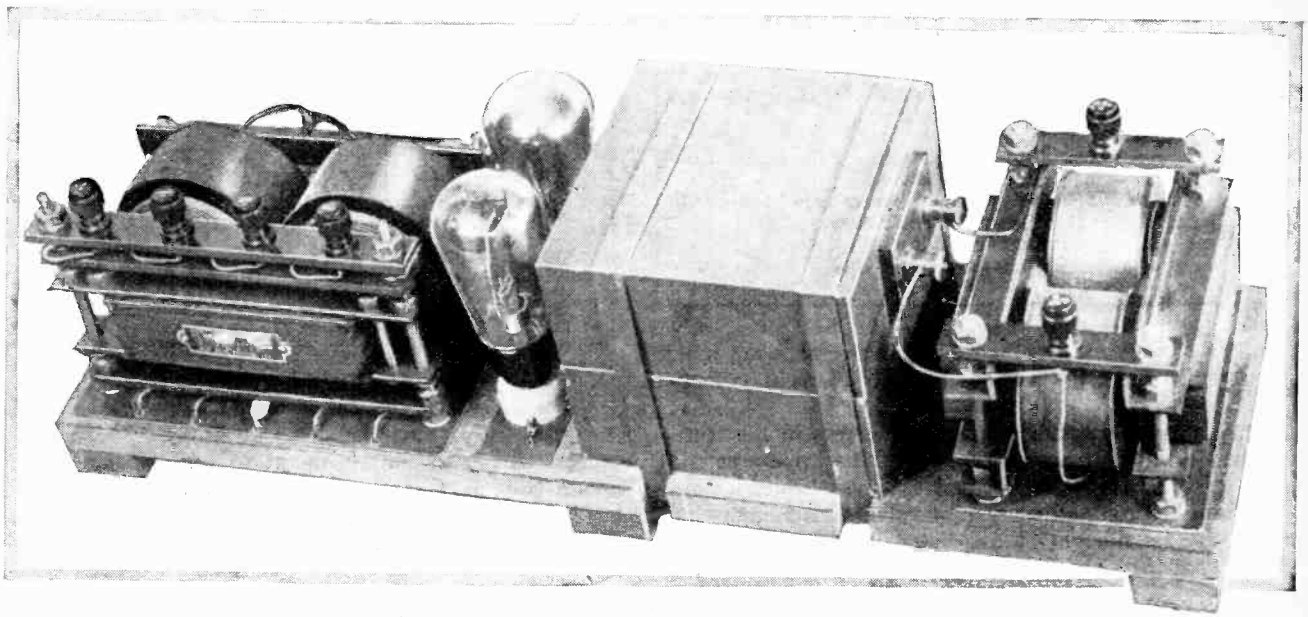
As many moving coil loud-speaker users will derive the field energising current from alternating current supply mains, constructional details are given of a suitable rectifier. A transformer has been designed for use with the Philips arc rectifying valve and the two associated of listening, as the total current consumed is rather heavy, drawing perhaps 3 or 4 amperes from the battery. Shunt resistances to absorb the voltage developed on breaking the field magnet circuit are scarcely necessary.

Avoid Reaction.

As no loud-speaker is better than the amplifier feeding it, circuit systems must be considered. Regeneration should be avoided, as it will result in a changing of pitch due to the circuits becoming too selective. Detuning as a means of volume control is equally objectionable, for if tuning is normally sharp there will be a raising of pitch. An anode bend detector valve in preference to leaky-grid detection is essential, and a convenient value for the wire-wound coupling resistance in its anode circuit is 100,000 ohms. It is followed by a mica dielectric coupling condenser, having a value of 0.1 mfd. Provided a good transformer is selected, it may be employed as a coupling between the first and second L.F. valves, and is, in fact, preferable to the use of an all-resistance L.F. amplifier. The choke in the output stage need have a value of only some 20 henries provided it has this inductance when passing the anode current. The output valve is of the L.S.5A type, and a single valve working on 250 volts is capable of giving good results. The more ambitious may increase the anode voltage to 350 and, further, may add additional parallel-connected output valves.

Battery Eliminators.

Information is given in an accompanying diagram for assembling a special high voltage H.T. eliminator. This



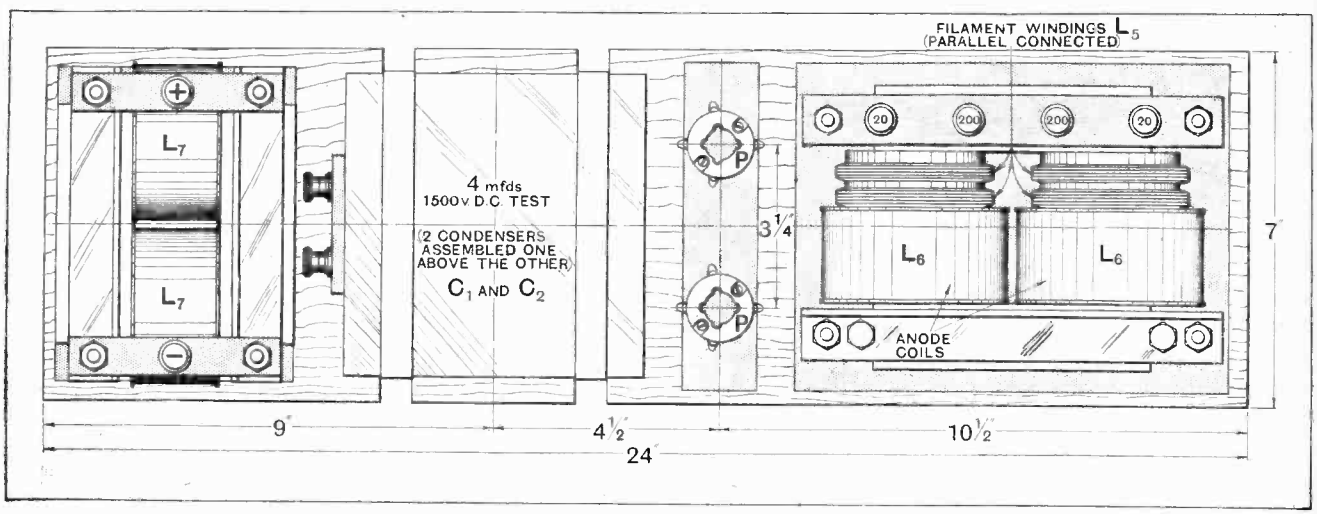
High voltage battery eliminator for feeding the output stage. The valves are of the B.T.H. R.H.I. type suitable for use with anode voltages up to 500 R.M.S.

will readily provide over 100 mA. at 350 volts. To prevent back coupling[1] it is better to feed the earlier valves from large type H.T. batteries of some 100 to 150 volts, as the current consumed is probably only of the order of 5 mA.

With D.C. supply limited in its voltage from 200 to 240, a push-pull output amplifier suggests itself. A special push-pull intervalve transformer is required, together with a centre-tapped output choke. The two output valves may be of slightly higher impedance than in the case of the previous output stage, and a centre-tapped output choke or transformer is used. It will be observed that the direct current components feeding the two output valves neutralise each other, thus avoiding saturation of the core of the choke of transformer, while the bridge formation of the circuit prevents speech currents circulating in the batteries, so avoiding the dangers of inter-stage coupling.[2] An H.T. accumulator of some 100 volts is, however, easily charged from D.C. supply, and can be arranged with a simple switch to discharge in series with the mains. This method is probably preferable to push-pull, and is more certain to give the best possible

[1] The perusal of "Low Frequency Oscillation," January 4th, 1928, p. 17, and "Back Coupling in L.F. Amplifiers," December 14th, 1927, is advised.

[2] For explicit constructional details the reader is referred to "Alternative Programme Quality Receiver," by A. L. M. Sowerby, *The Wireless World*, December 28th, 1927, p. 832.

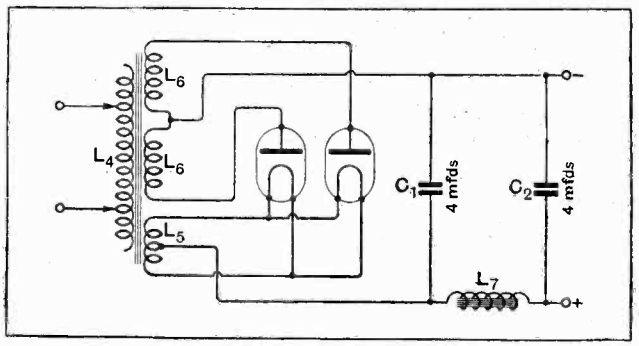


Dimensional layout of the high voltage battery eliminator. The windings L_5 supply the filament current to the rectifying valves and the coils L_6 are each wound for 420 volts. The two series connected windings L_7 have a total inductance of 30 henries when carrying a current of 100 mA. The windings of this transformer, as well as those of the battery charger, are on the basis of 4 turns to the volt.

PARTS FOR HIGH VOLTAGE ELIMINATOR.

Mains transformer for anode voltages of 420+420 (Rich & Bundy, 13, New Road, Ponders End, Middlesex).
2 Valve holders.
2 Bridging condensers, 4 mfds. 1,150 volts D.C. test (T.C.C.).
Heavy duty smoothing choke (Rich & Bundy).
2 Valves type R.H.1 (B.T.H.) for anode voltages up to 1,500 R.M.S.
¾in. Planed mahogany for baseboard and battens.
Input and output terminals.

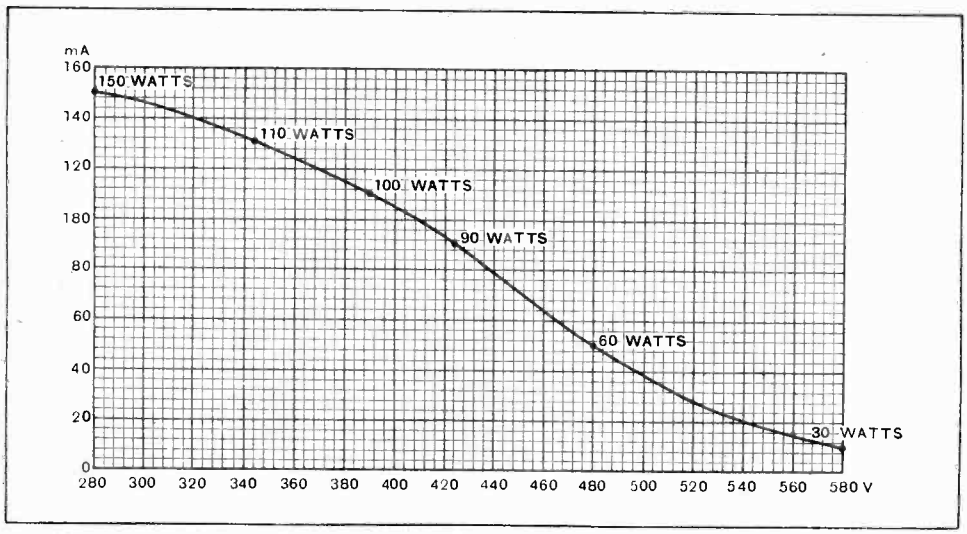
Approximate cost £7 : 10 : 0 less valves.



Circuit connections of the high voltage battery eliminator. Tappings are provided on the transformer primary so that it is suitable for use on several supply voltages.

results. The use of an indicating meter showing anode volts and current, as well as possibly filament potential is advised.

Poor results invariably arise from errors in the receiving set (or at the transmitter), and if the apparatus is of good design and correctly wired the most probable cause of failure is wrong adjustment of valves. Buzzing, which might at first thought be associated with a loose lead or frayed paper on the diaphragm, may be definitely due to insufficient grid bias. Short-circuited turns in the moving coil is another cause of poor quality, though difficult to localise. Six-volt valves are recommended to meet the requirements of the output stage. The H.F. valve may be a P.M.5X or D.E.5B (impedance about 15,000 to 30,000 ohms), or an equivalent of other make with an anode voltage of 80 and bias of 1.5. For the anode bend detector (20,000 to 50,000 ohms) again use a P.M.5X or D.E.5B, though a P.M.5B or other "resistance-capacity" coupling valve may be tried, particularly for local station reception, when an H.F. stage is not employed. An "L.F." valve (4,000 to 10,000 ohms) is required in the first L.F. stage with a Ferranti A.F.3 transformer feeding the output valve as described earlier.



Voltage at the terminals of the high voltage rectifier or various output current loads. At several points on the curve given the value of primary volts consumed from the supply mains.

The results obtainable with a coil-driven loud-speaker operating from a good amplifier are so vastly different from those produced by other means that it would be difficult to exaggerate the superior merit. The bowing of the strings of the double bass and the sound of the drums are heard with their true timbre. Loud signals are not overpowering, and speech can be followed with ease. Provided there is no condition existing in the transmission to falsify the effect, it would be difficult to distinguish between a studio programme delivered from the coil-driven loud-speaker and one from the actual concert platform.

CATALOGUES, RECEIVED.

Graham Amplion, Ltd., 25, Savile Row, London, W.1. Leaflet WL9, dealing with *Amplion* cone assemblies, Radiolux assemblies and gramophone attachments.

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C. A. Vandervell and Co., Ltd., Acton, London, W.3. Publication No. 7, a brochure describing *C.A.V.* radio sets, components and accessories.

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Burne-Jones and Co., Ltd., Magnum House, 288, Borough High Street, London, S.E.1. Catalogue of *Magnum* wireless receiving sets, accessories and components.

Venner Time Switches, Ltd., 45, Horseferry Road, Westminster, London, S.W.1. List No. 39, describing the Venauto radio switch.

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Langham Radio, 59, New Oxford Street, London, W.C.1. Leaflets describing the Langham Transatlantic portable and the Langham radio speaker.

King's Patent Agency, Ltd., 146a, Queen Victoria Street, London, E.C.4. "Patents for Inventions," a 16-page booklet of advice.

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Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W. Booklet: "How to Build your own High-tension Eliminator for A.C. or D.C."

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Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17. Radio Reference Pocket Book, containing list of the world's broadcasting stations, with columns for recording dial settings.

IDENTIFICATION OF STATIONS.

A Suggestion to Use Automatic Morse Signals.

By LÉON DELOY.

WITH the constant increase in the number of broadcasting stations it daily becomes more difficult to identify them, and this is a cause of complaint on all sides. In the early days when there were only a few stations the matter was simple. The tuning position where they were picked up gave a sufficiently close idea of the wavelength to enable us, without much risk of error, to decide the identity of the station heard. To-day, however, stations are to be found on almost every degree of the tuning condenser, and if we are to know the origin of the music we are listening to, we have to wait often an interminable time until the station chooses to announce itself, and then, when we have patiently waited for the end of a piece of music or a talk that we have broken into and we concentrate our attention closely so as to make out the name of the transmitter, how often we are let down! It frequently happens that the station does not announce its name, and recommences another long musical item or another talk, and we have to wait till the end of that in the hope that this time an announcement will be made.

Interest in an identification signal for broadcasting stations is not confined to this country. In this article M. Léon Deloy expresses his views on the need for some such signal and, although we do not endorse his suggestion of a Morse signal, we think that, nevertheless, our readers will be interested to read the views of a pioneer amateur of Europe who earned undying fame through his achievement of the first short-wave communication with America.

Again, the announcement is often made in a foreign language which we do not understand, and even if the language is one which we know it not infrequently happens that an exasperating atmospheric or fading leaves us as ignorant as we were before. It has happened to me—and I am not claiming that this is a record—that I have had to spend two hours without being able to identify a station successfully, although I have listened attentively during the whole of that time. In the case of many broadcasting stations the individuals in charge of them have been reminded of the matter and have had instructions to repeat the name or the call-sign of the station frequently, but this system is far from being ideal. First of all, the announcer is often occupied with other things between the end of a piece and the announcement of the next item, so that he has little opportunity to repeat the call-sign of the station from the microphone. Perhaps he has to carry on a conversation with the artists who are about to perform, or possibly he has to consult his notes. In any case, the great inconvenience of the repetition of the station name as a system is always that the national language employed is not understood, or badly understood, by the majority of distant listeners.

M. Léon Deloy, who here expresses his views on station identification.

Some transmitters have adopted the idea of transmitting characteristic sounds throughout the interval between items. To effect this, a metronome has been introduced or just a clock ticking before the microphone immediately at the end of a piece and until the following item commences, or, in the other case, two or three musical notes are repeated automatically whenever the microphone is not in operation. This method certainly constitutes a considerable advance, because it fulfils two of the essential conditions; the question of national language does not come into consideration, and the signal is repeated as frequently as possible during the intervals in the programme, so that there is little chance of the listener missing it.

But, although an improvement, there are indications already that this method is not perfect; several stations transmitting sounds which are so similar that confusion arises, and so only uncertain interpretation of the source of transmission can be obtained. It is necessary that the characteristic signal to be used should have a further essential quality, that of being absolutely different for each broadcasting station.

It seems to me that there is a very simple solution for this problem, which offers many advantages, and which I am surprised has not been suggested before. Why not employ the Morse alphabet? I can well imagine that many of my readers may feel disappointed at this suggestion, "because," they will say, "we do not even know the Morse alphabet, and certainly could not read it from sound." But there is no need to be despondent on this score. I have already considered this difficulty, and the proposal which I make for overcoming it is as follows.

Each broadcasting station should have a call-sign. Many already have one, and those which have not got one officially allotted can easily obtain one. Whenever lists, programmes, etc., are published the call-sign of each station could appear at the side of the name of the station—a scheme which is already adopted to a certain extent.

Each transmitter would be supplied with a little automatic transmitter which would repeat the number of the

Identification of Stations.—

station for a few moments at the commencement and at the end of the transmission and during each interval between items.

The automatic transmitter would be operated at a very slow speed, so that even the most inexperienced listeners could easily write down in dots and dashes the signals heard. Then, by looking up the Morse alphabet, which is so widely published, they could transcribe the signals into letters, and would at once be certain of the identity of the station which interested them.

I believe that this system is easily applicable and would give satisfaction to everyone concerned, and, furthermore, it would undoubtedly provide amongst a large number a new source of interest in listening to telegraphic transmissions.

Midland Societies Unite.

An important move towards the unification of interests among Midland amateurs is the formation of the Association of British Radio Societies with headquarters in Manchester. Among the aims of the new body are the following:—

The creation of a fellowship amongst the Radio Societies in this country for their mutual benefit.

The organisation of a comprehensive scheme for providing members with subjects to form the basis of discussions and experiments.

The organisation of Radio Societies into locally governed sections or groups which will elect members to the general committee.

The setting up of a standards committee in an endeavour to induce manufacturers to standardise components and accessories.

The Association asks for the co-operation of all Radio Society officials in compiling a list of "live" organisations. The Secretary is Mr. L. A. Gill, of Hope House, South Reddish, Stockport.

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A Set for the Family.

"What Set Shall I Build?" was the pertinent title of Mr. G. Collett's lecture before the South Croydon Radio Society on January 18th. The lecturer dealt with the type of set required by a typical family man—cheap, simple to build, and easy to operate. The set described consisted of one stage of high-frequency amplification, followed by leaky grid rectification and a transformer-coupled low-frequency stage. The H.F. circuit was a typical neutralised tuned anode arrangement.

Hon. Secretary: Mr. E. L. Cumbers, 14, Campden Road, S. Croydon.

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Ultra Short-wave Transmitter.

Transmission on wavelengths of 45 metres and below was the subject of discussion at the Tottenham Wireless Society's meeting on Wednesday, January 18th, when Mr. F. E. King (G 5AD), assisted by Mr. Pollock (G 5KU), exhibited his short-wave transmitter and gave a very full explanation of the various points in the design of the instrument and its component parts. Special attention was paid to the Meissner circuit.

Hon. Secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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Loud-speakers on Test.

A comparative test of loud-speakers invariably draws an interested audience.

CLUB NEWS.

An evening devoted to a test of this sort was held by the Muswell Hill and District Radio Society on January 18th. A home-made cone speaker with a bakelite diaphragm gave excellent results, as did also a folded exponential horn made to dimensions given recently by Mr. Dinsdale in *The Wireless World*. The winning loud-speaker was of the pleated diaphragm type, and the set used by the demonstrator was run off the mains.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 1st.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. (light refreshments at 5.30) At the Institution, Savoy Place, W.C.2. Lecture: "The Design and Distribution of Wireless Broadcasting Stations for a National Service," by Capt. P. P. Eckersley.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.19. Business meeting, followed by discussion on cone type loud-speakers.

Putney Literary Evening Institute Radio Club.—At 7.15 p.m. Lecture by the Dubilier Co.

South Croydon and District Radio Society.—At 8 p.m. At "The Surrey Drovers' Hotel." Lecture and Demonstration: "The Obtaining of True Radio Reproduction," by Mr. Garside, of Messrs. Ferranti, Ltd.

THURSDAY, FEBRUARY 2nd.

Stretford and District Radio Society.—At 8 p.m. At 60 Derbyshire Lane. "6JH Calling."

Leyton and Leytonstone Radio Society.—At 8 p.m. At Haydn House, Fairlop Road. "The Cossor Melody Maker."

Golders Green and Hendon Radio Society.—At 8 p.m. At the Club House, Willifield Way, N.W.11. Lecture and Demonstration: "How to Construct a Coil-Driven Loud-Speaker," by Capt. Basil Davis.

Hampstead Garden Suburb Institute Radio Society.—Lecture by the Dubilier Co.

FRIDAY, FEBRUARY 3rd.

Radio Society of Great Britain.—At 6 p.m. At the Institute of Electrical Engineers, Savoy Place, W.C.2. Lecture: "Wireless in Armoured Cars," by Capt. K. E. Hartridge.

Leeds Radio Society.—At the University. Lecture and Demonstration by Mr. J. Eules, M.A.(Cantab).

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Lecture: "The Composition of Dry Batteries," by Mr H. Haynurst.

Radio Experimental Society of Manchester.—Elementary Class.

Sheffield and District Wireless Society.—At the Applied Science Department, St. George's Square. Lecture: "Selectivity in Wireless Receivers," by Mr. R. E. Rayner.

MONDAY, FEBRUARY 6th.

Hounslow and District Wireless Society.—At 8 p.m. At Trinity Hall, Bulstrode Road. Whist Drive in aid of Club Transmitter fund.

Hackney and District Radio Society.—At the Electricity Show Rooms, Lower Clapton Road, E.5. "Topical Talks."

TUESDAY, FEBRUARY 7th.

Bradford Radio Society.—Annual General Meeting.

New members have recently joined the Society, but it is hoped that a still larger number will enrol this season. Copies of the syllabus, together with membership application form, will be sent by return on application to the Hon. Secretary, Mr. G. S. Sessions. 20, Grasmere Road, Muswell Hill, N.10.

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Kensington Radio Society.

At a meeting of the Kensington Radio Society on January 12th Mr. P. W. Harris gave an interesting lecture and demonstration of a circuit designed to secure constant reaction.

At the next meeting, on February 16th, Messrs. Ferranti, Ltd., will give a demonstration of their transformers. New members are welcome.

Hon. Secretary: Mr. G. T. Hoyes, 71A, Elsham Road, W.14.

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The Coming Session in Wembley.

The Wembley Wireless Society has now entered upon its sixth year. At the present time members are actively engaged in providing the new Wembley Hospital with a wireless installation, a pair of 'phones being supplied to each bedside, together with loud-speakers in the matron's and nurses' quarters. It is hoped, if funds allow, to provide a gramophone pick-up attachment. The 1928 session opened on January 20th at the Park Lane Schools. A feature of the Society's programme is the junior section, which opens its meetings at 6.30 p.m.; ordinary meetings begin at 8 o'clock. A very attractive programme has been prepared, several well-known names being included in the list of lecturers. Intending members can obtain the syllabus from the Hon. Secretary, Mr. H. Comben, 24, Park Lane, Wembley, Middlesex.

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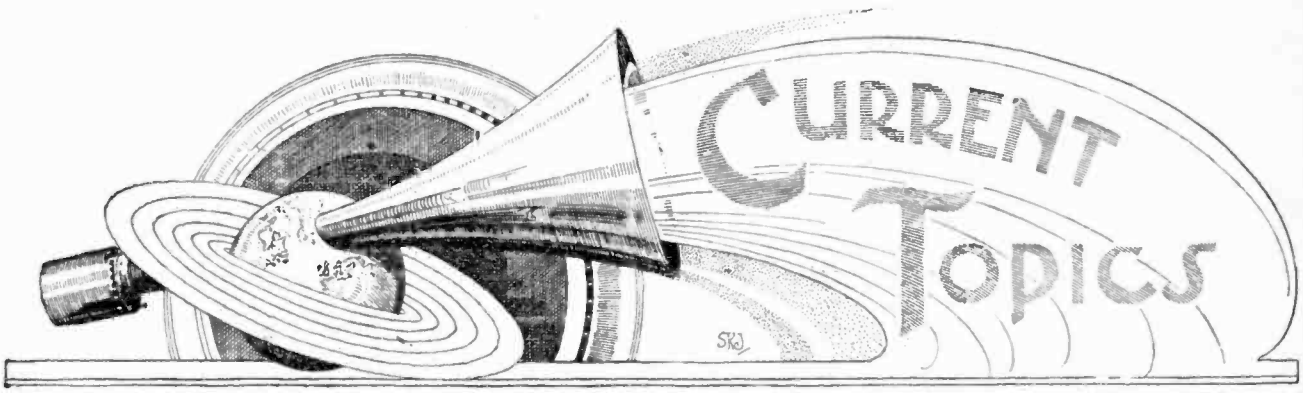
The Lightning Menace.

"The Ethics of Lightning" was the arresting title of a lecture by Mr. R. A. Price at a recent meeting of the Croydon Wireless and Physical Society. The lecturer dealt with the behaviour of lightning and gave hints towards the elimination of risks. It was pointed out that lightning did not obey the same laws as a constant electric current. Lightning would distribute itself over such metals as might be present on a building, paying little heed to ohmic resistance, and leaping over air gaps in a most disconcerting manner. The moral of Mr. Price's lecture was that too much importance cannot be placed on the necessity for proper safety switching.

Visitors are heartily welcomed to the Society's meetings. The Hon. Secretary is Mr. H. T. P. Gee, Staple House, 51-52, Chancery Lane, W.C.2.



Events of the Week in Brief Review.

WIRELESS AT THE B.I.F.

No fewer than fifty wireless manufacturers are exhibiting in the London section of the British Industries Fair, which opens at the White City, Shepherd's Bush, on February 20th.

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P.O. WIRELESS LICENCE SURPLUS.

The Post Office commercial accounts just issued show that, in the nine months ended December 31st last, wireless licences issued to the public produced £785,060. Of this sum £620,000 is payable to the B.B.C., leaving a balance of £165,060.

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CAPTAIN ECKERSLEY ON STATION DISTRIBUTION.

Captain P. P. Eckersley will lecture on a subject of topical interest—"The Design and Distribution of Wireless Broadcasting Stations for a National Service"—at a meeting this evening (Wednesday) of the Wireless Section of the Institution of Electrical Engineers.

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NEW DIRECTIONAL AERIALS AT KEMBACK.

Two giant directional aerials now under construction at the Transatlantic Wireless Telephone receiving station at Kemback, Fife, are nearing completion. Four self-supporting steel masts 130ft. high are being erected, each weighing four tons. The aerials are spaced three-quarters of a mile apart, each pair supporting a directional aerial 100ft. high and 600ft. long.

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CABLES AND WIRELESS COMPETITION.

An urgent recommendation that wireless and cable interests should continue work on a competitive basis has been forwarded to the Imperial Wireless and Cable Conference by the Empire Press Union. It is declared in the memorandum that, until the opening of the Australian beam system, the cable monopoly resulted in stagnation and poor service, messages from London to Australia occupying four or five hours in transit. Under the present competitive conditions the same cable system now handles similar messages in the space of twenty minutes.

GUARDED.

A Scottish wireless writer speaks of "a time when programmes were worse than they now are." The B.B.C. is wondering whether to be pleased or otherwise.

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£4 FINE FOR PIRATE.

A Glasgow defaulter under the Wireless Act was fined £4, with the alternative of ten days' imprisonment, at last week's session of the Glasgow Sheriff Court.

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THAT L.F. HUM.

There is a remarkable boom in wireless accessories, says a trade paper. A correspondent says there is a perfectly shocking boom in his neighbour's loud-speaker.—*The Humorist.*

IN THE NORTH.

According to the Norwegian Broadcasting Company there were 61,848 licensed listeners in the country at the end of 1927.

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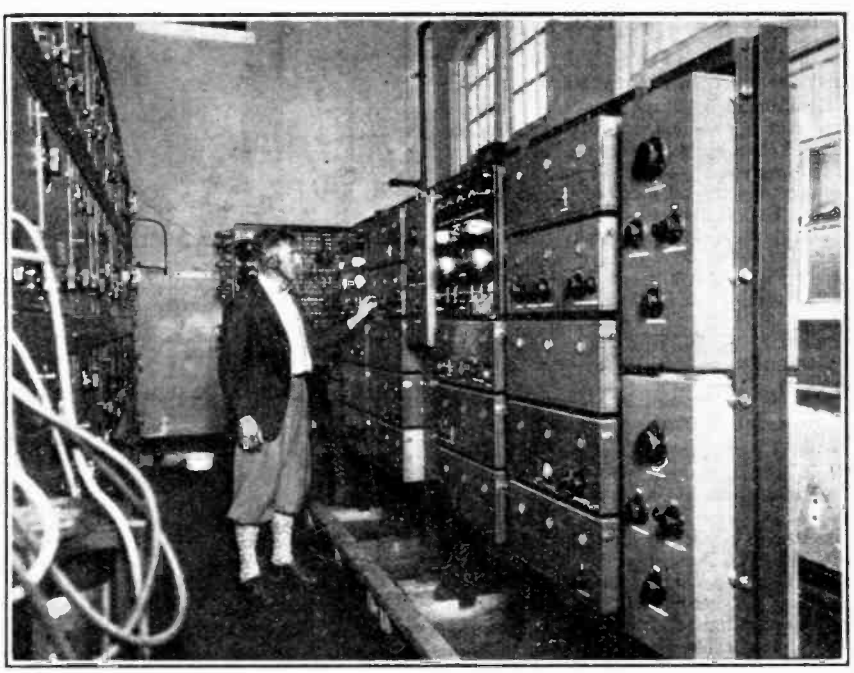
FARADAY MEDAL FOR PROF. FLEMING.

The Council of the Institution of Electrical Engineers have made the seventh award of the Faraday Medal to Professor J. A. Fleming, M.A., D.Sc., F.R.S., the inventor of the thermionic valve. The Faraday Medal is awarded not more frequently than once a year, either for notable achievement in electrical engineering or for conspicuous service towards the advancement of electrical science. There are no restrictions as regards nationality, or country of residence.



BEAM RECEPTION IN AMERICA. A view in the receiving room at the Pinehead Transatlantic Beam Station, Long Island. Note the banks of amplifiers and the elaborate screening arrangements.

WIRELESS IN LAMBETH HOSPITAL.

The new wireless installation at the Lambeth Hospital is being formally handed over to-day (Wednesday) to the Lambeth Board of Guardians.

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INDEX AND BINDING CASE.

The index for Volume XXI. of *The Wireless World* is now ready, and copies are obtainable, price 4d. post free from the publishers, Dorset House, Tudor Street, E.C.4. Binding cases for the same volume can also be supplied, price 3s. 6d., or 3s. 10d. post free.

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ITALIAN BROADCASTING.

"E.I.A.R." will soon be a familiar sign throughout Italy, as it stands for the Italian Corporation for Radiophonic Auditions, a new organisation entrusted with the control of broadcasting under the supervision of the Ministry of Communications.

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A VALUABLE TUNING FORK.

To avoid any risk of damage, a standard tuning fork was sent by the B.B.C. to Brussels last week by air liner. The tuning fork, which is used by the B.B.C. for calibrating wave meters, was sent to the Technical Commission of the International Broadcasting Union to be compared with the standard Geneva instrument.

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AUSTRALIAN WIRELESS PROFITS.

The Amalgamated Wireless Company of Australia shows a profit for the year ended June 30th, 1927, of £25,000, compared with £12,500 for the two previous years. This does not include profits on the beam service, these being realised after the books had been closed. The financial outlook is described as satisfactory.

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INTERNATIONAL AMATEUR TESTS.

Excitement will reach a pitch in the American amateur fraternity on Monday next, February 6th, when a new series of international transmission tests will begin under the auspices of the American Radio Relay League. Prizes will be awarded to those American and Canadian amateurs who receive the greatest number of reports from other countries during the period of the tests. The closing date is February 26th. Fuller particulars of the event appeared under "Transmitters' Notes" in our issue of January 11th.

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WRONG KIND OF "CHECK."

The U.S. Treasury Department has received a severe check at the hands of the Controller-General, who holds that it is illegal to make use of broadcasting for advertising purposes without the specific sanction of Congress. The Treasury recently scored a notable success by the use of a big "hook-up" in a campaign for the redemption of the Second Liberty Loan. The same plan was to have been adopted in regard to the Third Liberty Loan. Up to the present the Controller-General has refused to revoke his order.

TAKING WIRELESS SERIOUSLY.

An ordinance has been passed by the Town Council of Fairfield, Iowa, forbidding the use between the hours of noon and midnight of "any instrument, device or machine which shall cause electrical interference with radio reception." The penalty for law-breakers is £20 or thirty days' imprisonment.

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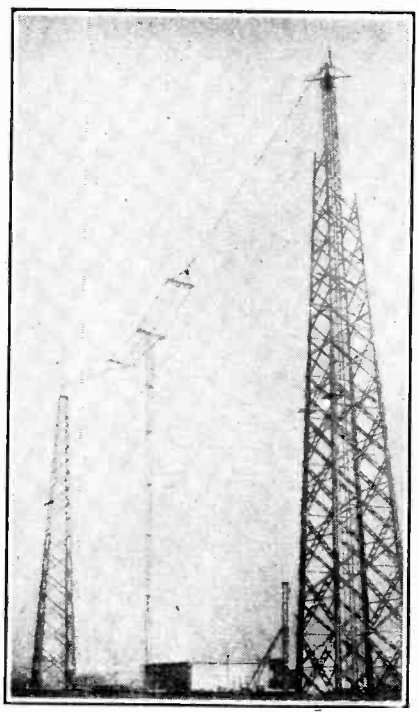
AMERICAN ETHER STILL CHAOTIC.

Any hopes among members of the U.S. Federal Radio Commission that they would be able to rest from their labours after March 15th are being dispelled by the claim of the Secretary of Commerce that there is still a great deal of work ahead. The authority of the Commission terminates on the date mentioned, but Secretary Hoover, upon whom the responsibility of radio control will fall,



NEW MASTS AT COLOGNE. Wooden masts are coming into favour again owing to their low absorption effect on the shorter wavelengths. This photograph shows the partially completed masts at Cologne. They are 260 feet high.

maintains that the wireless situation is still chaotic.

The question of short waves is causing some trouble, there being so many claimants for the limited bands available. The Commission is now being charged with allocating too many short waves to the Radio Corporation of America.

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SPAIN'S NEW WIRELESS COMPANY.

Wireless services from Spain to all parts of the world will be available to the public almost immediately in consequence of the formation of the Spanish Trans-radio Company, with a capital of about £143,000. The new company has obtained a concession from the Spanish Government for an international service, and we understand that it holds the rights in Spain for all Marconi patents. It is also concessionaire for the Iberian A.E.G. Company, the Telefunken Company, and the Compagnie Générale Française de T.S.F.

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CANADIAN TELEPHONE SERVICE.

A development in the Transatlantic telephone service occurred on Thursday last, when the Postmaster-General announced that the service to Canada, hitherto only available in this country to London subscribers, was open to subscribers in all parts of the country.

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LECTURES ON WIRELESS.

Capt. Jack Frost, late of the B.B.C., is delivering a series of lectures on wireless subjects at a number of Institutes in the London district.

In most cases the classes are followed by lectures given by well-known manufacturers. New students are welcome, and particulars regarding enrolment can be obtained on application to Captain J. Frost, "Murree," 32, Alma Road, Windsor, Berks.

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WIRELESS FOR BACKWOODSMEN.

In order that isolated settlers in the backwoods of Australia may be able to summon help in times of emergency, tests are being made with a simple and inexpensive form of wireless transmitter for installation in their homes. The Commonwealth Postmaster-General has agreed to issue special permits to enable settlers to use such sets and to conduct Morse conversations with their neighbours, says a *Times* correspondent. A wireless expert attached to the Australian Inland Mission will instruct the settlers in the use of these sets.

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LOWER IMPORT DUTIES.

The Indian import duty on wireless apparatus has been reduced. Radio receivers and accessories are now admitted to British India at a Customs duty of 2½ per cent. *ad valorem*.

BRANDESET IIIA.

In the test report on this receiver which appeared in the January 18th issue it was stated that the detector voltage when using two valves was 80 instead of 40, and it was assumed that the green and yellow H.T. leads, which are clearly stated in the instructions to belong to the detector and first L.F. valves respectively, had been reversed.

The makers write to say that the increase of detector voltage when using two valves is intentional, being due to the system of switching adopted, and that the original instructions regarding the connection of H.T. leads should be adhered to. The H.T. voltages for both positions of the "Volume" switch will then be as follow:

	Det.	*1st L.F.*	*2nd L.F.*
Three valves	40	80	100
Two Valves	80	—	100

KEEPING H.F. OUT OF THE L.F. AMPLIFIER.

The Theory of the Series Grid Resistance.

By A. L. M. SOWERBY, M.Sc.

THE presence of high-frequency voltages in a low-frequency amplifier is to be avoided if possible, for it tends to deprive the amplifier of both quality and stability. Of the two usual methods by which the unwanted high-frequency voltages can be decreased to a negligible amount, one in particular is rapidly gaining in popularity because it lends itself readily to compact construction, and is inexpensive. It consists in inserting in series with the grid lead of the low-frequency amplifying valve a non-inductive resistance, as shown at R in Fig. 1.

It is by virtue of the capacity between the grid and filament of V_2 that this resistance is effective in reducing the high-frequency voltage on the grid of that valve. This can perhaps be more clearly seen from a consideration of Fig. 2, which shows only such portions of Fig. 1 as are relevant to our present purpose. In this simplified diagram R represents the series grid resistance and C the valve capacity to which reference has already been made, and these two are connected in series across a source of high-frequency voltage E_0, which is actually the preceding valve, but is shown in Fig. 2 as a generator.

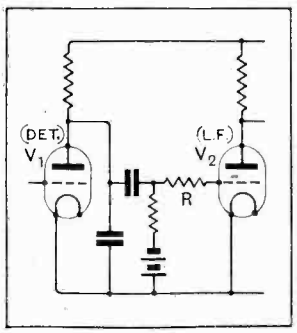

Fig. 1.—Series resistance R connected in grid circuit to reduce transfer of H.F. energy to L.F. amplifier.

Formula for H.F. Transfer.

If for the moment we imagine that the generator is supplying current at a very high frequency, which represents the radio-frequency component of the output from the preceding valve, it is clear that R will offer a much higher impedance to its passage than the condenser C, provided that the capacity of the latter is not extremely small. Consequently the bulk of the original voltage E_0 will be employed in forcing the current through R, and the drop in voltage across C will be small. Since it is only the reduced voltage E across C that is applied to the second valve V_2, the effect of inserting the resistance is to cut down the high-frequency voltage applied to this valve.

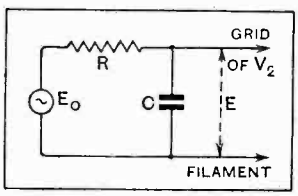

Fig. 2.—Equivalent circuit of series grid resistance.

By increasing the resistance, the capacity remaining constant, the proportion of the original high-frequency voltage dropped across the condenser can be decreased indefinitely, but, since the condenser always has some impedance, E can never be reduced quite to zero. From the point of view of cutting out high-frequency voltages, the greater the resistance of R the better.

But there is a limit to the increase of R; a time will come when the higher notes of the audio-frequency range begin also to be cut down. It is, therefore, desirable so to proportion the values of R and C that the highest audible notes just begin to be cut down, but to a negligible extent, so that we may be certain of obtaining the greatest high-frequency cut-off that is compatible with good quality.

A short calculation shows that

$$\frac{E_0}{E} = \sqrt{1 + R^2\omega^2C^2}$$

where $\omega = 2\pi \times$ frequency, and the remaining symbols have the meanings implied by Fig. 2. This formula, which applies equally to radio and audio-frequencies, shows that an increase in either R or C has the effect of increasing the fraction, or, in other words, of accentuating the difference between the original voltage E_0 and the voltage E applied to the second valve. This much, indeed, we have already seen by a qualitative examination of Fig. 2; the formula, however, goes further than this, and allows the exact magnitude of the effect to be calculated, or suitable values of R prescribed for various valves and purposes.

Wavelength Considerations.

If we assume, as a basis for set design, that we can safely allow a loss of not more than five per cent. of notes of frequency 5,000 (which is about the highest note that we need try to retain in our amplifier), we obtain from the formula the information that the maximum permissible value for the product RC is 10, when C is expressed in micro-microfarads and R in megohms.

Adopting this figure as our standard, it is interesting to see exactly how far the high-frequency voltages are reduced by the introduction of the resistance. Naturally, the exact degree of reduction will depend upon the frequency of the station being received, and will be greater the shorter the wavelength. Once again the formula will give us actual figures; for some of the more widely used wavelengths they are given in the accompanying table, in which the first column gives the wavelength being re-

Station.	Per cent. H.F. remaining.
200 metres 1,500 kC.	1.0
300 „ 1,000 „	1.6
400 „ 750 „	2.1
600 „ 500 „	3.2
1,000 „ 300 „	5.2
1,600 „ 188 „	8.3
2,000 „ 150 „	10.5
6,000 „ 50 „	30.0

Keeping H.F. out of the L.F. Amplifier.—

ceived, the second the corresponding frequency in kilocycles, and the third the percentage of the original high-frequency voltage which remains in spite of the introduction of the resistance.

Thus on the broadcast wave-band the introduction of the series resistance cuts down the high-frequency voltage applied to the L.F. amplifier to about one-fiftieth of its normal value, which, though not perhaps so great a reduction as one would like, is sufficient to ensure stability at least. At the other end of the scale, on a wavelength of 6,000 metres, the reduction is only to one-third, which, remembering the tendency of such long waves to be amplified by a low-frequency amplifier, is quite inadequate to ensure good quality and proper stability. The series resistance will thus be of very little use in a superheterodyne using some such wavelength as this in its intermediate frequency amplifier; for receivers of this type a properly designed low-pass filter would be required.

Having discussed the correct proportioning of R and C to provide the maximum possible reduction of high-frequency which is compatible with good retention of the high audio-frequency notes, it now remains to consider the approximate working value of C in various cases. C, it will be remembered, is the grid-filament capacity of the valve in whose grid-circuit the series resistance is placed. This capacity can only be changed by changing the valve, and, as this valve will normally be selected for more important properties than its grid-filament capacity, we must suit the value of R to whatever valve we have decided to use.

The *working* value of C (which is, unfortunately, very much higher than the measured capacity of the valve with unlighted filament) depends more upon the amplification factor than upon any other single constant of the valve. It is controlled also by the disposition of the electrodes, the material of the cap, and the impedance of the load in the plate circuit, but it is obviously impracticable to take all the variable factors into consideration simultaneously. Nor, fortunately, is it necessary, for a very reasonable approximation to the working value of C can be obtained by multiplying the amplification factor of the valve by about eight, which gives C in micro-micro-farads.

Working on this basis, we get the following figures for the various values of R to suit valves of different amplification factors:—

Amplification Factor of Valve.	Suitable Series Resistance.
2½	500,000 ohms
5	250,000 ,,
10	120,000 ,,
15	80,000 ,,
20	65,000 ,,
30	40,000 ,,
40	30,000 ,,
50	25,000 ,,

Although the values of R, which are suitable for our present purpose, cover almost exactly the same range as the usual anode resistances, there is no need to use such expensive components for this purpose. The current carried by R is minute, so that it will be sufficient if resistances of the type normally employed for grid-leaks are used. There is one maker at least who produces resistances of this type in all values down to 40,000 ohms.

READERS' NOVELTIES.

A TIP FOR THE UNTIDY.

Nothing is more annoying, when a neat-looking set has been built, to find that the silk covering of the flexible battery leads joining to a spade or a plug for attachment to the set has become frayed. This presents a very untidy appearance. Many people bind the frayed ends down with cotton, but this is a tedious operation, and a much better and neater method is to cover the frayed ends with some such substance as "Chatterton's Compound," or even seccotine. This will be found to overcome the trouble completely.

D. H. S.

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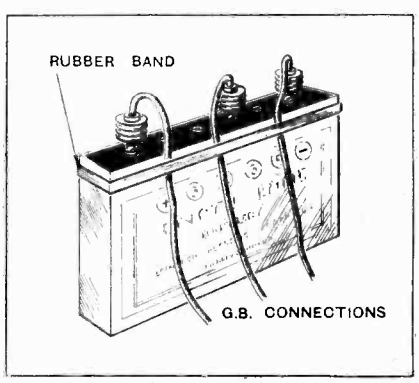
A VALVE INSURANCE POLICY.

It often happens that, when adjusting grid bias values in the usual manner, the plug accidentally slips from the fingers and makes contact with an H.T. busbar in the set with the resultant demise of the valve.

The possibility of this accident can be completely avoided by the simple expedient of passing a rubber band around the top of the grid bias battery as shown; it is then impossible for the plug to drop and touch the H.T. contact, while its normal usage is in no way impeded.



Method of anchoring grid bias leads.

G. C. R.

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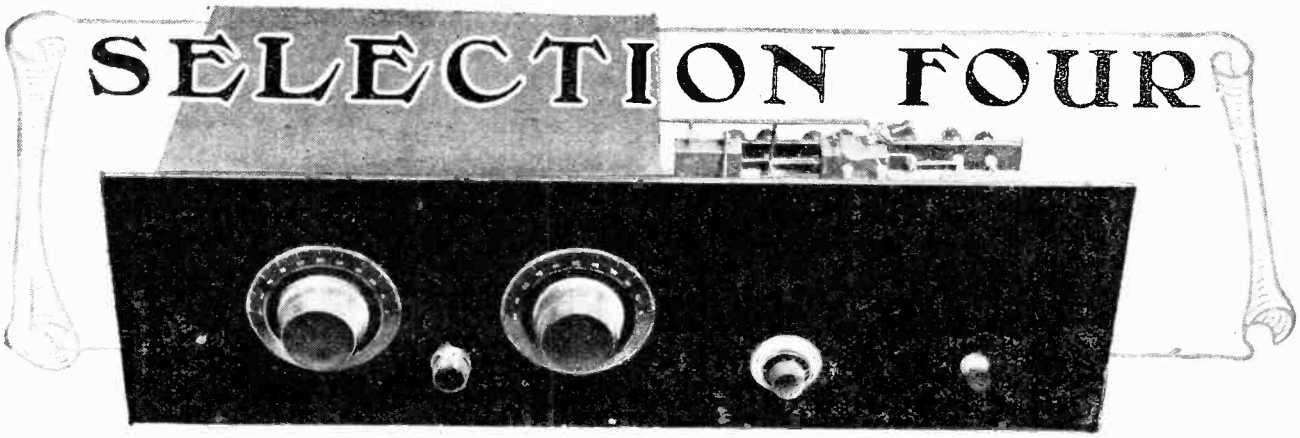
PREVENTING CORROSION ON BATTERY TERMINALS.

One of the principal reasons why wireless users are anxious to be rid of the accumulator is the dirty and unpleasant condition into which the terminals of it are apt to get even though great care may be taken.

It is often suggested that vaseline be smeared over the terminals to prevent this, but this operation is not always successful. If, however, the terminals are covered with a mixture consisting of 50 per cent. each by volume of castor oil and turpentine results are very different. It will be found that, even when terminals have become very dirty, this preparation will clean them, and they will not become corroded again if they are kept very thinly smeared with this mixture. No harm will be done to the celluloid, ebonite, or glass container of the accumulator.

S. M.

SELECTION FOUR



(*Concluded from page 86 of previous issue.*)

Wiring—Coil Construction—Operation.

By W. JAMES.

IN the first part of this article, included in last week's issue, the circuit arrangement of the receiver, which consists of one stage of high-frequency amplification followed by an anode bend detector and two low-frequency stages, was fully discussed. Particulars were given for the construction of the screening box, used to house the high-frequency circuits, together with details for the drilling of the panel and the layout of the components on the several baseboards. For those who wish to construct their own coils it is now necessary to describe the winding of the inductances and to give some hints as to choice of valves, since the performance of the receiver, as regards sensitivity, selectivity, and quality, will depend to a great extent upon the employment of valves having correct impedances.

To revert to the screening box, the final details of which were not given last week, it should be noted that it is advisable to remove the high-frequency and detector stages from the box and to put on as many wires as possible, using the diagram of Fig. 7. Then, when the first stage is put back, the wires from the aerial terminals and the battery can easily be fitted. The box is so large that there is plenty of room for the interconnecting wires to be put in without difficulty and soldered. One of the wires leaving the detector compartment from the grid circuit is flexible. All other wires should be covered with sistoflex.

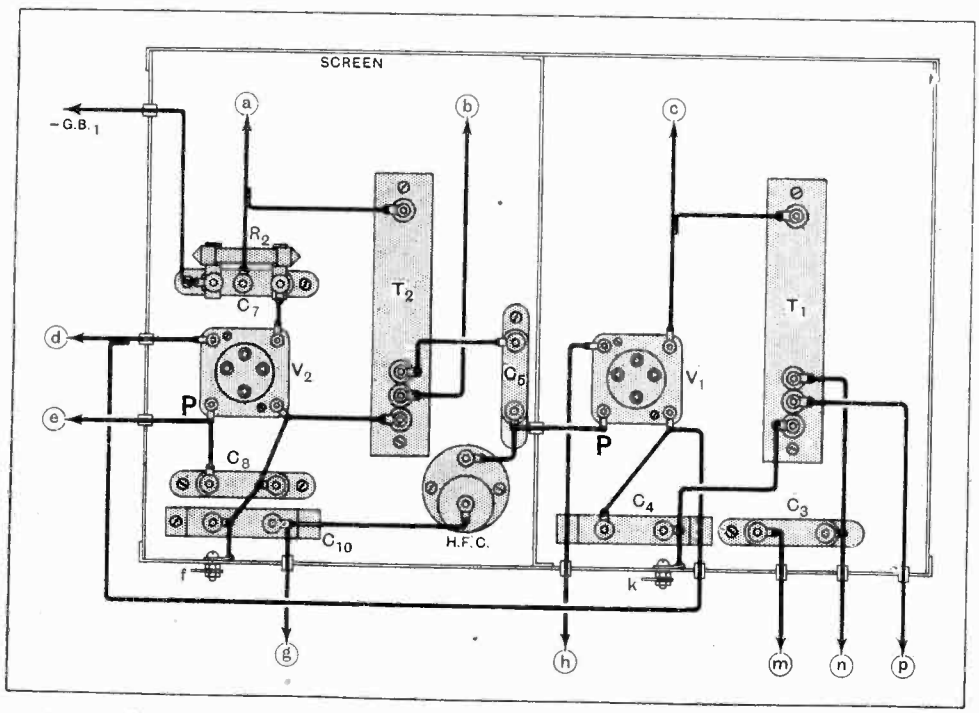


Fig. 7.—Wiring of the parts contained within the copper box. Notice that certain wires are lettered. These have to be joined with wires having similar letters shown in Fig. 8.

If the two wiring diagrams, Figs. 7 and 8, are examined, the reader will see that the ends of certain wires have been lettered. Ends having similar letters should be connected. Thus a is joined to a, and b to b, and so on. The two diagrams should be followed together in order to see those wires that connect parts inside the box with others outside. There is room for the grid bias battery at the right-hand end of the baseboard. It may be necessary to use two nine-volt or two sixteen and a half-volt grid batteries depending on the type of power valve and the value of H.T. These can easily be fitted in position, and the various flexible wires cut to length.

Selection Four.—

Two aerial coils and two high-frequency transformers are required. These are illustrated in Figs. 9 and 10. All four coils have a former comprising a tube of Paxolin or Radion 3in. in diameter and 4in. long with four pins mounted on them. Three are at one end and one at the other, and care must be taken that they are properly spaced to fit the bases. For the short-wave coil wind on sixty turns of No. 27/42 Litzendraht and connect the ends as shown in the diagram. Small holes should be made in the formers for the ends to pass through. Be sure that every strand is soldered and that good connections are made. Now wind on eight turns of No. 30 D.S.C., connecting the beginning of this coil to the Litz and winding the wire in the space between the turns of the Litz. At the eighth turn put a hole in the former and take the wire to one of the connecting pins as shown.

Then continue the winding for another eight turns and connect the end to the remaining contact pin. The primary coil, therefore, has sixteen turns with a tap at the eighth. The long wave aerial coil has 190 turns of No. 34 D.S.C.; a tapping is taken half-way along the coil, and a connection is also brought from the grid end to the third contact pin. The method of connecting the ends is clearly shown in the diagram.

The high-frequency transformers are rather more difficult to build. That for short waves has three windings.

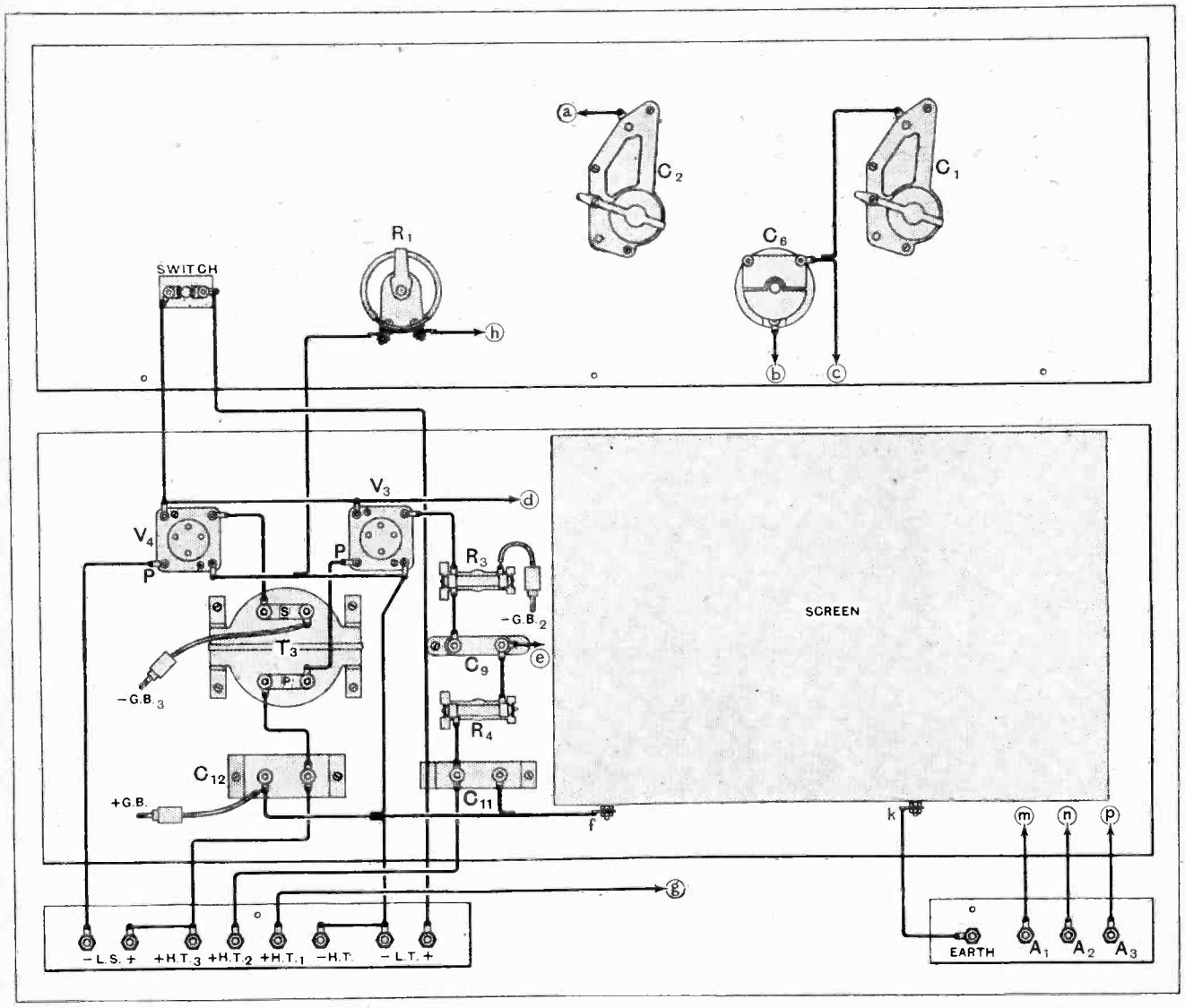


Fig. 8.—Wiring diagram. This should be used with Fig. 7.

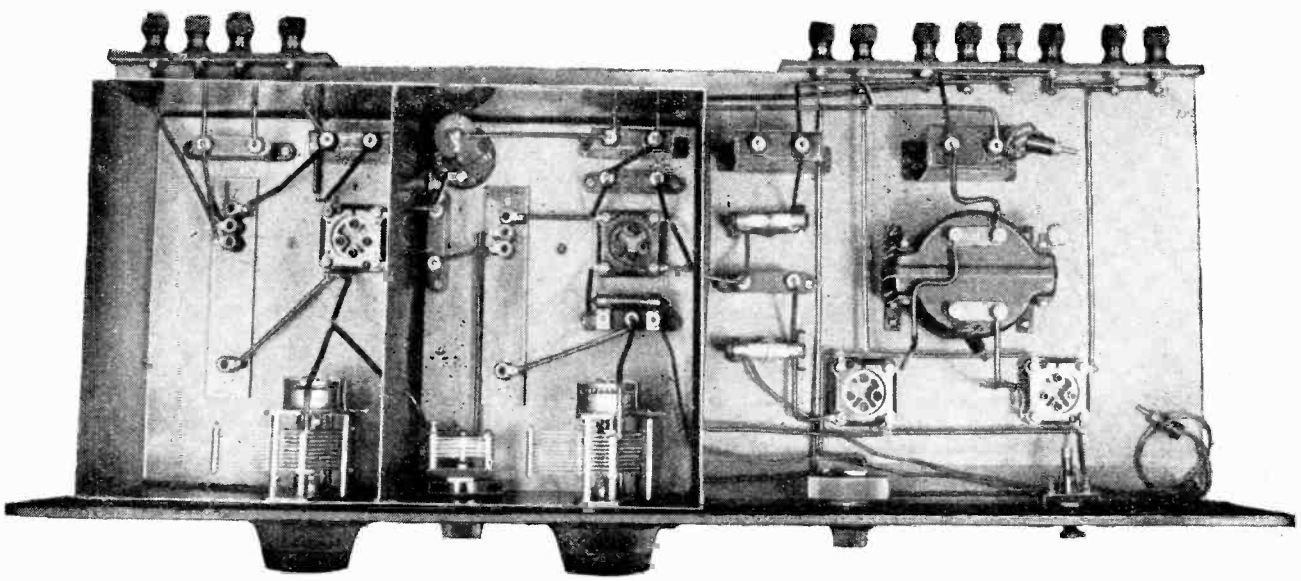
One of them comprises 60 turns of Litzendraht and has its ends connected to the two outer contact pins. The primary winding is of No. 44 D.S.C. wire. One end is connected to the Litz and 12 turns are wound on in the space between adjacent turns of the Litz. Its end is taken through a hole in the former and connected to the inner pin of the three. A balancing winding of eight turns is used, the beginning of this coil being connected to the centre pin of the three and the end to the Litz and

Selection Four.—

the beginning of the primary. It is advisable slightly to separate the end twelve turns of the Litz in order that the fine wires may be laid in position without stretching them. It is easier to construct the long-wave transformer, for it comprises a single winding of 220 turns of No. 34 D.S.C. with two tappings. One end of the winding is connected to the grid contact pin and the other end to the centre contact pin. Thirty turns along from this end a tapping is made for the outer pin and the inside pin is joined to the seventieth turn.

A set of this type must be fitted with suitable valves, any amplifying valve will not do. For V_1 a valve of approximately 20,000 ohms anode impedance should be used, and its amplification factor may be as high as possible. Given a choice of two valves of 20,000 ohms and having amplification factors of 10 and 20 respectively, the high-frequency amplification actually obtained will be twice as much when the latter valve is used, it being assumed, of course, that the circuit is properly balanced. If a valve of lower anode impedance is fitted at V_1 the selectivity will not be so good, although there will probably be a little increase in the magnification. A valve of higher impedance, on the other hand, will improve selectivity by a small amount. Use a high-tension voltage of 120-150.

The detector valve, V_2, should be of the resistance-capacity type. It should have a large amplification factor, say, of 30 or more. Such a valve will require a grid bias of -1.5 volts for a high-tension voltage of 100 to 120; $-GB_1$ should, therefore, be put in -1.5 volts on the grid battery, and $+H.T._2$ be taken to the voltage recommended. This should be varied a little to find the best value for sensitivity. For V_3 use a 20,000 ohms valve; give it a bias of -1.5 volts at $-GB_2$, and for V_4 use a valve of 2,000-3,500 ohms. Apply a high-tension voltage of at least 150 at $+H.T._3$ and connect the correct bias at $-GB_3$ to suit the valve.



Plan view of the receiver. Most of the wires can be seen in this illustration.

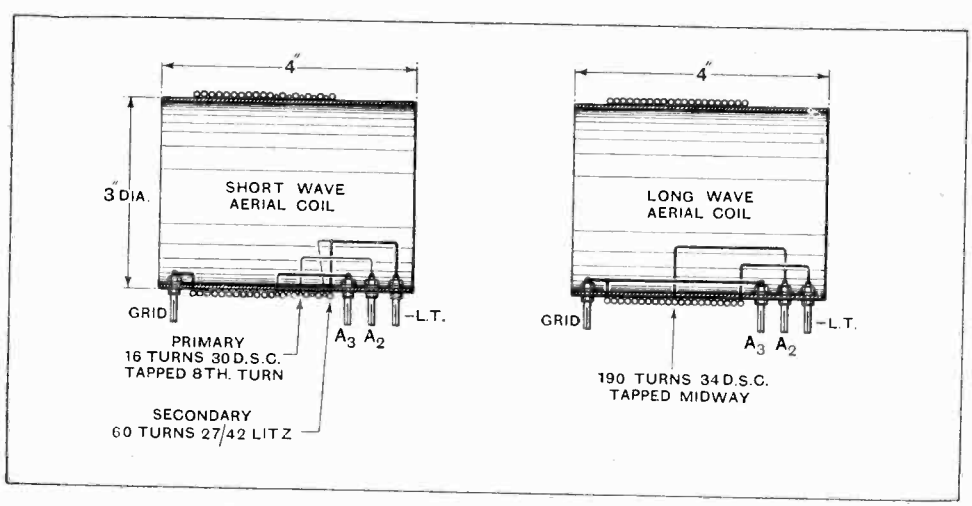


Fig. 9.—Details of the short and long wave aerial coils.

It is a simple matter to balance the high-frequency part of the circuit. Tune to the local station, and then turn the filament resistance (volume control) off. Now slowly turn the balancing condenser until the signals are no longer heard. This is the correct way to balance, and the circuit will be found stable over the whole tuning range for this adjustment. As the balancing condenser is slowly tuned from the "balance" position a reaction effect is produced.

Selection Four.—

This should be used very cautiously, as the reaction is applied to the aerial coil.

The set is selective and easy to tune. It is as effective on the long waves as on the short waves. Many stations can be received on both ranges with complete stability and good quality. Advantage should be taken of the alternative aerial positions provided, as they affect selectivity.

A user who wishes to try leaky grid rectification will have to connect the plug marked $-GB_1$ to a point that is 1.5 to 3 volts positive, but he is warned that selectivity is impaired by so doing.

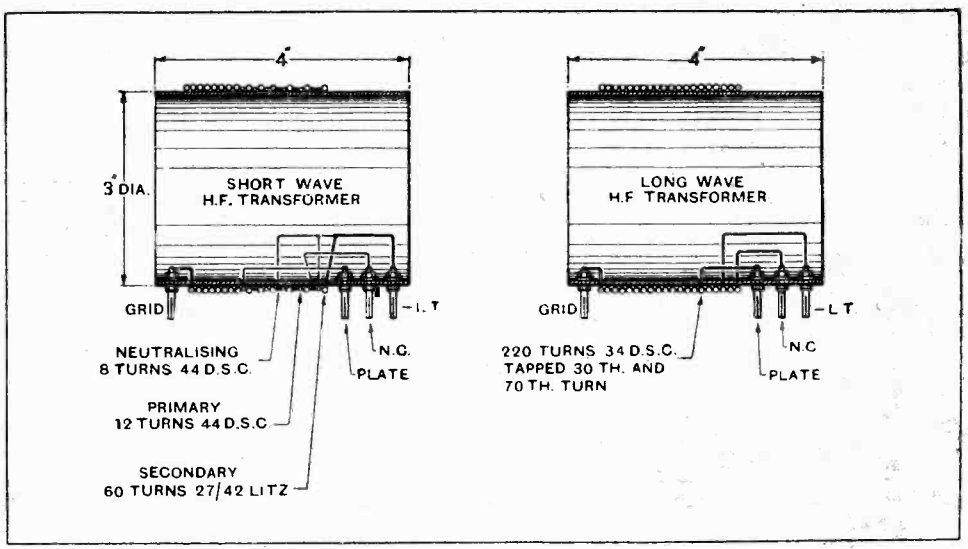


Fig. 10.—The short and long wave high-frequency transformers.

Distortion will be introduced at the detector if the input is more than a certain amount. The volume control should, therefore, be used to weaken strong signals.

To summarise the advantages of this receiver it can safely be claimed that the screening of both the high-frequency circuits will provide immunity from direct coil pick-up from the local station. As a result it will be undoubtedly easier to cut out a station when living within a short distance of it. The principle of preventing the D.C. component in the anode circuit of the H.F. valve from passing through the H.F. interstage inductances, by means of a coupling condenser, avoids the burning out of windings should the balancing condenser be short-circuited. The various coils for short and long waves are so constructed that they will stand a considerable amount of rough handling.

An Interesting Lecture.

Experimenters who are investigating the problems relating to terrestrial magnetism and its effect on wireless will be interested in an address to be given on February 22nd to the Physical Society of Birkbeck College, London, E.C.4, by Prof. E. V. Appleton, M.A., D.Sc., F.R.S., on "The Influence of the Earth's Magnetic Field on Wireless Transmission." This lecture constitutes one of the Distinguished Visitors' addresses to the Society and will be given in the College Theatre at 6.0 p.m. We understand from the hon. secretary that admission will be free and without ticket.

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Telephony Tests from Japan.

The Hiraiso Radio Laboratory, Ibarakiken, Japan, whose call-sign is JHBB, is conducting a series of radiotelephony tests on 37.5 metres, which began on January 16th and will end on February 17th. Gramophone music and rebroadcasting of the programmes from JOAK, the Tokyo Central Broadcasting station, are transmitted on Monday, Wednesday, and Friday of each week at 0600-0700, 1000-1300, and 2200-2300 G.M.T. The input to the aerial is 1-2 kW. Reports will be welcomed and should state the strength of signals, fading, clearness, and quality of signals, atmospherics, and other noises, weather conditions and general remarks. The type of receiver and dimensions of the aerial used should also be stated. Mr. C. A. Jamblin (6BT) has kindly undertaken to co-ordinate reports from British listeners, and these should be sent to him at 82, York Road, Bury St. Edmunds, Suffolk.

TRANSMITTERS' NOTES AND QUERIES.

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Call-signs Allotted and Stations Identified.

5 LN	A. P. Welch, 213, Brentwood Rd., Romford (change of address).
5 SH	S. F. Harris, 13a, Winstead St., Battersea, S.W.11.
6 AY	(ex 2BSJ), A. F. Hembury, 57, Winstead St., Battersea, S.W.11.
6 CA	C. A. Allen, "The Larches," Headroomgate Rd., St. Annes-on-Sea, transmits on 45 and 90 metres and is carrying out tests on regional fading.

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Short-wave Station in Java.

Through the courtesy of the chief of the Tjililin wireless station in Java we are able to give some reliable particulars concerning the Government short-wave stations ANC, AND, ANE, ANF, ANH, and ANK, which have been heard by a number of listeners in Europe. All these, together with the long-wave stations ANA and ANB are associated with the high-power station PKX at Malabar.

ANC, AND and ANF are situated at Tjililin, about eighteen miles from Bandoeng; ANE is at the Government Radio Laboratory at Bandoeng; ANH, at Malabar, was designed and erected by the late Dr. C. J. de Groot, who was so largely responsible for the establishment and progress of wireless in the Dutch East Indies, and ANK is an experimental station used for tests.

The wavelengths and nature of transmissions are :—

ANC	transmits telegraphy only on 26.2 and 40.2 metres.
AND	transmits telegraphy only on 18.8, 28.8 and 37.5 metres.
ANE	transmits both telegraphy and telephony on 17.4 metres.
ANF	transmits telegraphy only on 20.3 and 36.5 metres.
ANH	transmits both telegraphy and telephony on 17.4 metres.
ANK	transmits telegraphy only on 19.4 and 30.2 metres.

The usual transmissions from ANH are :—

Monday.—Telephonic communication with PCLL, Kootwijk, Holland, from 1400 to 1600 G.M.T.

Wednesday, Friday, and Saturday.—Broadcasting from 1300 to 1600 G.M.T., alterations in times of transmission being announced.

The nominal power of this station is 30-40 kW., with double-rectified A.C. at 12,000 volts 500 cycles, and the aerial input is 8 amps.

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QRA's Wanted.

2ZH, AB 1AB, OH 2AX, EY YK2, ET 1F, NG UF, XNH 2VQ, NH 1CA, NV EWY, AG RANN, NE 8AE.

News from All Quarters: By Our Special Correspondent.

The Corporation Considers Controversy.—Drawing the Line.—Cardiff Repeats a Triumph.—The Prince's Broadcasts.—New Paradise for Pirates.—Those Talks.—Faults in Programme Timing.

Controversy.

The seeker after information has a thin time at Savoy Hill when he mentions the subject of controversial broadcasting. All lips are sealed.

This is not to say that the matter has been shelved in the hope that the public will forget it. Oh no. We have the Governors' solemn pronouncement that the whole question is having their careful consideration.

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Extending the Frontiers.

There seems to be no definite antagonism in the B.B.C. itself towards the idea of controversial broadcasting; indeed, recently published documents go to show that the Corporation has been "extending the frontiers" for months past with the idea of establishing precedents. In other words, it has been trying to reach the top rung of the ladder without being noticed.

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The Collapse.

Unfortunately the ladder has collapsed, leaving the B.B.C. in the universal gaze. If the ladder is still to be climbed three courses are open. The Corporation can start all over again, like Bruce's spider; it can stay where it is, or it can ask boldly for official sanction to proceed.

There is no sign that the last mentioned course is being taken, the reason being, presumably, that the Corporation has doubts concerning the desirability of renewing the project.

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Drawing the Line.

From what I can gather, the whole question of controversial broadcasting has resolved itself into the single query, Where shall the line be drawn? Controversy in itself is not resented, the main difficulty being to decide whether we may listen to views about conservatories but not Conservatives or about the honesty of labour, but not of Labour.

On the last point it is interesting to hear that the B.B.C. has received numerous complaints from horrified listeners because the News Bulletin on Sunday of last week included an extract from a speech by a Labour M.P.

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Is Controversy Worth While?

This is a little example of what would undoubtedly follow the introduction of political controversy. The question is, would it still be wolth while? Many folks will answer, Yes.

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Bravo, Cardiff

There are some interesting features in the record of hours worked by the various B.B.C. stations during 1927. Cardiff again heads the list with the minimum of breakdowns, its percentage amounting to only .003. London had a breakdown percentage of .02, Daventry (5XX) .07, and Liverpool .09.

The hardest-worked station was 5XX with 4,792 hours to its credit, while 2LO came next with 3,562. The total working time of all stations of the B.B.C. during the year was 65,299 hours 22 minutes.

In the case of 5GB certain allowances have to be made, this being avowedly an experimental station. The percentage of breakdowns was .56, and the total number of hours worked was 2,997.

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Famous Women Musicians.

An exceptional combination of feminine talent will go on the ether on February 8th, when Elizabeth Schumann, the well-known singer, and the equally famous 'cellist Suggia, are to broadcast from 2LO, 5XX and other stations.

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The Prince at the Microphone.

The Prince of Wales is to make two appearances before the microphone in the near future. The first occasion will be on February 23rd, when H.R.H., at the annual dinner of the Chamber of Shipping at the Guildhall, will propose the toast of "The Shipping Industry," and will be heard by 2LO and 5XX listeners.

The Prince will again be heard on

FUTURE FEATURES.

London and Daventry (5XX).

FEB. 5TH.—Orchestral Concert.
FEB. 6TH.—Vaudeville Programme.
FEB. 7TH.—"The Burden of Women," a play by E. Temple Thurston.
FEB. 8TH.—Recital by Elizabeth Schumann and Suggia.
FEB. 9TH.—Concert by the Gloucester Orpheus Society.
FEB. 10TH.—Symphony Concert relayed from the Queen's Hall.
FEB. 11TH.—Operatic Programme.

Daventry Experimental (5GB).

FEB. 5TH.—Albert Sandler and Grand Hotel, Eastbourne, Orchestra.
FEB. 6TH.—An Edward German Programme.
FEB. 7TH.—From the Musical Comedies.
FEB. 8TH.—Vaudeville Programme.
FEB. 9TH.—Symphony Concert from the Town Hall.
FEB. 10TH.—Speeches following the annual Civil Service Dinner.
FEB. 11TH.—Orchestral Concert.

Cardiff.

FEB. 5TH.—"The Light of Life." Oratorio by Sir Edward Elgar.
FEB. 7TH.—Lecture-recital by Fred E. Weatherly.

Manchester.

FEB. 6TH.—"Carry Me Out," a farce by A. E. Bryan.
FEB. 8TH.—"Leap Year," a new revue.

Newcastle.

FEB. 6TH.—"A Neet wi' Geordie."
FEB. 7TH.—Dickens Birthday Anniversary Programme.

Glasgow.

FEB. 11TH.—An Arabian Night.

Belfast.

FEB. 9TH.—Hungarian Programme.
FEB. 11TH.—"Don Quixote," a radio version of Cervantes' novel, by Clifford Carter.

March 21st, when he will be present at the annual banquet of the Company of Master Mariners, to be held at the Mansion House. The Prime Minister will also speak on this occasion.

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Marmalade and the Microphone.

The statement frequently made that women are not interested in the discussion of domestic subjects on the ether appears to be a libel on the sex. A talk was broadcast the other day by Mrs. Cottington Taylor containing a recipe for marmalade. Within a few hours more than 1,500 applications had been received at Savoy Hill by post for copies of the recipe.

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India—The Pirates' Paradise.

Not long ago the noble Hottentot could affirm that his country sheltered more broadcast pirates than any other. Not so to-day. The palm goes to India.

The "grand" total of licences issued in India from January to October last was 1,692!

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Income £500; Expenditure . . . ?

Quite naturally the Indian Broadcasting Company is beginning to feel the draught. The company gets 8 rupees, or about 10s. 8d. per licence per annum, so its income during the ten months under review came to little more than £500. Thus it is unable to afford Sir Harry Lauder.

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No Rush for Licences.

In the December *Indian Radio Times* some astounding figures are published showing how receiving licences have been issued in various districts. In the whole of the Punjab during the period of review licences were taken out by seven persons, *i.e.*, 0.7 person per month; precisely the same number found their way to the licence counter in the province of Assam. The United Provinces showed a more go-ahead spirit, producing one licensed soul a month.

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A Significant Point.

Among the cities Shillong cut a poor figure with two holders of licences (not much oscillation here!), and even Delhi could only muster seven. Bombay led the way with 1,108 licensed listeners, Calcutta following with 550.

In the opinion of the Indian Broadcasting Company, "piracy" exists on a considerable scale, to judge only from the sale of the *Indian Radio Times*, which far exceeds the total number of licences! "Why," asks the company, "should anyone buy *The Radio Times* unless he has a receiving set?"

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Cheltenham's New Organ.

An organ recital by Sir Herbert Brewer will be relayed from the Town Hall, Cheltenham, to 5GB on February 15th, on the occasion of the opening of the new Town Hall organ. The programme will consist of Fugue in G minor (Bach), "Caprice" (Guilmont), "Marche Heroique" (Herbert Brewer), "Cantabile" and "Fanfare (Lemans).

Strange!

The name of the leading vocalist in a recent Palmolive Hour broadcast through the U.S. Red Network was Olive Palmer.

This suggests a new and insidious form of advertisement!

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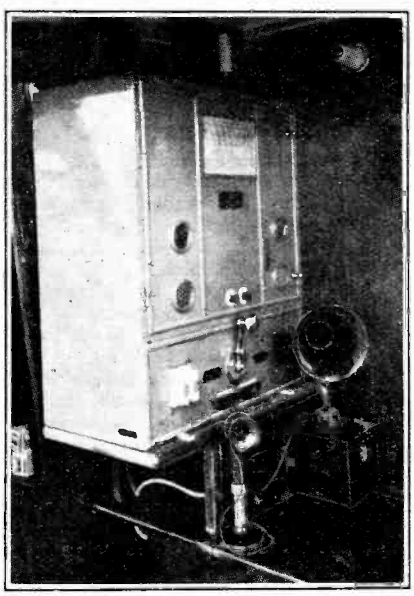
Too Much Talk from 2LO.

The prevailing fashion of decrying the B.B.C. "Talks" policy has a good deal of sound reason behind it. On most evenings 2LO, 5XX and other stations taking the London programme indulge in a welter of talk from the time that the ordinary worker sits down to his evening meal until he has completed the processes of digestion.

Take the fare offered on Tuesday of last week. I choose this day for no other



BROADCASTING PLANT IN A BOX. This compact ¼kW telephony set has been built by the Marconi Co. for use on the yacht of a Californian big game hunter who wishes to enjoy private broadcasting programmes from the coast while roaming East African forests.

reason than that I had unusual opportunities to listen. From 6.30 until 9.35 more than half the period was occupied by solid talk, including a twenty minutes' lecture (during dinner) on mediæval Europe and an uninspired reading of Shakespeare's sonnets and lyrics. The alternative to the last-named was a talk from 5XX on Danish farming, lasting half-an-hour!

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What a Change Might Do.

The period from 6 to 8 p.m. is generally packed with more talk than any other time of the day, despite the fact that this is the one period when the majority of listeners—highbrow and lowbrow—would be satisfied with light music as an accompaniment to their meal.

The arrangement of the programmes is far from ideal. Perhaps if some change were tried in this respect the programmes as a whole would receive more appreciation—even if the type of material remained unaltered.

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Programme Timing.

In the routine of programme presentation the B.B.C. seem to have reached a very high pitch of efficiency. The days when artistes forgot their music, when microphones became short circuited at critical moments, when stage whispers were broadcast for all the world to hear—these days have passed. On one point, however, the Corporation still merits criticism. Programme timing is still a dubious art and, especially of late, there have been several flagrant cases of departure from schedule.

Where "S.B." events are concerned the trouble may be unavoidable, but there is little excuse for these divergencies when a programme from a single studio has to be cut about to suit the clock.

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Penalising the Punctual.

The worst form of mistiming occurs when the programme is actually ahead of time, for this often means that people switching on at the advertised moment miss the particular item they wish to hear. They do not object to a wait of a minute or two if their item is late, but I have heard some strong comments from punctual people who have not been satisfied with only the closing chords of their favourite pieces.

Railway timing provides a parallel. Trains have been known to *arrive* early and late, but it is a standing order that no train may *leave* early.

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All Irish.

An all-Irish programme is to be broadcast by Belfast on February 13th. Drama will be represented by W. B. Yeats' play, "The Land of Heart's Desire." Variety will include Seamus Clandillon and Margaret Hannigan in Irish folk songs and the ever-popular Mrs. Rooney. Seamus Clandillon is director of the Dublin broadcasting station.

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"The Immortal Hour."

"Legend Land" is the title of a programme from Cardiff station on February 16th. Arthur Cranmer will sing items from "The Immortal Hour," and a play will be given on the Arthurian legends in the area.

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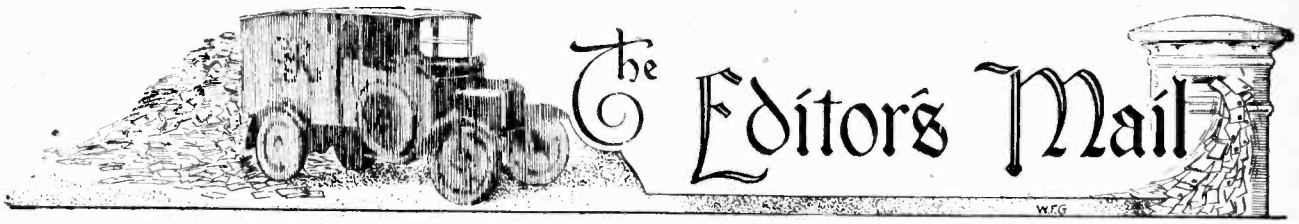
A Real Song Hit.

A new terror is suggested by the experience of a listener to WEAF, New York, who wrote the other day: "Sunday evening, when the soprano hit a high note, the vibrations from the loud-speaker shattered a valuable glass vase. My wife and I were quietly enjoying the songs when we heard a loud crash. The vase had collapsed and lay in pieces on the table on which it had stood."

If this sort of thing is repeated it will soon be the height of tactlessness to say that a singer "brought down the house."



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.

CHEAPER VALVES.

Sir,—The editorial entitled "Cheaper Valves" in your issue of the 18th January contains statements which are contrary to fact and which I therefore hope you will permit me to correct.

Prof. Hughes (in collaboration with Mr. Poindexter) did neither discover nor announce the discovery "that a trap of sodium and potassium alloy would act just as well as a liquid air trap for collecting mercury vapour." They did, however, discover that a solid film of a distilled alkali metal, in particular either sodium or potassium, would trap mercury vapour, and announced this discovery in *Nature*, vol. 115 (1925), p. 979, and in the *Philosophical Magazine*, August, 1925. In neither publication is there any mention whatsoever of a mixture or alloy, solid or liquid, of any of the alkali metals. Immediately after Hughes' and Poindexter's first announcement of their discovery, I tried out their method and found that a solid sodium or potassium surface speedily becomes clogged with mercury, and is thus rapidly rendered inactive. In view of the then state of knowledge of the properties of the liquid alloys of sodium and potassium and of their amalgams there was no doubt some justification for the belief that the liquid alloys would be unsuitable for trapping mercury vapour. Some $2\frac{1}{2}$ years of systematic research carried out in these laboratories upon the properties of the alloys in question and their amalgams have, however, resulted in the preparation of a liquid alloy of sodium and potassium, called for the sake of brevity "sorbaloy," which, as it continuously presents fresh surfaces to mercury vapour, does not clog up and still retains its activity unimpaired after having absorbed more than thirty times its own weight of mercury. Also, given suitable conditions, this alloy will absorb quantitatively all gases other than the rare gases. You will therefore realise that the invention of a mercury vapour trap using a liquid alloy is quite and fundamentally distinct from Hughes' and Poindexter's discovery of the solid alkali metals, and that the statement that "this result has, therefore, been known for two years to workers interested in vacuum technique" is not in accordance with fact.

The final paragraph of the editorial in question, entitled "Too Optimistic," is presumably to be taken as a mere expression of opinion based on what I have above tried to show is an imperfect knowledge of the facts. The preparation of the solid alkali metal films calls for the exercise of such precautions and skill, and their active life is so short that their use is impracticable under works conditions. "Sorbaloy," however, is easily handled without special precautions, and makes possible the attainment of vacua of the order of 10^{-9} mm., *i.e.*, about one thousand times better than those obtainable with liquid air cooled traps. This is not the place to enlarge upon the advantages of such an improvement in the vacuum of all classes of thermionic valves, whether they be used for wireless or other purposes.

A high-capacity pump with an evacuating speed of 15 litres per second requires for a year's continuous working a single trap filling of 20 grams of "sorbaloy." The trapping of the vapours of a similar pump with liquid air for the same period of time requires at least 700lb. of the latter, and necessitates repeated filling of the trap at regular intervals throughout the working day. The liquid air trap is reversible, and needs regular attention; the "sorbaloy" trap is irreversible and needs no attention.

G. I. FINCH.

Imperial College of Science and Technology.
January 19th, 1928.

OPTIMISTIC PERFORMANCE CLAIMS.

Sir,—I should like to express my entire agreement with the remarks of your correspondents, Mr. S. G. Black and Mr. F. Appleton, on the exaggerated claims for the 0-v-2 type of receiver.

In skilled hands, under favourable conditions, such a set is capable of receiving a number of stations, but only at great sacrifice of quality. The point is immediately obvious if we consider the claim that such sets can receive Radio Paris in London when Daventry 5XX is working. There is only 17 kilocycles separation between these stations, and I imagine the field strength of Daventry in London to be at least twenty times that of Radio Paris. Any set with a single circuit tuner capable of eliminating 5XX can only do so by using reaction so as to sharpen the resonance curve to a point where the higher sound frequencies are cut off, resulting in vile quality of reproduction, which the makers in some cases endeavour to correct by using transformers with a sharply rising characteristic; the final result being that such a set cuts off the higher frequencies in the tuning coil and the lower frequencies in the transformer L.F. stages, musical items losing their tone colour, and speech much of its intelligibility.

Users of this type of set in London suburbs are largely responsible for the bad quality of reception obtained on good sets by their neighbours, as a set operated just off the oscillation point upon a given station sharpens the tuning of a neighbouring aerial also.

As a proof that even moderate selectivity in a tuned circuit affects quality, I may say that I have a tuned-anode set using one shielded-grid H.F. valve, which, using *two* tuned circuits, is not quite capable of eliminating 5XX when receiving Radio Paris—in other words, this set is not particularly selective.

Having two tuned circuits the combined resonance curve is fairly flat-topped circuit with that of a single circuit with the tuning sharpened to cut out 5XX.

Yet the improvement in quality of reception of 5XX, obtained by mistuning each circuit about 4 kilocycles to right and left as suggested by Captain Round, is most noticeable. In other words, a two-circuit tuner not attaining the selectivity claimed for the 0-v-2 set is capable of improvement as regards cutting off the side-bands—a single circuit tuner must obviously be much worse, while one cannot adopt the "mistuning" idea to improve matters.

The quality of reproduction of the average wireless set as generally operated in the London suburbs is deplorable. This state of affairs is largely due to the use of a detector valve with reaction as a substitute for an H.F. stage, a system abandoned three years ago by all American manufacturers.

The Wireless World would be doing a good turn to our export trade if it brought pressure on our manufacturers to produce sets having selectivity combined with good quality and range, which would stand some chance of competition with American apparatus.

O. D. NORTH.

Chelsea, S.W.10.
January 18th, 1928.

Dear Sir,—With reference to the various letters published by you regarding claims made for 3-valve sets, the following should prove of interest.

I made up one such receiver, which appeared at the Radio Exhibition, and obtained what I considered average results for the number of valves and circuit employed. When another set appeared on the market I made it up and found it would not do anything like what was claimed. I thereupon, to

satisfy myself, called on the advertisers at their London showrooms and asked for a demonstration. This they could not do on the grounds that they had no suitable valves. As they are valve manufacturers, need I say more? Upon asking a few questions as to the capabilities of the set I was informed it would cut out London on an indoor aerial.

Also, and this is more interesting, a certain well-known store possessed of a good outside aerial, gave facilities for display of this set and made a point of selling kits by instalments. To still further convince myself, I called here for a demonstration and found the set was being worked from an indoor aerial and gave moderate results on London, and would not get 5GB. The reason an indoor aerial is used is obvious, as although I was given to understand that London could be cut out in London, it cannot be done on a good outdoor aerial, which is every amateur's aim. Also, everyone knows that the circuit used should give good headphone signals on foreign stations, but I consider it is misleading the public to make such exaggerated statements in advertisements. I might add that at least a dozen sales went "west" at the store in question, in fact, the demonstration caused some amusement.

Kensington, W.14, "MULTI VALVE."
January 19th, 1928.

SIR,—After reading the various letters which have appeared in *The Wireless World* regarding the results obtained from a well designed and carefully constructed 3-valve set, I should like, as a *Wireless World* enthusiast of seven years' standing, to detail my experience in this respect.

Previous to taking this house about a year ago I was handicapped as far as having a good aerial was concerned. Consequently anything less than four valves was useless, but now I am in a better position. I fixed up an aerial 90 feet long and 35 feet high. I scrapped the four-valve, *The Wireless World* "Everyman Four" not because it was not good enough, it was too good; it was like taking a 10-ton truck to fetch a ½-cwt. of coal. Volume, etc., nearly paralysed us. I would never have believed that an aerial could make so much difference. Anyway, I built the "Everyman Three" (*Wireless World* again) and results, well, if I started writing, a great number of your readers would not credit it, so I am not going to start, but my advice is this: If any of your readers wish to have a set which he can swank with, here they are:—

1. If he is restricted as to aerial, *Wireless World* "Everyman Four."

2. If he can get a good aerial, *Wireless World* "Everyman Three 0-v-2."

And he can laugh at all the stunt sets. Wishing your wonderful journal every success. WM. SMURDEN.

Sidney Street, King's Lynn.

[*The Wireless World* Everyman Three employs a H.F. stage followed by detector and one L.F. stage, and is not therefore 0-v-2 as our correspondent states.—ED.]

IDENTIFYING BROADCASTING STATIONS.

SIR,—I have read with interest Captain Eckersley's article on the above subject in this week's *Wireless World*, but without surprise, as I was aware of his attitude. In endeavouring to prove there is no necessity for identifying signals, Captain Eckersley has indeed set himself an impossible task, and the only part his article has served is to clearly show that he is entirely out of sympathy with one trend of modern broadcast development, which raises the point as to whether it is fair that he should represent British public opinion at the various conferences.

The weakness of Captain Eckersley's case is perhaps best expressed by his reference to foreign broadcast as "tame." I feel sure readers of *The Wireless World* will not be misled by such a mis-statement of fact, and I think it ill befits him to talk disparagingly of foreign broadcast, as we have much to learn therefrom. I cannot understand this cry of Captain Eckersley's to be content with your local station, because very few people are to-day so minded; also, it is a very narrow view to take of the possibilities of broadcasting, and he may as well try to stem the tide as to stop the thousands (a number only limited by expense) who, each year, join the ranks of those who listen afield, because, here, and here only, lies the solution of the programme problem, a point admitted by the B.B.C. in the introduction of the regional system.

I am grateful for Captain Eckersley's admission that there are good items on the programme transmitted from the Continent, and note with satisfaction that he is endeavouring to link them up. While agreeing this is of great value, to users of crystal sets in particular, it does not, however, in any way solve the programme problem, because the listener would still have to take what was served, and I have come to the conclusion that one's mood has as much to do with satisfaction in a broadcast programme as the artist or the item. The ideal solution, therefore, rests in the development of efficient receiving sets so that one may choose their own programme, and to be able to do so in a satisfactory manner it is necessary to be able to identify the various stations with the minimum of trouble. This question of call signs is not the insignificant matter Captain Eckersley would have us believe—satisfying the "searcher" on a multi valve set—but one which concerns the average listener, because it is essential to the normal development of broadcasting on legitimate grounds. I can assure Captain Eckersley that it is quite as important to know the station transmitting as it is to know the artist, composer, or item, because if the station could be easily and quickly identified, then the artist, composer, or item could be readily obtained from the official foreign broadcast programme if it is to be of any value at all. If Captain Eckersley is right in his argument that we derive no benefit from knowing these things, then there is no necessity for any announcement.

With regard to Captain Eckersley's suggestion that the station can be identified by means of a wavemeter, this method can be dismissed at once as impracticable for the purpose under discussion, being far too troublesome and quite beyond the average listener.

Captain Eckersley's reference to the "minority" can be more fittingly applied to himself, as practically every broadcasting authority of importance has admitted the necessity for identifying signals, the only difference of opinion being the system to be employed. This statement is substantiated by their repeated endeavours to arrive at an "ideal" solution, and it will be of great interest to your readers to know that in Germany (a country which has, perhaps, done more to solve this problem than any other, and whose progress in broadcasting we must admire) a call sign, which they consider the "ideal," is shortly to be transmitted from their Munich station.

Captain Eckersley's description of a call sign in action is very misleading, because there is no necessity to employ foul and discordant noises emitted at inopportune moments, and no one with intelligence would advocate the use of such a system.

I can assure Captain Eckersley that from experiments carried out by myself, and some of my most critical musical friends, that when the call sign is judiciously chosen and applied, it in no way interferes with the artistic side of the programme.

Townmill Road, Glasgow, E. A. A. SCHASCHKE.
January 17th, 1928.

B.B.C. PROGRAMMES.

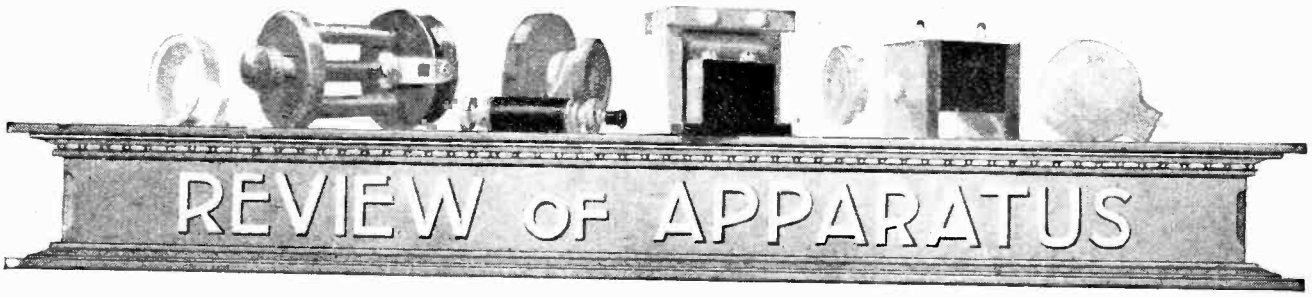
SIR,—I read your leading article in the issue of the 21st ult. with the greatest interest. I wish something could be done to liven up the Daventry programmes; they are dreadfully dull and depressing, and I firmly believe that if a referendum could be taken the directorship would be shaken out of their complacency. Reading the Handbook and the *Radio Times*, it is clear that the management are very pleased with themselves.

What I am sure many of us want is something jolly and inspiriting, such as military band music—marches. The "Military Band" concerts provided by the B.B.C. comprise, as a rule, twice as many songs as band music, and there is usually nothing military about the band items. Last week the Eastbourne Grand Hotel and Frank Westfield's cinema orchestra were the only bits of lively stuff we had.

If you listen-in to Motala, Langenberg or Toulouse, you get a much more cheery class of thing altogether. The foreign stations, too, give many outside broadcasts of plays and operas, excellently done. No studio performance, in my humble opinion, can be compared with the real article.

I think if any open-minded person will study the programme for to-day, which I selected quite at random, he will agree that it is a very unsatisfactory one, from an entertainment point of view. R. T. WATKIN WILLIAMS.

Honiton, Devon.
January 2, 1928.



Latest Products of the Manufacturers.

"ELPHI" SAFETY TESTER.

This neat and simple device, produced by Messrs. T. Phillips, 65, Chancery Lane, London, W.C.2, is intended for use with lighting mains for testing continuity and is perfectly safe to handle, as it is impossible to receive a shock from any part of the instrument, including the two testing terminals. If mains are not available, an ordinary H.T. battery is suitable for working the tester, but in this case the leads would have to be disconnected from the plug.

The "Elphi" safety tester employs a neon lamp as indicator and is shock-proof.

When applied to an open circuit with perfect insulation, no glow appears, but a direct connection or short-circuit causes the lamp to glow brightly, though the discharge does not completely cover the electrodes. This is quite normal and is due to an arrangement of safety resistances incorporated in the instrument.

Grid leaks can also be tested and their value estimated by the brightness of the glow. When applied to a condenser in good condition the glow is intermittent, and the frequency of the flashes is an indication of the capacity; the higher the capacity, the slower the flashes. If the condenser be short-circuited the glow will naturally be continuous, but it is difficult to tell whether the leads to the condenser electrodes are making good contact, particularly in the case of condensers of large capacity, when the time between flashes may be of the order of minutes. There are other applications too numerous to mention which will at once become apparent when once the tester has been installed. The price is 15s., including lamp.

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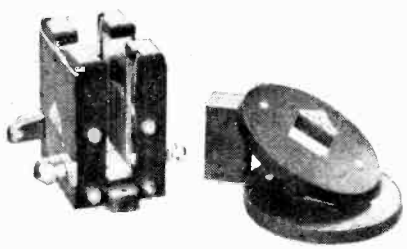
THE MULTIFORMER.

This component is designed with the object of providing the experimenter with a means of making comparative tests of the various systems of low-frequency amplification. Not only can resistance and choke-capacity be substituted for transformer coupling, but the electrical characteristics of each system can be varied to suit the valves with which the unit is to be used.

The foundation of the unit consists of a laminated iron core encased in a moulding which also carries terminals and spring clips for picking up contact with the coil, resistance, and condenser units. The latter are encased in a standardised hollow disc with rectangular centre hole. Into this hole fits the top section of the iron core, which is a sliding fit into the main section of the core. The removable section is so shaped that the disc units, when inserted, automatically fall with their contacts in the right position. It would appear that a considerable air gap is introduced by this form of construction, but this is no doubt compensated for by the generous cross-section of the remainder of the core.

If the base unit is wired into the receiver according to the diagram accompanying the outfit, no change of connections is necessary while experimenting with the different units.



The "Multiformer" with which experiments in transformer, resistance and choke coupling can be made without alterations in circuit wiring.

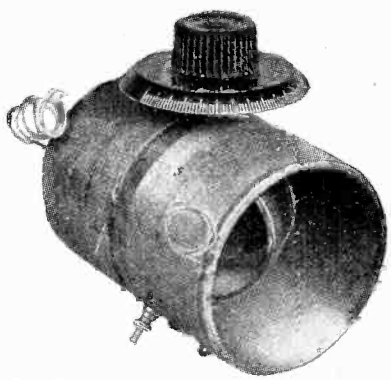
The makers, Messrs. Geo. E. Pohu, 16, Colville Road, London, W.11, supply coil units ranging from 500 to 20,000 turns, non-inductive wire-wound resistances up to 400,000 ohms, and condenser units up to 0.01 mfd.

We understand that a "choke leak" unit is shortly to be produced as an alternative to the ordinary ohmic resistance leak.

○○○○

DUNHAM 'ALL WAVE" TUNER.

Consisting of a cylindrical former wound with two coils for long and short wavelengths, this tuner covers a wavelength range of 150 to 2,000 metres. Mounted on a spindle passing between the two coils is a reaction coil, also wound on a cylindrical shellacked former, the turns of which have been adjusted to suit both aerial coils.



For the home constructor—the Dunham "All Wave" tuner.

The aerial coils are tapped, and a special one-hole fixing panel switch is sold as a separate accessory.

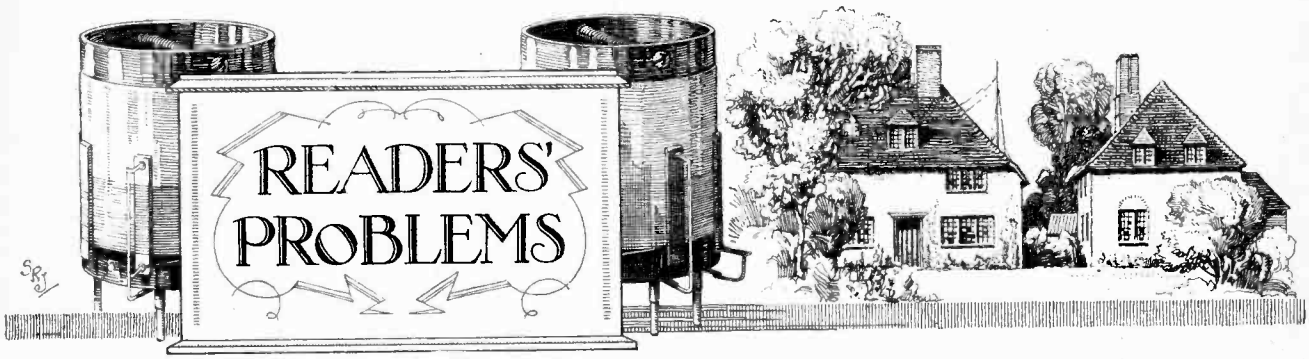
The finish is quite good, though in the particular specimen examined the reaction coil contacts, which at one end are made through spring washers, were inclined to be loose.

Made by Messrs. C. S. Dunham, Elm Works, Elm Park, Brixton Hill, London, it sells for 9s. 6d., and should prove useful to home constructors who do not wish to wind their own coils.

CATALOGUES RECEIVED.

The British Ebonite Co., Ltd., Nightingale Road, Hanwell, London, W.7. Price list of "Becol" ebonite.

The Holrose Manufacturing Co., 43, Lonsdale Road, Kilburn, London, N.W.6. Catalogue of "Holrose" loud-speakers.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases of greater length than would be possible in a letter.

A Question of Doubt.

I have a three-valve receiver with a super-power valve in the last stage. Can you tell me if this would be suitable for operating a moving coil loud-speaker? P. R.

The fact that you use a super-power valve in the last stage of your receiver does not necessarily guarantee that sufficient power will be available for successfully operating one of these loud-speakers. If, however, the design of the receiver is such that you find that the signal strength delivered to the final valve is sufficient to take full advantage of the permissible grid swing of that valve, then you should have enough signal strength for operating the loud-speaker you mention. It may be, however, that you are getting only moderate signal strength from your receiver, and that the grid swing of your valve by no means approaches the permissible limits imposed by the valve. If this is so, there would probably not be enough signal strength available, and you may have to increase the efficiency of your receiver, or aerial system, in order to get a bigger input to the last valve so that full advantage would be taken of its power handling capacities.

o o o o

Which Way Does the Current Flow?

I have been led to understand that in all valve circuits the current flows from the H.T. battery through the valve to the negative. Quite recently I purchased a book on the theory of thermionic valves and read that the electron stream passes from the filament to the plate. How can I reconcile these two statements, please? W. H.

The electron emission from a hot filament is admittedly in the direction of the plate, but the current flow is generally accepted to be from the H.T. battery through the valve to the L.T. negative. The inclusion of a milliammeter in the anode circuit of a valve indicates that this is so, and in addition if the current flowed in the opposite direction the H.T. battery would accumulate a charge and not be discharged. It is essential that the plate should have a positive potential for the purpose of attracting the electron stream, as this renders the space between the plate and filament conductive.

o o o o

Super Selectivity.

I reside within 1½ miles of a main broadcast station and should be obliged if you could recommend a receiver which would enable me to listen to distant broadcast while the local station is working. My present receiver embodies a stage of high-frequency amplification, but the nearby transmitter swamps all other signals. R. D.

Owing to the proximity of a powerful broadcast station you will require a highly selective and sensitive receiver for the purpose of listening to distant transmissions when the local station is in operation. Even with the most selective receiving apparatus some difficulty will be experienced in receiving stations closely associated in wavelengths with that of the nearby stations, but if distant transmissions are receivable under your conditions, "*The Wireless World* Super Seven" would achieve this with greater ease than would be possible with other types of receivers. This set, which follows the well-known supersonic-heterodyne principle, was described in the November 9th and 23rd, 1927, issues of this journal.

o o o o

Gramophone on a Portable Receiver.

I wish to connect a gramophone pick-up to The Wireless World *portable receiver, using the two L.F. amplifiers. Can you please indicate the correct points between which this should be connected?* G. S. R.

The gramophone pick-up should be connected to the grid of the valve V_3 and the grid bias applied *via* the windings on the pick-up. This could be arranged very conveniently by using a jack for the purpose, and the diagram Fig. 1 on this page shows the correct way of including this in the circuit.

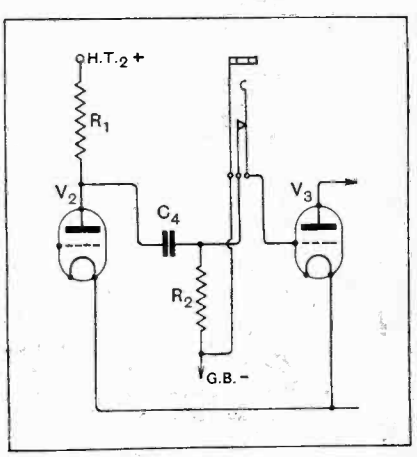


Fig. 1.—Method of interposing gramophone pick-up in "The Wireless World" portable receiver.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

The Wireless World AND RADIO REVIEW

(15th Year of Publication)

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

CONTENTS OF THIS ISSUE.

MAN-MADE STATIC.

"MAN-MADE static" is a term which we believe originated in America and has now come to be used generally to describe sources of interference other than is produced by atmospherics or by interference of one transmitter with another. Man-made static is produced by electrical machinery of a variety of types, and on this account is always likely to be much more serious in towns than in rural districts less thickly populated, where electrical machinery is not in use to the same extent. In the big cities in America, where almost everything is done electrically, very serious interference has long been experienced, and yet it is only recently that the bigger electrical firms have got together and taken the problem seriously in hand with a view to preventing radiation from the machinery they supply. It is recognised that it is far easier to correct it at the source than to attempt to eliminate it at the receiving end.

Broadcasting in this country has now developed up to a point where it can well be regarded as one of the common amenities of life, and the citizen whose broadcast reception is interfered with as a result of avoidable man-made static or other interference is, we think, entitled to complain.

We are glad to learn that the B.B.C. are taking steps to induce electrical firms in this country to do their part in the endeavour to free broadcast reception from these disturbances, which are becoming daily more acute now that the use of electricity in the home is so much on the increase. The remedies should be applied by the producer at the time electrical machinery is designed and manufactured, as it must always be a more expensive method to effect a remedy on individual electrical plants after they have been installed. The electrical appliances which are mainly responsible for causing interference are sparking motors, circuit-breakers on lifts, tramway contacts, arc lights, ultra-violet and X-ray apparatus, electric signs, and automatic telephones; but, in considering interference with broadcasting, we think it well to include electric supply mains for domestic purposes, because, especially in the case of direct current mains, it is a fairly common experience of those who use receivers operating from the mains that fluctuations in voltage and commutator ripple impair reception to a pronounced extent, and the ripple is frequently so bad that it is almost impossible to get rid of it even with quite elaborate smoothing devices.

When Parliament in 1925 considered a short Bill relating to wireless telegraphy intended to clarify the position of authority of the Postmaster-General, a clause was included to give the Postmaster-General control over the radiation of electrical energy, but this clause was omitted when the Act was finally passed. We believe it has never been made clear as to whether the Postmaster-General is the authority responsible for seeing that broadcast reception is not interfered with by radiation from electrical machinery, but, if that authority has been assumed by him, how is it that more drastic methods are not adopted to secure for the listener, as far as possible, immunity from these nuisances? It seems to us unsatisfactory that the B.B.C. and the public should be placed in the position of having to appeal to the goodwill of those responsible for causing this unnecessary interference to take steps to remedy it; rather, we think, that in localities where these troubles are serious the public should be entitled to *demand* that it should be remedied. We could, from information which reaches us in our offices, compile quite an interesting black list of offending areas where electrical machinery causes disturbances, and particularly power stations, which, either because the machinery is old or ill-cared for, are a constant source of annoyance to the ever-growing number of listeners who employ the electric light mains for wireless purposes.

Wireless the Pilot of Our Airways.

By W. G. W. MITCHELL, B.Sc.

LONDON'S new air port—the terminal aerodrome for cross-Channel services—is now rapidly nearing completion, although the official opening may not take place until March. The new aerodrome is built on land adjoining the old buildings between Purley and Mitcham, some 2 miles from West Croydon Station and roughly 10 miles due south of Central London. The maximum run provided from east to west is about 1,450 yards, clear of obstruction at either end, and from north to south in the neighbourhood of 1,300 yards, without obstruction at the southern end and with the aerodrome hangars erected at the northern end. The scheme provides for the demolition of the miscellaneous collection of war-time huts and buildings which, since 1920, have served, somewhat inadequately, to house the engineering, signalling, and administrative services of the air terminus. A beginning was made last week in transferring the staff and equipment to the new buildings, which, with offices and workshops, cover a total floor space of 36,000 sq. ft. In addition, there will be two bays of hangars with a floor space of 90,000 sq. ft., so that when the change over is completed and the station is in thorough working order London's new air port will undoubtedly be the best equipped terminal aerodrome in the world. The total cost of the scheme is estimated at about £260,000.

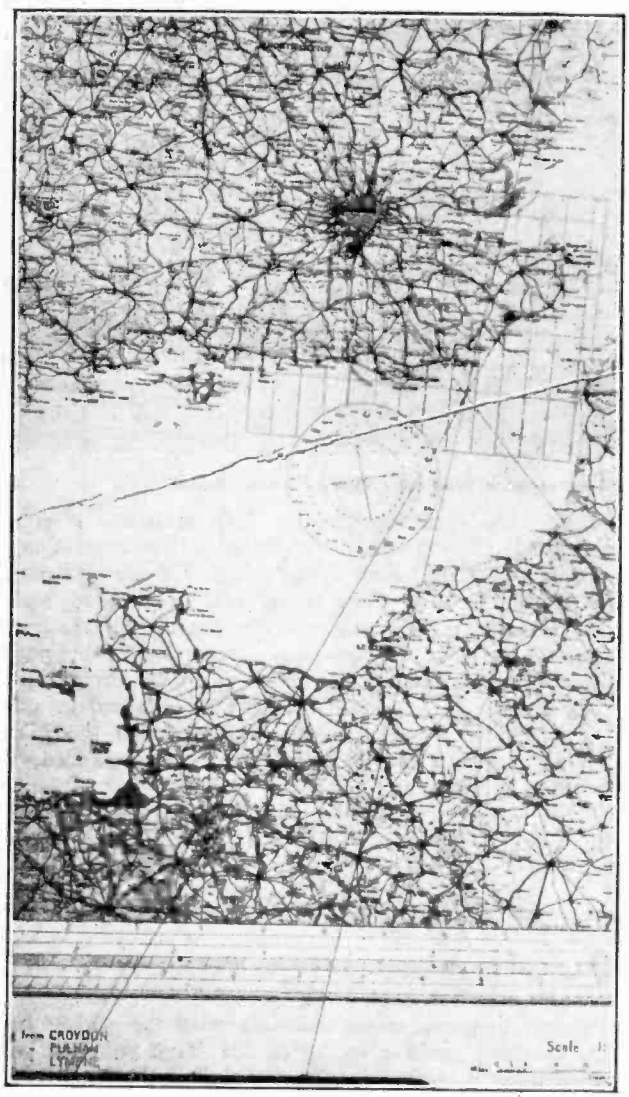
Six Years of Progress.

Croydon aerodrome was first put into commission for civil flying in 1920; a year later the wireless beacon was installed to enable pilots to ascertain their position at any time while in the air, and to navigate their craft safely to port. It was some years after this that the flashing neon beacon was brought into use as a visual aid to air navigation, and it is claimed that (in clear weather) the beacon can be seen from the air half-way across the Channel. In the early days no regular time-table was worked; the average passenger-carrying capacity of the planes in use was small compared with the modern Argosy liner which has accommodation for 18 first- and second-class passengers, as well as a crew of three. During the first year of civil flying the average number of passengers arriving at and departing from the aerodrome was 16 a day; the corresponding figures for last year had risen to over 60 persons on an average each day, or well over 20,000 for the year.

London's New Air Port.—

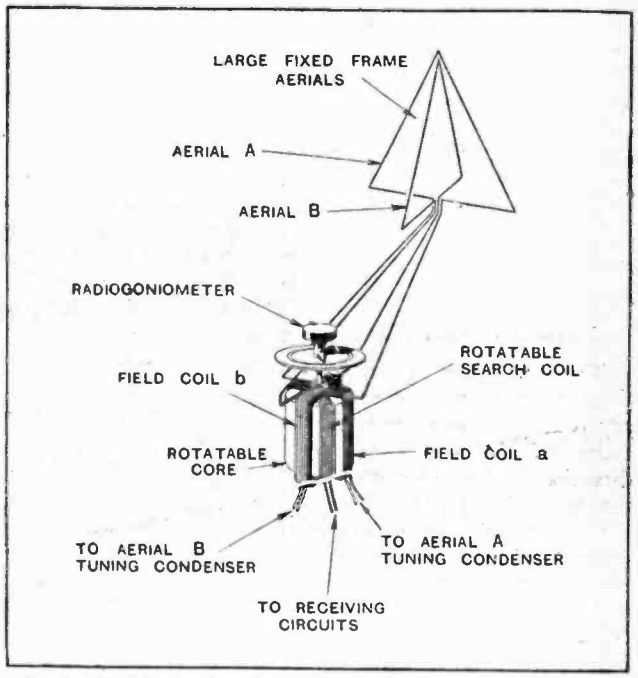
The total value of imports and exports is given as £1,000,000 for 1920, and in 1926 this value had risen to over £10,000,000, chiefly accounted for by the large amount of bullion carried by air. These figures go to show the steady growth which has taken place in civil flying. Improved methods of signalling and position finding of aircraft in flight by means of wireless, and a reliable system for collecting and distributing weather reports along the chief air routes have each contributed to the safety of commercial airways.

To-day, as we step out of the car which has brought us from London into the entrance hall of the new aerodrome, the first thing which arrests our attention is the "Arrival and Departure Indicator" in the middle of the hall. On a wall facing us are two weather maps similar to those exhibited in the Air Ministry at Kingsway. These weather maps are brought up to date every hour while flying is in progress.



Directional wireless receivers at Croydon, Lympne and Pulham (Norfolk) are used to locate machines flying on our air routes. The point of intersection of the strings set to the observed angles gives the position of the machine. Location messages to aircraft on 900 metres are well known to listeners.

The importance of the wireless link, which makes it possible for a pilot to speak from the air to the Traffic Officer, cannot be over-estimated. It must be remembered that aircraft move very rapidly, and communication to be of any use must be rapid, and it must also be brief. The comparative freedom of the air channel, the possibility of getting lost or even of collision when another machine is following the same route, and otherwise



The direction finding receiver comprises two tuned aerial loops set at right angles. Maximum signals are received by a frame aerial from stations located in the plane of the aerial in either direction. A "search coil" is variably coupled to the two frames and indicates the direction of a station when set to deliver the greatest signal strength. Readings are actually taken at position of the minimum signal strength, as this can be more readily observed.

familiar land markings cannot be picked out owing to fog or low-lying cloud, all these are factors which make it imperative that the system of signalling on our airways shall be highly efficient and reliable.

All air traffic is under the control of the Civil Aviation Traffic Officer (C.A.T.O.), and the layout of the new aerodrome buildings provides that this officer has an uninterrupted view of the whole aerodrome from the control tower. This is a square tower, 25ft. glass-panelled sides giving an open view across the aerodrome from a height of 50ft. above ground level.

Spread out before him, the C.A.T.O. has a map of the air routes on a cork base, on which he pins the position of each plane as its movements are reported by wireless.

In the same room, separated from the Traffic Officer's quarters by a glass partition, two wireless operators are constantly on duty during the hours of flying. Fixed on the roof of the control tower are the Marconi Bellini-Tosi aerials, supported in the centre by a 40ft. steel lattice mast. The two triangular-shaped limbs of the aerial, which are set 90 degrees apart, are supported

London's New Air Port.—

on insulators at the top of the mast, and at each of the four corners of the tower, and are led in through the roof to stout copper tubes, and from thence by flex to the receiver proper, which is housed in the operators' room.

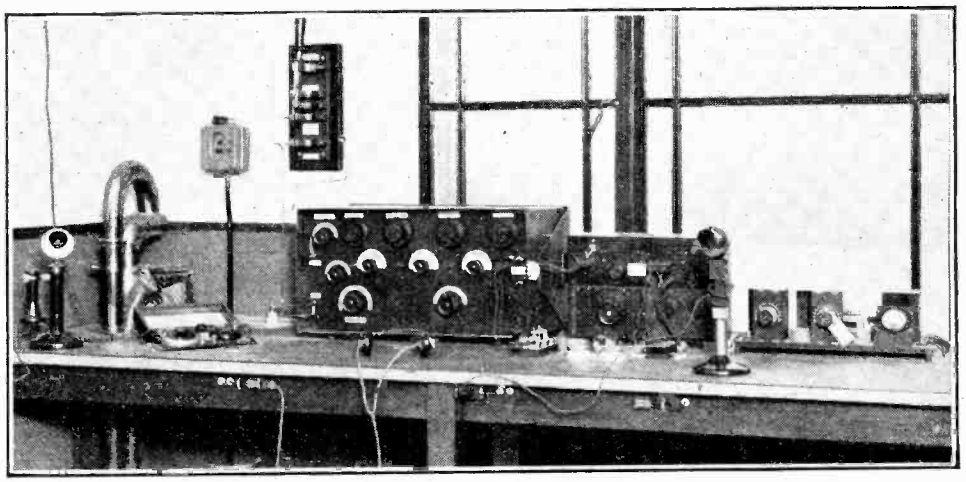
The top of the mast also carries the tower light and tubes for the wind gauge anemometer, which are led straight down through the control tower to the meteorological office on a lower floor.

Great care has been taken in the design and construction of the tower and surrounding buildings to ensure that all ironwork shall be symmetrically placed with regard to the centre point of the tower, so as not to adversely affect the bearings given by the direction finder. Four earthing points are provided, one on each wall of the tower.

A verandah runs round the whole length of the control room on each side, so that the Traffic Officer can in emergencies work aircraft on to the aerodrome by sound.

Aircraft Direction Finding.

The well-known directional properties of the ordinary rotating frame aerial are embodied in the Croydon direction finder, except that the aerial itself is fixed and the effect of swinging the aerial for direction is carried out by rotating the search coil of the radiogoniometer. A calibrated scale and pointer gives direct readings of true direction.



Receiving equipment and microphone used for communication with aircraft.

The receiver, which has been installed by the Marconi Company, is the type known as RG14, embodying four high-frequency valves, type D.E.H. (of which one may be cut out as desired), a rectifying valve, type D.E.H., two low-frequency valves, type D.E.L. (of which one or both may be cut out), a "phasing" valve, type D.E.H., and oscillator valve, type D.E.L. All valves are of the 6-volt filament type, and an H.T. supply of 120 volts is used on the last magnifier. The wavelength range of the receiver is from 800 to 2,000 metres; the normal setting being the aircraft wave of 900 metres. Main tuning is done on the oscillator control, the circuits being arranged to give a quick 10 per cent. sweep on any given setting. The normal working range is 250 miles. A throw-over switch enables the receiver to be used for either Morse or telephony at will, an arrangement which is necessary, as German pilots always communicate with Croydon by Morse code, owing to the language difficulty.

Locating a Machine.

The procedure in taking bearings is as follows: The pilot of a machine calls up Croydon and is asked to run his generator for 30 seconds, during which time Croydon, Lympne, and Pulham (the three D.F. stations always on continuous watch for requests) each take bearings on the aircraft. Lympne and Pulham report to Croydon in turn, and the operator sets off the angular readings on the special map which is in the control room, alongside the direction finder. This map has a glass cover and is slightly tilted, with holes at the three stations, Croydon, Lympne, and Pulham. Weighted coloured threads run through these holes, and a coloured scale round the edge of the map enables the three threads to be set off, so that they give an intersection of bearings indicating approximately the position of the aircraft.

The time taken for a "fix" to be obtained in this way, including the 30 seconds during which the pilot runs his generator and the position is communicated, is less than 1½ minutes.

(To be concluded.)

"CHOKING" IN L.F. AMPLIFIERS.

THE phenomenon known as "choking" is one that manifests itself fairly frequently in resistance or choke-coupled amplifiers, but is not met with where transformers are in use. It shows itself as a momentary cessation of all sound, or, in a less bad case, as a momentary distortion, following an exceptionally loud signal. It is most commonly heard when an endeavour is made to operate a loud-speaker at good strength from a receiver in which the output valve is not adequate for its task, and is due, in all cases, to overloading one of the valves —usually the last.

In such a case there are moments when the grid of the valve becomes positive owing to the large voltages impressed upon it by the signals, and during these moments the grid collects electrons which pass into the coupling condenser, so charging it up. The electrons so collected are, of course, negative, therefore in addition to the grid bias intentionally applied, there is this extra negative

"Choking" in L.F. Amplifiers.—

charge in the condenser. The two together make up a grid bias that is far too large for the valve, so that either distortion through bottom bend rectification, or, in a bad case, complete silence through taking the valve right off its curve, must necessarily ensue.

This silence or distortion is only momentary because the charge on the condenser leaks away through the grid leak, and the grid is restored again to its normal potential.

When the receiver is in use for the local station only, this source of distortion can very easily be avoided either by cutting down signal strength until it has reached a value with which the output valve can deal, or by substituting a valve which can handle the volume properly. Often a simple increase in anode voltage, together with a suitable increase in grid bias, is all that is required to remove this trouble.

It is when an attempt to receive distant stations is made that "choking" becomes really annoying, for although the signals themselves may be adjusted to such a volume that the last valve is not being overloaded, yet an atmospheric or other loud disturbance is often sufficient to cause complete temporary paralysis of the receiver. Nor is there any way of avoiding this possibility, except by altering the relative values of condenser and grid leak.

Alternative Grid Leak Values.

If the leak is made of lower resistance, the charge produced by this momentary overloading can be made to drain away more rapidly, so that the paralysis of the receiver lasts so short a time that it is barely perceptible. Alternatively, a coupling condenser of smaller capacity may be substituted for that normally used, so that the charge that is collected is smaller, and so disperses more rapidly through the original leak.

Unfortunately, either of these remedies has the result of cutting down the amplification of the lower notes, so that, if the receiver is to be used with a loud-speaker that will reproduce them, a very audible deterioration of quality will follow upon their adoption. It is not desirable, therefore, so to design a resistance amplifier that it is immune from the effects of temporary overloading, while it is also extremely exasperating to have the receiver "choked up" by every atmospheric or other passing disturbance.

As a compromise, it is suggested that whenever a receiver is intended for both local and distant listening, arrangements should be made to employ grid leaks of high value when the local station is being received, so that the low notes may be properly reproduced. These leaks should be replaced, when a distant station is tuned in, by others of much lower value so that the annoyance of "choking" by atmospherics may be mitigated as far as possible. Admittedly, this procedure cuts the low notes from the distant station, but as high notes are also cut whenever a number of tuned circuits are used, or when reaction is employed to any great extent, this loss is very roughly counterbalanced, and the general tone of the received music will not be greatly affected.

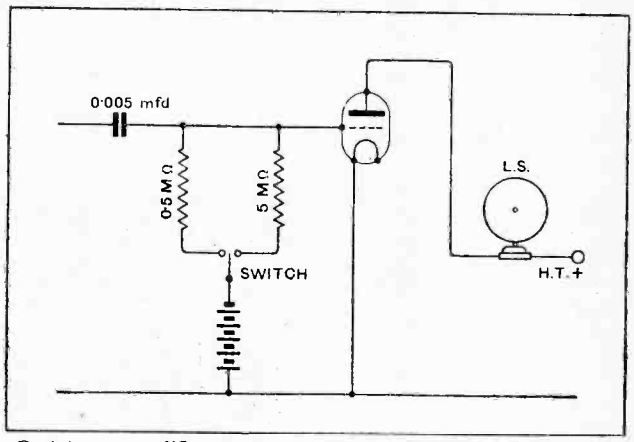
If desired, a switch may be employed, as suggested in the diagram, so that either a high- or a low-resistance leak may be put into action as required. The coupling condenser may have a capacity of 0.005 to 0.01 mfd, while the high-resistance leak may be 5 megohms and the low-resistance leak half a megohm less.

There is, of course, no need to alter the grid bias when changing from one leak to the other.

It depends upon the design of the receiver whether it is necessary to fit duplicate leaks also to the valve preceding the output valve; generally it is only the output valve that tends to overload on loud signals, but where the last valve but one is of the modern high-amplification type, it is probable that it also will overload easily. In such a case it is advisable to fit it also with two leaks, which may be changed at the same time as those fitted to the last valve, in a single operation, if a double-pole change-over switch be used.

The Grid Choke a Poor Compromise.

Attempts have been made in some quarters to popularise another cure for "choking" in which the grid leak is



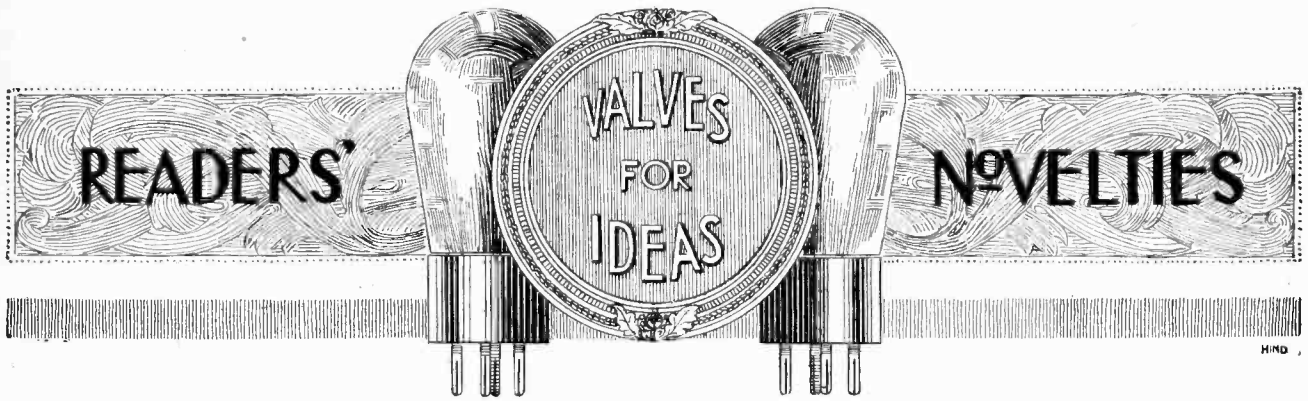
Resistance amplifier employing alternative grid leak values for distant or local stations.

replaced by an iron-cored choke, which is usually employed in conjunction with another choke coil in the plate circuit of the preceding valve. In such a case temporary overloading is harmless, because the charge produced in the coupling condenser runs straight to earth through the low ohmic resistance of the windings of the grid choke.

In the writer's own opinion, this solution of the difficulty is fundamentally unsound. In the interests of bass reproduction, the anode choke must have an inductance which is very high; if good amplification is also required, it must have as high an inductance as can be attained without so increasing the self-capacity that the high notes suffer. If, then, another choke of equal inductance is used instead of the grid leak, the effective inductance in the anode circuit is approximately halved, while the self-capacity is doubled. Thus, both high and low notes must inevitably suffer in such an arrangement.

Nor can there be any satisfactory compromise; for if the grid choke is increased in inductance with the object of retaining the low notes, then the extra self-capacity so introduced makes the high-note loss even worse. But it is conceivable that, in cases where amplification per stage can be freely sacrificed to quality, this method of avoiding "choking" might be found of considerable value.

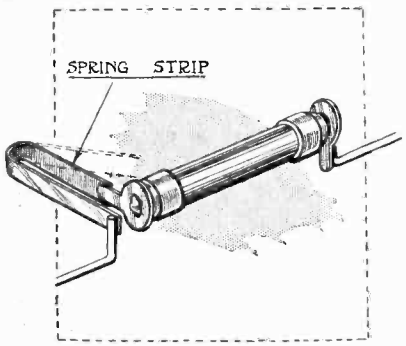
A. L. M. S.



A Section Devoted to New Ideas and Practical Devices.

GRID LEAK CLIP.

It is essential that grid circuits should be kept as free as possible from stray capacities. To this end the grid leak may be suspended



Grid leak suspended in wiring of receiver.

actually in the wiring of the receiver without using a special holder.

Ordinary soldering tags are used to fit over the points of the grid leak clips, and the requisite pressure to ensure good contact is obtained by means of a thin bow spring attached to the rigid wiring at one end. This method obviates the possibility of any alternative leakage path and the springing of the copper strip precludes any possibility of a loose contact.—W. W.

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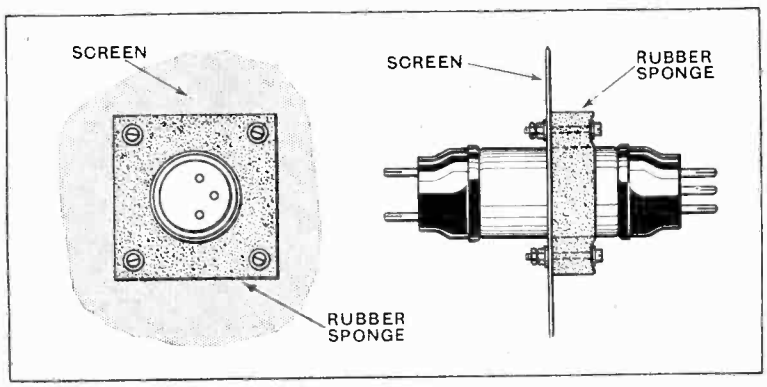
SCREENED VALVE HOLDER.

The screened valve has brought with it new problems of valve mounting, and no standardised method has so far been generally adopted. The method shown in plan and elevation in the diagram should, however, appeal to the experimenter.

A hole having a diameter of about half or three-quarters that of the valve is cut in a square piece of sponge rubber, which is attached to the metal screen by means of screws and washers at each corner. The hole in the screen should be large enough to clear the valve bases, and the valve is secured in position by tightening up the four corner screws, which cause the rubber to expand and grip the glass bulb. The position of the valve can be adjusted until the screen grid coincides with the external sheet metal screen. Connection to the valve legs can then be made by means of valve sockets and flexible leads.—T. V. J. P.



Non-microphonic mounting for the new screened valves.

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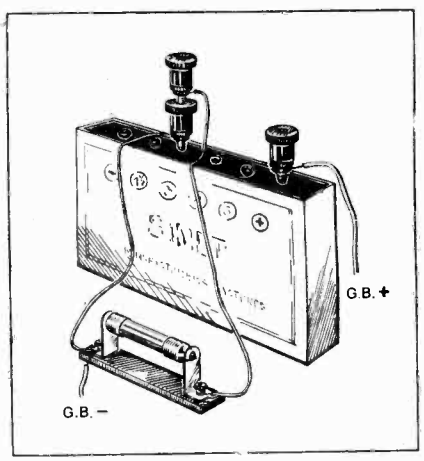
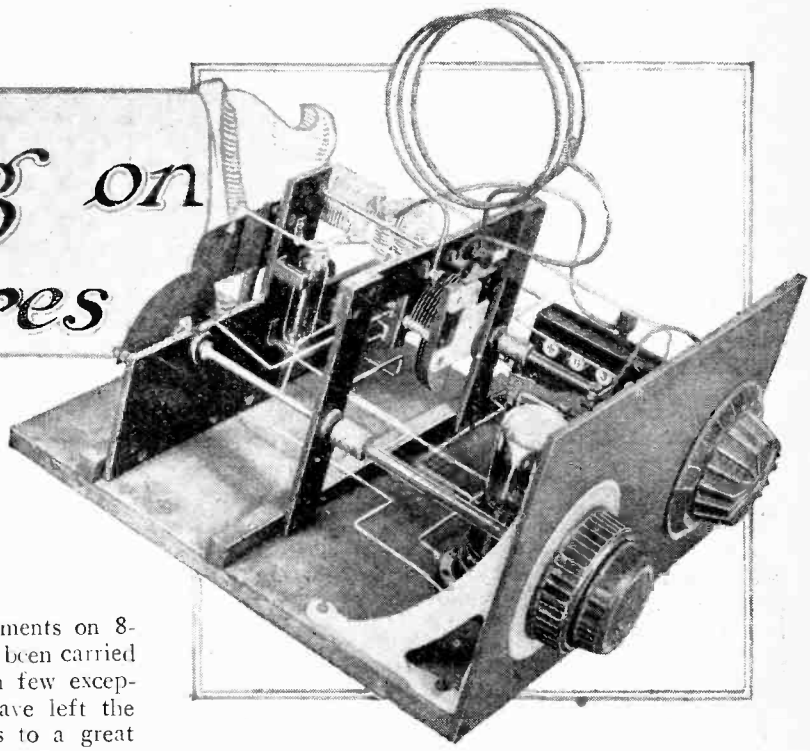
GRID BIAS FOR SUPER POWER VALVES.

As has been pointed out previously in this journal it is bad practice to alter the grid bias on a super-power valve without first switching off, on account of the large current which flows when the plug is removed. To avoid this constant switching on and off, two plugs, of the type which plug into one another, are used, connected together through a resistance. If the plugs are moved into the required socket one at a time, the valve will never be without its negative potential. The resistance can conveniently be any cheap grid leak.—F. F. M.



Safety device for grid bias adjustment.

Working on 8 Metres



Description of a Receiver and Transmitter for Ultra-short Waves.

By C. D. ABBOTT.

ALTHOUGH a fair number of experiments on 8-metre transmission and reception have been carried out in various foreign countries, with few exceptions the radio amateurs of this country have left the subject of ultra-short waves alone. This is to a great extent due to the difficulty in obtaining reliable constructional information without which trouble is experienced in maintaining steady oscillations, carrying out successful reception and accurately calibrating wavemeters. The transmitter and receiver, which will be described later, are illustrated in the various photographs. Together with the necessary accessories they formed one of the "Stations" used by the Q.R.P. Transmitters' Society in their recent extensive experiments with portable equipment.

Fig. 1 is the circuit diagram of the transmitter. L_1 is the plate-grid inductance, and has three turns of $\frac{1}{8}$in. copper tube, $3\frac{1}{2}$in. diameter, with $\frac{3}{4}$in. spacing. The coil is supported at its extremities only by being clamped under two large terminals which are fixed to two pieces of ebonite $\frac{3}{4}$in. × $1\frac{3}{4}$in., which are in turn bolted to the tops of porcelain stand-off insulators (clearly seen in the photographs).

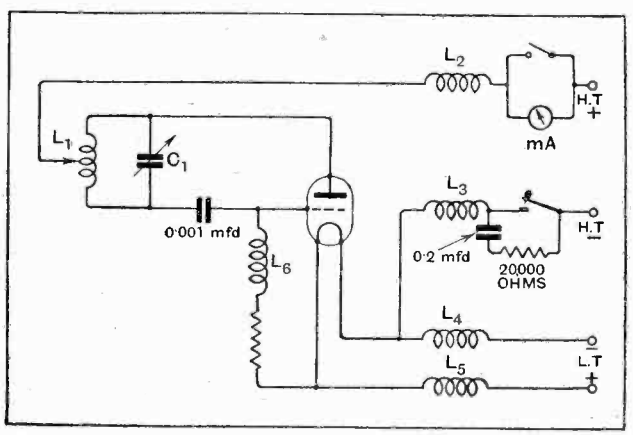


Fig. 1.—Circuit diagram of the complete 8-metre transmitter. L_1 is a 3-turn coil, C_1, a home-constructed 2-plate condenser. L_2, L_3, L_4, L_5 and L_6 are radio-frequency chokes. The valve is a Mullard S.W.50.

Connected at L_2, L_3, L_4, L_5 and L_6 are radio frequency chokes made of 20 D.C.C. wire wound "Lorenz" fashion on 1in. formers. They have 50, 50, 30, 30 and 50 turns respectively.

The tuning condenser C_1 is cut from 20 gauge copper sheet as shown in Fig. 2. It is bent at right angles along the dotted lines to ensure the necessary rigidity. The method of mounting on two ebonite strips measuring 7in. × 1in. gives an exceptionally "low-loss" condenser. One plate of the condenser is connected with flexible wire so that the ebonite strip, which is only secured by a single screw to the 1in × 1in. batten, can be rotated through a small arc in order to vary the capacity of the condenser. The grid condenser has a value of 0.0002 mfd. and was purchased from Messrs. The Dubilier Condenser Co., Ltd. It has a mica dielectric and is capable of withstanding 1,000 volts. The grid leak is an R.I. Varley wire-wound 100,000 ohm resistance.

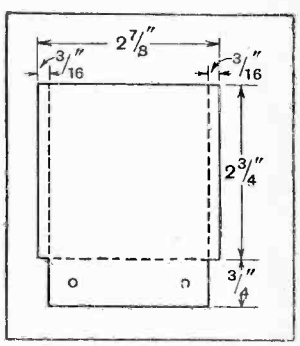


Fig. 2.—Details of the 20-gauge copper sheet used in the two-plate condenser.

Difficulty was experienced in finding a valve which would efficiently dissipate its rated power on this low wavelength. It was decided that a double-ended valve would be essential and the Mullard type S.W.50 was tried and found to be exceedingly satisfactory.

Working on 8 Metres.—

As will be seen from Fig. 1, the set is keyed in the negative H.T. lead, a 0.2 mfd. mica condenser in series with a 20,000 ohm resistance is placed across the gap to minimise arcing, while a relay is used if the power exceeds about 5 watts. The keying, whether operated directly or by means of a relay, must be carried out at least three feet from the set, and vibration must be absent or it will be impossible to maintain a constant frequency. With ordinary valve-rectified A.C., in conjunction with a filter circuit comprising a 30-henry choke and two 1 mfd. condensers, a pure D.C. note is obtainable, and with the Heising choke-control system of modulation successful telephony tests have been carried out.

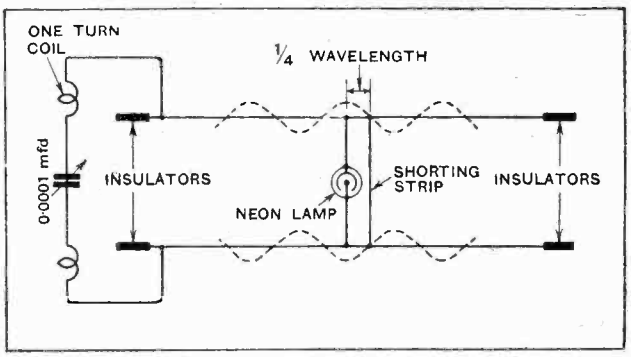
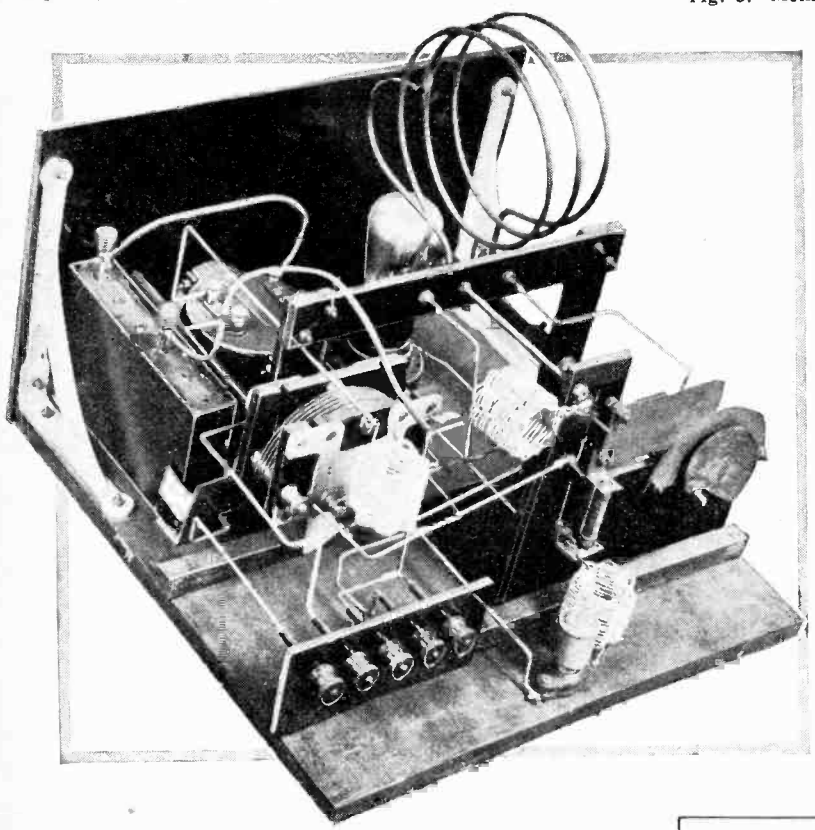


Fig. 3.—Method of measuring wavelength by means of Lecher wires.



The complete receiver. The three Lorenz-wound H.F. chokes can be clearly seen.

Having assembled the transmitter, and proof of oscillation having been obtained, it is necessary to ensure that the wavelength is correct; this can be measured, within a few centimetres, by means of a method invented by Lecher. If C.W. oscillations are induced into a coil connected to the ends of two wires running parallel, a wave will travel down each wire, and when it reaches the far end it will be reflected back again. The coil and wires can be tuned by a variable condenser so that the voltage nodes and antinodes caused by the reflected wave occur at the same places in the wires as those caused by the outgoing wave. To measure the wavelength of the 8-metre transmitter it is necessary to stretch two bare copper wires of equal length, and at least 50ft. long, between two pairs of insulators as in Fig. 3, and to connect the two near ends through two single turn coils about 3in. in diameter to a 0.0001 mfd. condenser. The oscillator coil of the transmitter is next coupled fairly loosely to the single turn coils, and the Lecher wire system brought to resonance by rotating its variable condenser until the plate milliammeter shows a maximum reading. A neon lamp, with a short piece of wire, bent into a hook, soldered to each of its two electrodes, is then pushed along the wires until a position is found where it is seen to glow brightest. A shorting strip is next pushed along the wires starting near the lamp and left where no appreciable difference is noted in the brilliancy of the neon lamp. Referring to Fig. 3, it will be seen that the strip is at a point of zero potential and therefore no current tends to flow through it. The distance between the lamp and the shorting strip is one quarter the wavelength of the transmitter.

It was found, after numerous experiments, that the Zeppelin-type aerial gave the best results; its construction is shown in Fig. 4. The horizontal portion is an

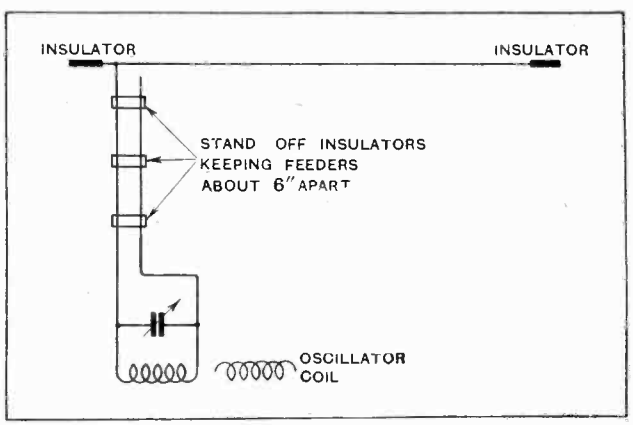


Fig. 4.—The aerial system. Note that one feeder is not connected to the aerial and is included to prevent radiation.

Working on 8 Metres.—

exact wavelength, or half a wavelength, long, *i.e.*, 26ft. 3in., or, if this stretch be impossible, 13ft. 1½in. The two feeders, which are spaced about 6in. apart by means of insulators, may be of any reasonable length; one is connected to the aerial, the other is only there to prevent radiation from the feeder part of the aerial system and is totally unconnected at the aerial end. The lower ends of the feeders are connected to a three-turn coil tuned

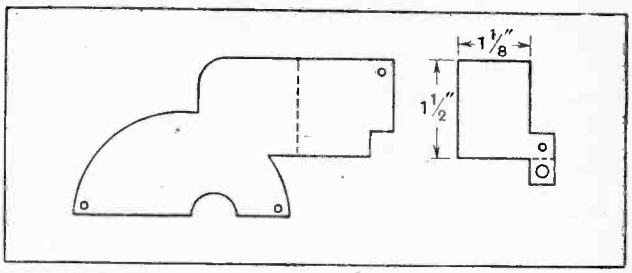
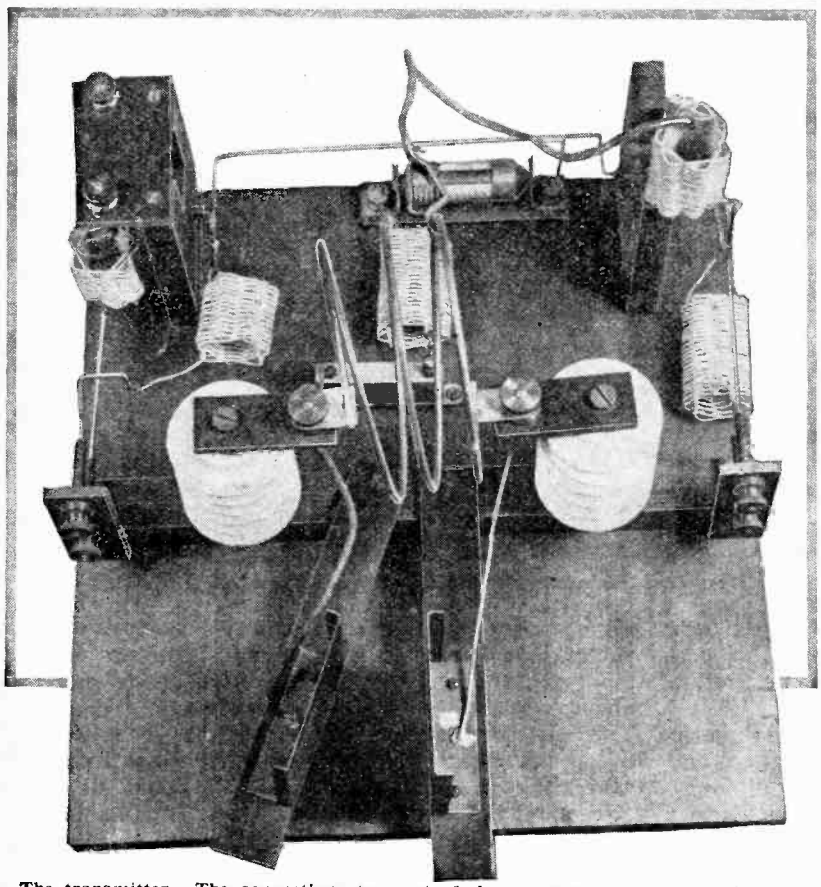


Fig. 5.—On the left is the fixed plate of the tuning condenser (1/3rd actual size), the right hand portion of which is used as one plate of the grid condenser. On the right is the other plate of the grid condenser.



The transmitter. The connections to most of the components can be followed.

by a variable condenser similar in construction to the one tuning the oscillator coil. The resonance point is indicated by a maximum reading on the plate milliammeter. It is important to employ loose coupling in order to obtain a good note and to maintain oscillations.

Receiver for 8 Metres.

The 8-metre receiver is mounted on a baseboard 12in. × 12in. × ½in., which has two ½in. × ½in. battens screwed to it with their front faces running parallel to the front edge and 5¾in. and 9½in. from it respectively. The ebonite panel measures 7in. × 12in., and is supported by two aluminium panel brackets. The ebonite holding the valve supports and tuning condenser is cut to shape. Four clips to hold a V.24 type valve must be constructed, and three ¼in. holes should be drilled between them to minimise capacity between the grid and plate leads.

As will be seen from the wiring diagram in Fig. 6, and also in the photographs, the fixed plate of the tuning condenser acts as one plate of the grid condenser. The other plate of the grid condenser (measurements given in Fig. 5) has a tag, which is bent at right angles to form the support for the grid leak. This plate is soldered to the grid clip of the valve after mounting, and the support for the filament end of the grid leak is made of a small piece of copper sheet, which is so fashioned that it can be attached to the bolt holding the lower filament clip.

The moving plate of the tuning condenser is of the ordinary square law type and is also cut from copper sheet, which is soldered to a piece of $\frac{3}{16}$in. brass rod 5in. long, and is rotated by means of a Bowyer-Lowe ebonite extension handle. An Accuratune dial is used, and the tuning when operating the vernier is quite as simple as that of an ordinary broadcast receiver.

The tuning coil and reaction condenser are supported on a frame made from three ebonite strips, two uprights, 6in. × 1in. × $\frac{3}{16}$in., and a top measuring 8in. ×

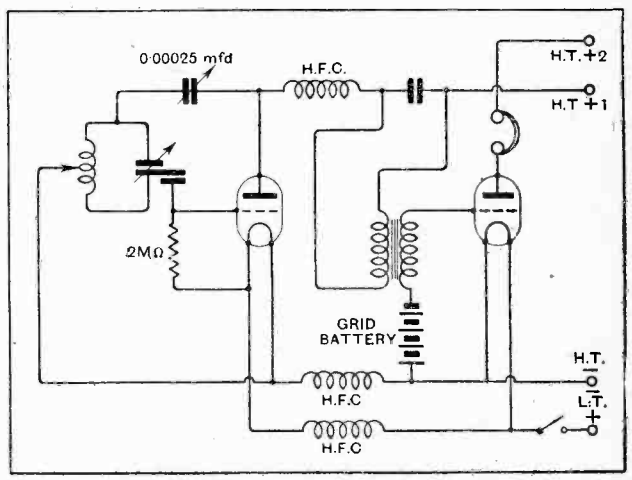
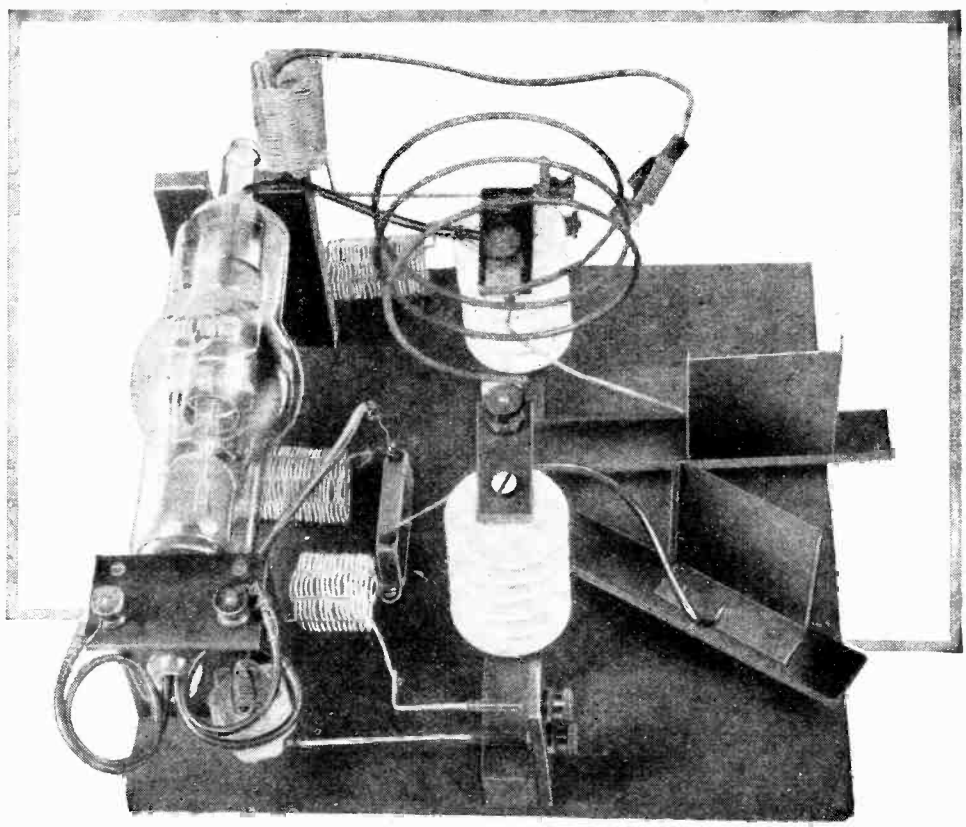


Fig. 6.—Circuit diagram of 8-metre receiver. A DEV valve is used as the detector.

Working on 8 Metres.—

1in. × $\frac{3}{16}$in., which is bolted to them. The uprights are screwed to the front face of the front batten. The terminals for the coil are mounted 1in. apart in the centre of the top strip. The reaction condenser is an Ormond 0.00025 mfd. square law type, and is fixed to the right-hand upright. This condenser also is operated by means of a Bowyer-Lowe ebonite extension handle. A vernier dial was found to be quite unnecessary, as the control is delightfully smooth, and the receiver, contrary to medium- and long-wave practice, is quite sensitive to tonic train, i.c.w., and telephony when a fair way from the point where oscillation takes place.

A 6:1 ratio Marconi Ideal transformer is used and is mounted together with the bias battery holder and amplifying valve between the frame and the front panel. A suitable terminal strip holding five terminals is mounted as shown in the photographs on the rear batten. A filament jack is used, while the correct voltage for the DEV valve, which is used for the detector, is obtained by a Burndept resistor.



The short-wave transmitting valve is here shown in position.

The coil consists of three turns of No. 10 gauge copper wire, $1\frac{1}{4}$ turns being used for regeneration, and $1\frac{3}{4}$ turns as the grid circuit.

The high-frequency chokes in the plate and filament leads are wound with 20 D.C.C. wire, Lorenz fashion, on an inch former, and have 30 turns.

With regard to performance, the set has been used in connection with another receiver and two transmitters all operating on this wavelength, each station being mounted on a car. No aerial nor earth was used on the receivers; the transmitting aerial never exceeded about 15ft. in height and was as already described. The distance between the cars never exceeded ten miles, but communication using about 7 watts on each transmitter was very strong and reliable at all times. Reception and transmission were found to be impracticable unless the cars were stationary.

In another part of this issue will be found a comprehensive list of short-wave stations which transmit fairly regularly on wavelengths below 100 metres.

Book Review.

Pioneers of Wireless.

By Ellison Hawks, F.R.A.S.[1] Methuen and Co., Ltd., London. 304 pp. +xviii. Price 12s. 6d. net.

In this volume Mr. Hawks has given us a very readable account of the development of wireless telegraphy up to a certain point. In the early part of his book in dealing with that type of wireless depending on electric conduction through soil or water or induction across space, that is with the work of such pioneers as Morse, Lindsay, Trowbridge, Preece and others, he covers much the same ground, but with amplification, as that occupied previously by Mr. J. J. Fahie in his book "History of Wireless Telegraphy" in 1899. Mr. Hawks reviews first the fundamental discoveries and inventions of Volta, Ampère, Oersted, Sturgeon, Faraday, Henry, and Bell, and this part of the book is illustrated with good portraits of many of these pioneers. Then we pass on to the details of the work of Morse, Lindsay, Wilkins, Edison, Willoughby Smith, and Preece in their endeavours to make a practical system of wireless telegraphy by conduction through the earth or sea or magnetic induction across space. It is curious to see how much time and effort were expended by each of these early workers, apparently in ignorance of the attempts in the same direction by previous workers, and also how little practical result there was to show for a very large expenditure of time and money. All this work at present has nothing but an historical interest, and it would perhaps have been better if Mr. Hawks had devoted rather less space to it and left himself therefore greater room to deal with the modern developments and more recent workers in connection with electric wave telegraphy and telephony, which alone concerns us at the present time.

Some objection must, however, be taken to certain statements of the author in his review of early work. Thus in Chapter IX he is discussing the contribution of A. E. Dolbear to the subject. He heads this chapter "Dolbear

[1] A series of illustrated articles, "Pioneers of Wireless," by Mr. Ellison Hawks, appeared in the issues of this journal between January 6th and December 13th, 1926.

nearly forestalls Marconi." Mr. Hawks gives on p. 135 a diagram taken, apparently with modification, from one of Dolbear's patent specifications in which an induction coil has one terminal of its secondary to earth and the other to an elevated conductor, and at a receiving station a receiver (nature of which is not stated) has a similar connection. The whole thing is described as if it were an actual experiment, and more or less an anticipation of Marconi. In the early part of this century the owners of Marconi's fundamental patent brought an action against certain firms and persons in the United States who were asserted to be infringing that patent. This specification of Dolbear's was put forward as an anticipation of Marconi. The defendants were then challenged to show Dolbear's method in actual operation, but they entirely failed to make it work. There is no doubt that the diagram and description of it given in Dolbear's specification represents much more the hopes and anticipations of the patentee than his actual experience. In any case neither Dolbear nor Edison made use of electromagnetic waves and therefore could not be regarded as anticipators of Marconi's method. Chapter XII deals with the work of D. E. Hughes, who did actually, unknown to himself, produce electric radiation and detected it at a distance by a metallic fittings coherer. He was a great experimental genius, and if he had not allowed himself to be discouraged by the opinions of those to whom he showed his experiments, he might indeed have anticipated the invention of electric wave telegraphy by ten years or more. Chapter XIII discusses briefly the classical work of

Prof. David Edward Hughes.

Maxwell and Hertz, the two chief pioneers who respectively conceived and predicted the existence of electric waves and experimentally produced them.

Two hundred pages of the book, all too short, are devoted to the evolution of radio telegraphy. We think that the author has not been sufficiently in contact with the actual work to know all the facts. Hence he omits to mention names which ought to have been included and gives undue credit to others. Lodge ought to have been mentioned before Marconi as his work on the oscillatory discharge of the Leyden jar was important and prepared the way for syntonic radio telegraphy. Also, in 1894, his lecture on Hertz and use of the coherer to detect electric waves at a considerable distance from the source clearly stimulated in many minds besides his own the

Heinich Rudolf Hertz.

idea of using the appliances telegraphically. Admiral Sir Henry Jackson, F.R.S. (then Captain Jackson, R.N.), made a confidential report to the Navy on the subject, and Mr. A. A. Campbell Swinton, the late Dr. A. Muirhead, and others had their thoughts and labours directed to it. Marconi, however, has a peculiar genius for bringing to a practical completion and perfecting the immature or crude previous attempts of others. He did this with the rudimentary apparatus of Branly, Popoff, and Lodge, and added to it his own earthed aerial wire, and before 1899 gave us a quite effective set of appliances for transmitting information telegraphically by electric waves 50 miles or more over sea and thus started into existence practical radio telegraphy. Mr. Hawks has, however, not related the facts with regard to the early transatlantic wireless at all correctly. When Senatore Marconi returned from the United States in the autumn of 1899, where he had made successful demonstrations of his system, he was full of the idea of bridging the Atlantic. Up to that time he had used only an induction coil as his oscillation generator. In 1900 he patented his syntonic system and retained the services of the writer of this review to assist him in translating it into engineering appliances. The plans for plant for the first Poldhu wireless station were worked out at University College, London, by the writer, and specifications for the oil engine, alternator, H.T. transformers, drawn up there. Also condensers, signalling key and spark gap were designed. The double transformation system employed in the transmitter was described in British patent specifications filed by the writer in 1901. With this powerful transmitter the first radio signals were received by Marconi in Newfoundland on December 12th, 1901.

It is not correct to state, as Mr. Hawks does on p. 246, that they were received with a magnetic detector. This detector was not devised until a year or more later. The Newfoundland "S" signals were received on various forms of coherer (see "Electric Wave Telegraphy," Fleming, 2nd ed., p. 545). The magnetic detector was in its first form invented by Sir E. Rutherford, and in 1895 he used it to detect electric waves sent out across Cambridge in 1897. Professor E. Wilson made improvements in it later. Senatore Marconi patented his endless wire band form in the middle of 1902. In the section on directive telegraphy, p. 250, whilst Marconi's bent aerial is mentioned, there is no mention of the names of Artom, Bellini and Tosi, S. G. Brown, Robertson, or Round, all of whom made contributions of great value to directive wireless. The name of Mr. C. S. Franklin ought certainly to have been included in any reference to the Beam system.

As regards Chapter XVIII, on the evolution of the Thermionic valve, the facts are fairly stated, but it would have been an advantage, perhaps, to Mr. Hawks if he had had before him in writing this chapter the actual judgments given in the United States Courts on the valve invention. He would then have seen the opinion of the United States Appeal Court that de Forest made no essential inventive addition to the valve until *after* he had seen the writer's published papers on that subject, and he then promptly used the knowledge so acquired.

Taking the book as a whole, it is, how-

Senatore Guglielmo Marconi.

ever, an interesting volume which well repays perusal. The chief criticism which seems called for is that it devotes rather too much space to the extinct and unpractical methods of wireless telegraphy and rather too little or nothing to the work of very numerous men whose combined efforts have given us the marvel of modern broadcasting and the beam system.

J. A. FLEMING.

CURRENT TOPICS

Events of the Week in Brief Review.

THE COUNTER ATTRACTION.

"It has to be recognised that the wireless entertainment in the home, which has now become almost universal, is a serious competitor with club life."—From the annual report of the Alderley Edge (Cheshire) Union Club.

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DAWN OF THE UNBREAKABLE VALVE?

At an exhibition of "metalised" products held by British Airships, Ltd., last week at the Hotel Victoria, London, W.C.2, it was stated that the new process, which aims at strengthening fragile objects by treatment in a metal bath, could be applied to wireless parts, and could render glass unbreakable.

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WHY NOT ON BRITISH TRAINS?

The afternoon express from Paris to Bordeaux is now equipped with broadcast receiving apparatus, writes a Paris correspondent. There are about sixty headphones available for passengers, and outside the electrified section of the line, reception is said to be excellent. The innovation is shortly to be introduced on other trains.

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SHORT WAVES ARE SO USEFUL.

Short waves are being enlisted to aid the currency speculator, and it is reported from Shanghai that speculators at Dairen have temporarily outwitted their rivals by means of an ingenious scheme of short-wave messages sent in code by confederates in the Shanghai money exchange.

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SHORT-WAVE MORSE FROM AUSTRALIA.

OHK2, Austria's official short-wave transmitter at Vienna, will carry out a special series of tests on Sunday next, February 12th, on a wavelength of about 70 metres. Each test period, lasting for 15 minutes, will begin on the stroke of the hour, the series commencing at 5 p.m. (G.M.T.) and concluding with the period 12 midnight to 12.15 a.m. The text of the message, in Morse, will be "CQ de OHK2,—Pse QSL to Radio Austria, Vienna."

Reports should be addressed to Radio Austria A.G., Renngasse 14, Wien, I, Austria.

WIRELESS AND THE WORKLESS.

That unemployment is no excuse in cases of listening without a licence was the view taken last week by Lexden (Essex) magistrates when fining a delinquent £1 under the Wireless Act.

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ARE YOU HEARING PCJJ?

The Philips experimental short-wave broadcasting station at Hilversum is now transmitting regularly on Tuesdays and Thursdays between 6 and 9 p.m. (G.M.T.) on a wavelength of 30.2 metres.

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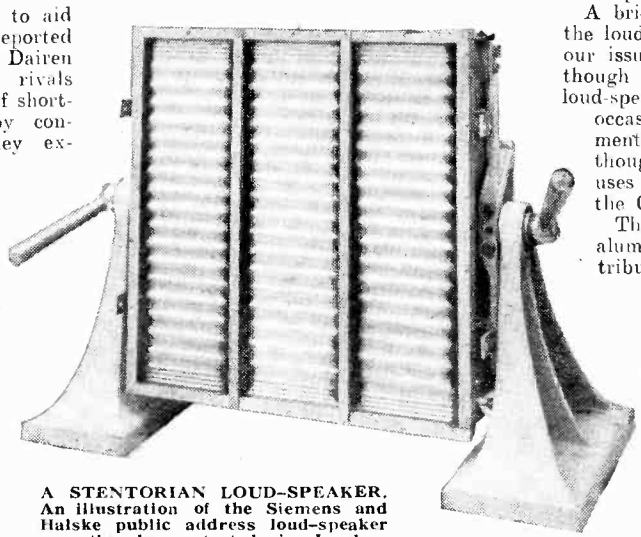
SO SIMPLE!

Congratulations are due to the Institute of Patentees for the following, which we cull from their list of "What's Wanted":—

"A wireless loud-speaker to translate any foreign language into English."

This stupendous conception seems to be offered in all seriousness, for all the other "wants" in the list can at least be termed rational. "What's Wanted" is published by the Institute at 39, Victoria Street, London, S.W.1, price 6d., or post free 8d.



A STENTORIAN LOUD-SPEAKER.
An illustration of the Siemens and Halske public address loud-speaker recently demonstrated in London. The photograph shows the diaphragm which, when in use, is covered by a wooden grill which acts as a diffuser of sound as well as a protection to the diaphragm itself.

A "KESTON" FOR KENYA.

Settlers in Kenya Colony will soon, we understand, have a reasonable chance of hearing British and Continental broadcast programmes through a short-wave relay station shortly to be erected at Nairobi.

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NEW I.R.E. PRESIDENT.

Dr. Alfred N. Goldsmith, well known as the chief engineer of the Radio Corporation of America, has been appointed President of the Institute of Radio Engineers.

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CANADA'S MOST POWERFUL STATION.

The construction of the most powerful and up-to-date broadcasting station in Canada will be begun in six months' time, according to Mr. Bracken, the Prime Minister of Manitoba, who states that the chosen site is at Brandon.

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A STENTORIAN LOUD-SPEAKER.

What is probably the most powerful loud-speaker equipment which has yet been seen in this country arrived here recently from Germany, and was demonstrated to us last week by Messrs. Siemens & Halske, who are responsible for its development.

A brief description of the principle of the loud-speaker appeared on page 768 of our issue of December 7th last, but although this information concerning the loud-speaker has appeared this is the first occasion on which one of these instruments has been in this country, although it has been put to a variety of uses as a public address system on the Continent.

The diaphragm is of corrugated aluminium and the drive is distributed over the entire surface of the diaphragm, as indicated in the drawing which accompanied the article in our issue of December 7th. The public will have many opportunities of hearing this equipment in the near future, as it has been booked for use at Olympia in connection with the *Daily Mail* Ideal Home Exhibition, which opens at the end of the present month. The instrument is essentially a high-power public address unit, requiring somewhat elaborate and expensive equipment in the way of

amplifiers to operate it, so that it must not be thought that the instrument is an addition to the present range of wireless loud-speakers suitable for domestic use.

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SHORT WAVES FROM HOLLAND.

Those who are out to "bag" short wave transmissions can add another to their list of "possibles" in the shape of Kootwijk, the well-known Dutch station, which now transmits on 18 metres every Wednesday from 2 to 3 p.m. (G.M.T.). Reports should be addressed to the Telegraph Service Laboratory, at The Hague.

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NEW INTERNATIONAL TELEGRAPH DIRECTOR.

The successor to the late M. H. L. Etienne, Director of the International Telegraph Bureau at Berne, is Dr. Joseph Räber, Councillor of the Canton of Schwyz.

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AMATEUR SHORT-WAVE BROADCASTING.

Mr Gerald Marcuse, famous as the owner of the amateur experimental broadcasting station, 2NM, Caterham, Surrey, has received a eulogistic report from the lighthouse-keeper at Random Head, Trinity Bay, Newfoundland. Random Head is a little island 50 miles N.W. of St. John's.

The writer mentions his pleasure at hearing a relay of Continental programmes through 2NM.

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BURNDEPT WIRELESS, LTD.

In the Chancery Division last week Mr. Justice Romer dismissed the petition brought by Mr. Eric Ball, for the compulsory winding up of Burndept Wireless, Ltd.

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NEW BOLSHEVIK RADIO MOVEMENT.

The "political education" of members and the broadcasting of propaganda are the avowed objects of a Workmen's Radio International which is being formed in Moscow by the Executive Committee of the Komintern.

According to a "Daily Telegraph" correspondent, the Komintern attaches great importance to this radio organisation as, in times of war or blockade, it will help Moscow to maintain connection with what it terms "foreign abodes of revolution."

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THE MOVING COIL LOUD-SPEAKER.

We regret two typographical errors which occurred on p. 112 of our last issue in the concluding article on the moving coil loud-speaker. In the list of parts the test voltage of the bridging condensers should have been given as 1,500. The anode potential of the B.T.H. rectifying valves, type R.H.1, is 500 volts.

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CABLE OR WIRELESS ?

A striking move in the so-called cable and wireless war has been made by the Commercial Cable Company of America, which has bought the high-power transoceanic wireless station at Sayville, Long Island, thus making a bid to secure the ship-to-shore wireless service on both of the U.S. coasts. The company already possesses stations on the Pacific Coast at San Francisco, Los Angeles, and Portland, Oregon.

Short-wave equipment is to be installed at Sayville to form the first link in a chain of receiving stations across the Continent.

The superior attractiveness of wireless is emphasised by the fact that none of the wireless companies appears to have retaliated by buying a cable!

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WIRELESS OPERATORS FOR R.A.F.

Six hundred aircraft apprentices, between the ages of 15 and 17, are required by the Royal Air Force for entry into the schools of technical training at Halton, Bucks, and at Flowerdown, near Winchester. Among the principal trades open to boys is that of wireless operator-mechanic. Full particulars of the competitions for entry can be obtained on application to the Secretary, Air Ministry, Kingsway, London, W.C.2.

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LEAGUE OF NATIONS WIRELESS STATION ?

The erection of a £20,000 wireless station by the League of Nations specially for use in times of crisis is being considered by a number of experts at Geneva under the chairmanship of General Ferrié, Director of French Military Wireless. Such a station, which could be used for ordinary telegraphic correspondence in times of peace, would be under the control of the League Secretariat, and would be independent of any national postal authority.

The scheme is being objected to by the Swiss Government, on the grounds that such a station would violate Swiss neutrality. Supporters of the scheme contend that the station would enjoy the same privileges as an embassy or legation, and that, since its sole purpose would be the maintenance of peace, no nation could regard it as inimical to patriotic interests.

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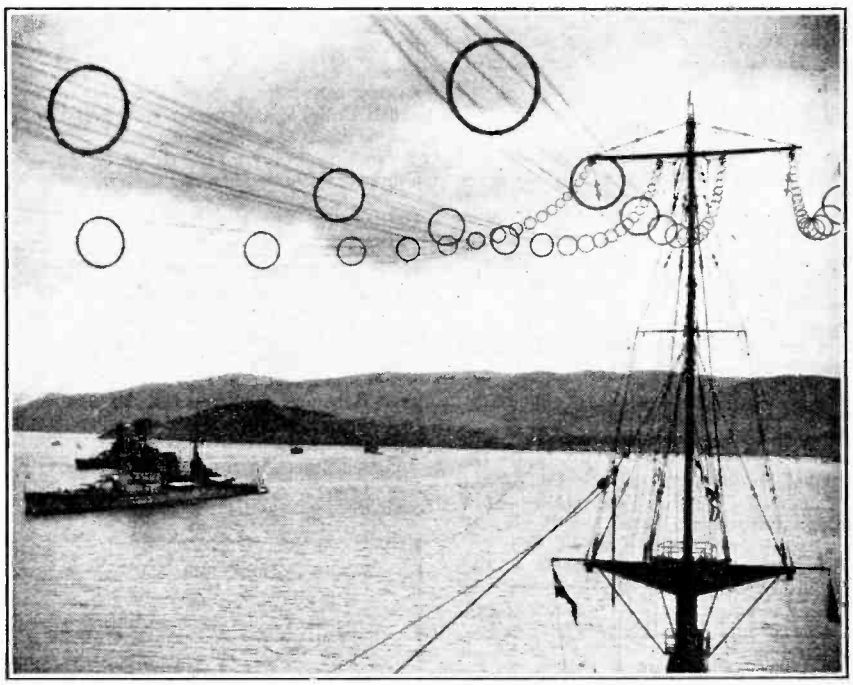
TALKING PICTURES IN AMERICA.

The American cinema world is eagerly awaiting the results of a new alliance between the Radio Corporation of America and the Film Booking Office Pictures Corporation for the purpose of developing a new method of synchronisation of sound and picture.



THE EARS OF THE FLEET. An unusual view of a battleship's aerial system. The photograph was taken from the gun-directing turret of H.M.S. Renown while at Vigo, Northern Spain. On the left can be seen Repulse and Hood.

It is stated that all present patents covering speaking films, broadcasting and television will be available for the new project. The first step will be the presentation of a new system of sound reproduction and synchronisation perfected by the General Electric Co. of New York, to be used in conjunction with a reproducing instrument recently perfected by the Radio Corporation of America.

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SCREENED VALVE FIVE.

In the list of parts for the construction of the Screened Valve Five in our issue of December 14th last, a suitable variable resistance for controlling the screen potential was mentioned, with the information that such an instrument could be obtained from Claude Lyons, Ltd., 76, Old Hall Street, Liverpool. It was, however, incorrectly described as a "Variostat." The name of this component is the "Clarostat."

CLUB REPORTS AND TOPICS

Secretaries of Local Clubs are invited to send in for publication club news of general interest. All photographs published will be paid for.

A Real Radio Dance.

The second dance and whist drive held by the Muswell Hill and District Radio Society on January 21st brought a large number of guests. An extremely powerful receiver—the "Round 6"—picked up dance music from British and Continental stations, using a small frame aerial, and further dance music was provided by a Panatrope gramophone reproducer. Both these instruments were brought by Capt. H. J. Round, who is President of the Society.

Hon. Secretary: Mr. Gerald S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

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At Streatham and Holloway.

Members of the Streatham and Tooting Institute Radio Society enjoyed an interesting lecture on new "Polar" wireless components, given by Mr. R. Jefferies, of Wingrove and Rogers, on January 24th. The Hon. Secretary is Mr. A. L. Odell, 171, Tranmere Road, S.W.18.

A similar lecture was given by Mr. Jefferies at the Holloway Literary Institute Wireless Club on January 23rd.

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Discussion on the Regional Scheme.

Mr. G. Leslie Morrow will open a discussion entitled "Selectivity and the Regional Scheme" at a meeting of the Institute of Wireless Technology at 7 p.m. on February 14th at the Engineers' Club, Coventry Street, London, W.

Information respecting meetings and other activities of the Institute may be obtained from the Hon. Secretary, Mr. H. J. King, 71, Kingsway, London, W.C.2.

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Yesterday and To-day.

A comparison between modern wireless receiving sets and those of two or three years ago was made by Mr. A. J. Webb, M.A., B.Sc., at the last meeting of the Croydon Wireless and Physical Society. Mr. Webb pointed out that though the principles of detection and amplification had not altered the details both of design and construction had greatly advanced, owing to progress in valve construction and the general improvement in accessories. Controls on the panel were reduced to a minimum, while wires and battery leads were at the back. An unconventional method of capacity-controlled loose coupling was demonstrated which was both sensitive and selective. At 9.15 members were able to listen to a talk from 2LO by Captain Eckersley, who confirmed the speaker's last point, viz., that reasonable selectivity was essential.

Visitors are welcome to the Society's meetings, particulars of which may be obtained from the Hon. Secretary, Mr. H. T. P. Gee, Staple House, 51/52, Chancery Lane, London, W.C.2.

Woolwich Radio Society.

The Woolwich Radio Society is maintaining an interesting programme of lectures. Meetings are held every Wednesday evening at 8 o'clock at Cottingham's College, Plumstead Common Road, and visitors are welcome.

Hon. Secretary: Mr. H. J. Smith, 42, Greenvale Road, Eltham, S.E.9.

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Methods of Detection.

"Methods of Detection with Special Reference to Quality Reproduction" was the title of a lecture given by Mr. Kelly at a meeting of the Manchester Radio Scientific Society on January 25th. The lecturer discussed the processes of crystal, anode bend and leaky grid detection and gave it as his opinion that, for the very best results, either crystal or anode bend must be used.

Hon. Secretary: Mr. Reg. Murphy, 150, Cromwell Road, Pendleton, Manchester.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 8th.

Tottenham Wireless Society.—Radio Social. Tickets from Mr. H. T. Wood, 41, Woodside Gardens, N.17.

Stretford and District Radio Society.—At 8 p.m., at 6a, Derbyshire Lane. Lecture: "How to Select Your Accessories," by Mr. Daynes.

Manchester Radio Scientific Society.—At 16, St. Mary's Parsonage, Manchester. Demonstration of the Rice-Kellogg Loudspeaker by the B.T.-H. Co., Ltd.

FRIDAY, FEBRUARY 10th.

Leeds Radio Society.—At the University. Lecture No. 4: "Three-Valve Set," by Mr. A. F. Carter, A.M.I.E.E.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Demonstration of Members' Sets.

Sheffield and District Wireless Society.—At the Department of Applied Science, St. George's Square. Lecture: "Short Waves," by Mr. J. H. Hollingworth, M.A., M.Sc.

Wigan and District Technical College Radio Society. Presidential address: "Waves," by Mr. F. J. Harlow, M.B.E., B.Sc., F.Inst.P.

MONDAY, FEBRUARY 13th.

Hackney and District Radio Society.—At the Electricity Show Rooms, Lower Clapton Road, E.5. Discussion: "Must Quality be Sacrificed for Selectivity?"

TUESDAY, FEBRUARY 14th.

Bradford Radio Society.—Debate: "Should You Earth Your Aerial when not in Use?"

Institute of Wireless Technology.—At 7 p.m. At the Engineers' Club, Coventry Street, London, W. Discussion: "Selectivity and the Regional Scheme," to be opened by Mr. G. Leslie Morrow.

Bermondsey Wireless Classes.

Lectures on wireless and allied subjects are being resumed at the Alma Institute Scientific Society at the Bermondsey Men's Evening Institute, The Alma Schools, Southwark Park Road, S.E.16. The classes are held on Monday and Wednesday evenings from 7.30 to 9.30. Facilities are available for making and testing sets, and the inclusive charge for the course until Easter is 1s.

Hon. Secretary: Mr. G. Archer, 24, Reverdy Road, Bermondsey, S.E.1.

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"The Tickler."

The above is the title of the bright little magazine turned out by the Stretford and District Radio Society. The list of contributors is sufficiently imposing to include "Listener-In," "The Wanderer," "Plus Fours," "The Professor," and "The Jester," while authority is represented by "Editorial Harmonics."

One of the mysteries of wireless is the fact that very few clubs run a magazine of this sort; the advantages to be derived from a club "rag" are worth considering.

The Hon. Secretary of the Society is Mr. W. Hardingham, 21, Burleigh Road, Stretford.

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Indirectly Heated Valves.

The many troubles associated with the use and upkeep of batteries in connection with wireless sets were discussed at the last meeting of the Tottenham Wireless Society, when Mr. E. Yeoman, a representative of Messrs. Metro-Vick Supplies, Ltd., gave a lecture on indirectly heated filament valves working from the mains. An interesting demonstration was given of a five-valve set employing these valves, the lecturer showing some slides illustrating the construction of the Cosmos A.C. types. These valves are absolutely non-microphonic, and can be used with ordinary cheap rigid valve-holders. On tapping the detector valve no "ponging" could be heard. The receiver reproduced with great purity and at considerable strength a number of programmes from European stations. Not the slightest trace of hum could be observed even during silent periods.

Hon. Secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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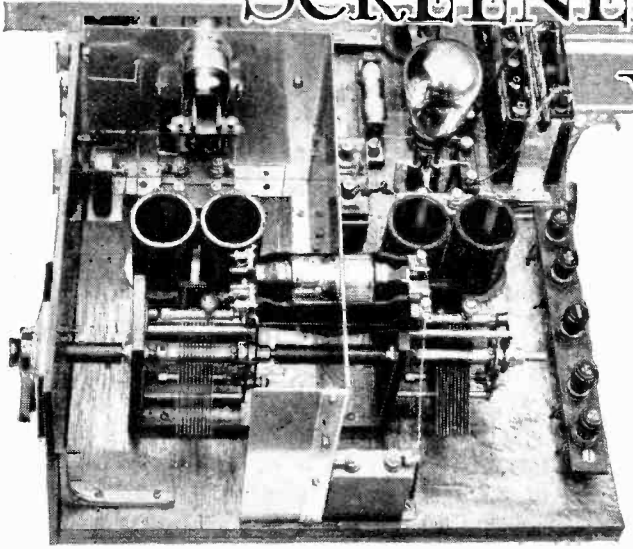
Southport Society's Dance.

The Southport and District Radio Society will hold a Grand Carnival Dance on Friday next, February 10th, at St. John Hall, Scarisbrick Street. A number of novelties are promised, and valuable prizes are to be given.

Hon. Secretary: Mr. Stanley C. Irving, 53, Hampton Road, Southport.

SCREENED GRID VALVE VERSUS TRIODE



A Discussion on the Relative Merits of Each Type.

By JOHN HARMON.

WHEN the screened grid valve appeared last September those who had an opportunity of testing its remarkable properties expected that it would take a high place as a topic of radio interest during the coming year. The volume of discussion which the new valve has given rise to in the wireless papers seems to show that this expectation is being realised, and during the last few weeks manufacturers, who were at first caught unawares owing to the sudden arrival of such a novelty, have been producing 3- to 5-valve sets in which the screened valve appears in one or two stages of H.F. amplification.

Among the less expert amateurs, however, there seems to be still some uncertainty as to the use of the new valve, and it is hoped that the following remarks will make the situation clear.

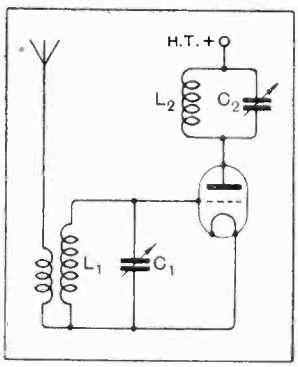


Fig. 1.—A simple tuned grid—tuned anode stage which tends to oscillate.

Triode with Tuned Anode.

In a H.F. (or L.F., for that matter) amplifier it is necessary to introduce a load of some kind between the H.T. supply and the plate. This load is shown in Fig. 1 as a tuned anode circuit L_2C_2, but it might also, though with less efficiency, consist of a pure resistance or a choke coil. The amplification is also increased by incorporating a tuned grid circuit L_1C_1 coupled to the aerial coil.

Now, suppose we take a valve such as the D.E.5b or P.M.5 type with an amplification factor of 18 and A.C. resistance from plate to filament of 20,000 ohms. For L_1 and L_2 let us use single-layer coils of 240 microhenries each, and tune them with 0.00025 condensers C_1 and C_2 so as to work at a frequency of a million cycles; then we shall find that even when the coils L_1 and L_2 are carefully screened from each other by copper partitions the amplifier will oscillate and can be stabilised only by adding a large amount of resistance to the anode circuit, say 200 ohms in series with L_2. The oscillations are caused by the capacity of some 5 micromicrofarads existing between the grid and plate which forms a connecting link between the tuned circuits.

When stability is produced by the above-mentioned brutal method of adding 200 ohms in the L_2 circuit, it

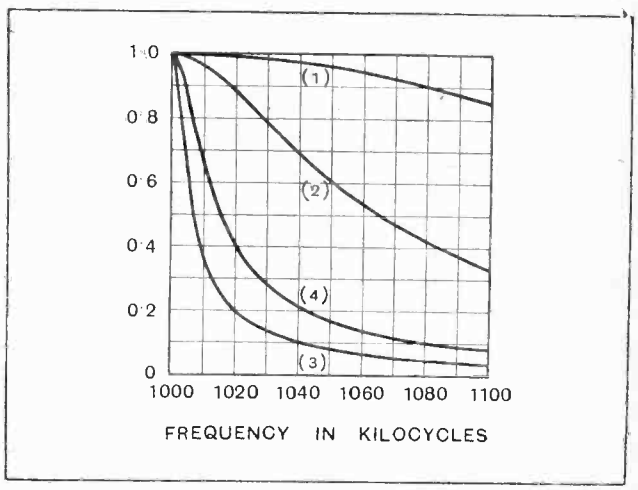


Fig. 2.—Resonance curves showing different degrees of selectivity with (1) damped tuned anode, (2) Neutralised tuned anode, (3) Neutralised tuned transformer ("Everyman Four" type), (4) Screened-grid valve coupling.

will be found that the stage gain (the voltage amplification from grid to plate) has the small value of 4, and that the resonance curve is extremely flat, as shown in Fig. 2, curve 1. This was the unhappy state of H.F. amplification prior to the invention of neutralised circuits in 1923.

Neutralised Triode with Tuned Anode.

One form of neutralised circuit is shown in Fig. 3. The current fed back through the condenser C_{gp}, which represents the grid-plate capacity, is neutralised by current fed back through an equal neutralising condenser C_n. By this means the baneful effect of C_{gp} is eliminated and there is now no need to swamp the anode circuit with

Screened Grid Valve versus Triode.—

resistance, since however energetically the L_2C_2 circuit is oscillating it is isolated and cannot set up a howl in the grid circuit. It will now be found possible to obtain a stage gain of 17, but the resonance curve (Fig. 2, curve 2), though improved by the absence of the 200-ohm resistance, will still be flat, since the plate circuit is being shunted by the valve resistance of 20,000 ohms.

Neutralised Triode with Transformer.

The circuit just mentioned can be still further improved by bringing the H.T. supply to a suitable tapping point on the anode coil, or, what is essentially the same thing, using a step-up transformer with tuned secondary. This circuit is shown in Fig. 4: S is the secondary tuned coil; P is the coil in series with the plate, and N is an exactly similar coil leading to the neutralising condenser C_n. The ratio of turns between S and P for the best amplification is given by the formula:

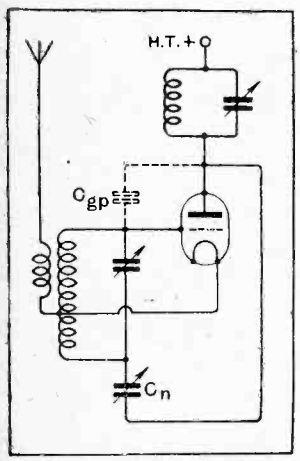


Fig. 3.—A neutralised tuned anode circuit.

Square of turns ratio = ratio of reactance to resistance of S, multiplied by ratio of reactance of S to A.C. resistance of valve: thus with the coil used in the "Everyman Four" set the reactance of S at 10^6 cycles is 1,500 ohms, and its effective series resistance under working conditions is 6 ohms, while the valve resistance is 21,000 ohms. This gives square of turns ratio $= \frac{1,500}{6} \times \frac{1,500}{21,000}$ = 17.6, or turns ratio = 4.2.

When the best value of turns ratio is thus worked out, the stage gain is one-half the product of the valve amplification factor into the turns ratio: in the case we are considering it is $\frac{1}{2} \times 18 \times 4.2 = 38$. This is more than twice the value found in the preceding section for a neutralised tuned anode circuit, and represents the high-water mark to-day for H.F. amplification with a triode valve. When the circuit is designed in this way it works out that the selectivity of the tuned secondary is half that of the secondary alone; in our case it is accordingly the same as if S were used alone but possessed a resistance of 12 ohms instead of its effective value of 6 ohms. The corresponding resonance curve is shown in Fig. 2, curve 3, and is evidently as sharp as could be desired.

Table I gives figures for typical H.F. valves: the voltage amplification factor *m* and A.C. resistance are given in the first and second columns, the best value of turns ratio for sensitivity in the third column, and the stage gain in the fourth.

TABLE I.

Valve.	*m*.	Valve Resistance.	Turns Ratio.	Stage Gain.
P.M.1	13.5	28,000	3.66	24.6
Osram D.E.5b	18	21,000	4.2	38
P.M.5	18	19,000	4.45	40
Green Spot SP.18	15	17,000	4.7	35.2

The Screened Valve in the H.F. Stage.

This valve differs from those in Table I in having a much larger value for amplification factor and A.C. resistance, average values being respectively 90 and 150,000. Table II shows that the turns ratio is only 1.56, and that the stage gain is nearly doubled, the selectivity remaining the same as in Fig. 2, curve 3.

TABLE II.

Valve.	*m*.	Valve Resistance.	Turns Ratio.	Stage Gain.
Screened Grid	90	150,000	1.56	71

Although a substantial gain has thus been achieved by the use of the screened valve in a neutralised circuit, the experience which has now been gained indicates that it is better to sacrifice some of the stage gain for the sake of simplicity and cheapness of construction. Since the turns ratio is not far from unity we may try the effect of going back to the tuned anode circuit of Fig. 1, which is equivalent to a one-to-one transformer. This will bring the stage gain down to 64. Since the circuit is now not neutralised we must enquire whether the small grid-plate capacity is likely to cause instability. The valves now on the market have a capacity of 0.05$\mu\mu f$ (this is half the value of some of the earlier ones), and with this value a stage gain of 80 could be obtained before instability sets in, or if we are out for absolute safety, a gain of about 50. This concession at once entails a further valuable simplification, for a gain of 50 can be reached with a single-layer coil of solid wire instead of the expensive Litz which we have previously assumed.

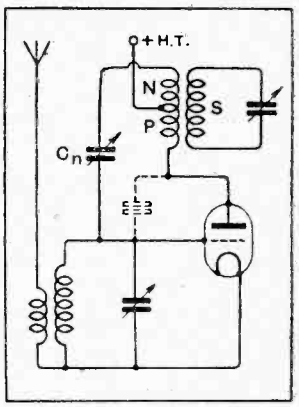


Fig. 4.—A H.F. step-up transformer with neutralising windings.

It is interesting that our investigations, summarised in Figs. 1, 3 and 4, which started with the tuned anode circuit, went on to the neutralised anode, and turned from it to the step-up transformer, have now led us back to the tuned anode—but with all its drawbacks annihilated by the use of the screened valve.

The selectivity will not be so good as in Fig. 2, curve 3, since we have put in a solid wire coil of effective resistance 12 ohms, and are not using any step-up. The resonance curve is shown in Fig. 2, curve 4.

The Use of Reaction.

When a neutralised H.F. amplifier is used a further gain of about 15 can be obtained by altering the setting of the neutralised condenser so as to obtain reaction; when the screened valve is used, however, this method is no longer available. Obviously, we can instead use reaction on the detector just as effectively. When this is done and reaction is pushed to the limit where the detector circuit goes into oscillation, we would naturally expect the disturbance to extend back to our aerial, with the usual distressing results to our neighbours. Actu-

Screene Grid Valve versus Triode.—

ally nothing of the sort happens; the back coupling inside the screened valve is so minute that, although its tuned plate circuit may be oscillating, its grid circuit is unaffected. In the case of my own set, which consists of a screened valve H.F., detector, and two L.F., I have set the detector oscillating so as to give an unbearable squeak with 2LO, and on visiting my neighbours have found them enjoying perfectly undisturbed reception. As a further test a Mouillin voltmeter was connected between aerial and earth, and no motion of the pointer could be seen, whatever the setting of the reaction condenser. Of course, precautions were taken to screen the circuits to prevent direct pick-up by the aerial.

Legitimate Oscillation.

The picking up of distant stations is made much easier by throwing the set into oscillation and listening for the heterodyne note, but out of respect for our neighbours we should not use this method except with a small frame aerial. By using the method described in the previous section, the squeak is confined to the set, and any kind of aerial may be used.

Conclusions.

Comparing the screened valve with the triode in sets having one stage of H.F. amplification, the former gives a slight gain in strength, but smaller selectivity. Construction is cheaper and simpler, since we do not require a neutralising condenser or a transformer with neutralising winding. Litz is unnecessary—solid wire is good enough for the anode coil. Reaction may be used on the detector, and by excessive reaction oscillations may be produced which are strictly confined to the cabinet, and by them distant stations may be readily picked up.

International Amateur Tests.

The series of tests conducted under the auspices of the American Radio Relay League between February 6th and 20th are likely to prove of great interest to amateur transmitters on both sides of the Atlantic.

We understand that up to January 10th 270 American and Canadian stations had entered, and that a considerably greater number was expected before the contest opened. The prizes offered are not confined solely to transatlantic experimenters, as stations outside the United States and Canada receiving and replying to the test messages are also eligible. A brief summary of the procedure as far as it concerns European stations appeared on page 39 of our issue of January 11th, and full details were published in the December issue of "Q.S.T.", the official journal of the A.R.R.L.

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The 10-Metre Waveband.

The Executive Committee of the A.R.R.L. is asking the Federal Radio Commission to make the 10-metre wavelength available for U.S. amateurs at an early date.

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Troubles of American Amateurs.

The proximity of a high-power station is not always considered a blessing by amateurs. We hear from a correspondent that WGY, when working the 100 kW. transmitter, gets many complaints of "blown toobs" from experimenters in the vicinity.

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Greenland Expedition.

Mr. T. P. Allen, the Hon. Organiser of the R.S.G.B. Contact Bureau in Belfast, whose station, GI 6YW, is at 59, Marlborough Park North, Belfast, has been in touch with NX 1XL, the Michigan University Expedition in Greenland, and has arranged with the operator to stand by for British stations at 1730 G.M.T. every Saturday on 45 metres. A similar arrangement made by Messrs. D. F. and D. M. O'Dwyer (GW 18B), of Dublin, was noted in our issue of January 25th, so that the Greenland station will now be in two-way communication with both Northern and Southern Ireland.

TRANSMITTERS' NOTES AND QUERIES.

An Irish Amateur Station.

Mr. J. Burleigh Scott's station, GW 17C, at Rathgar, Dublin, has, as shown by the cards on the walls, been in communication with stations in Europe, Africa, Asia, and North and South America. It is also the only GW amateur station which has as yet worked with Brazil.

GW 17C, Dublin, Ireland.

The photograph shows on the left a four-valve receiver, above which is the meter for measuring the anode current to the transmitter and the modulator for telephony, to the right of which is the 23-metre transmitter. Below this is the switchboard for changing from the 23- to the 45-metre transmitter, putting in the modulator or varying the input. On the table is a two-valve short-wave receiver, above which is the 45-metre transmitter. Below the four-valve receiver is the H.T. eliminator.

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General Notes.

The Malvern College Radio Society (2MV) will shortly be transmitting on wavelengths between 150 and 200 metres. Concerts given in the College Gymnasium may be transmitted from time to time. The Society will welcome reports, which should be addressed to the Hon. Secretary, Mr. A. E. L. Parmis.

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Mr. E. T. Somerset, Inholmes Park, Burgess Hill, Sussex, has been allotted by the R.S.G.B. the Research number BRS 125, and will be glad to carry out telephony experiments with EG, EF, EB, and EK, transmitters on 13 to 200 metres.

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Mr. W. G. Sherratt (5TZ), Bath Road, Cowes, I. of W., is carrying out special tests with high quality 'phone transmission, on Sundays, from 11.0 a.m. to 1.30 p.m., and 2.0 p.m. to 3.30 p.m. G.M.T. The transmissions at present will be on 44.15 metres with an input to the anode of the oscillator of 8.5 watts, the transmitter consisting of C and B magnifiers coupled to a special choke modulator. A differential microphone is being used, and is mounted in a draped studio, the amount of draping being variable. Reports are very much wanted, from any distance, on the quality, percentage of overall modulation, and amount of frequency distortion. Communications should be sent to the above address direct. Reports from the Continent are especially welcome.

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Obituary.

We regret to record the death at Harrogate of Mr. J. A. Walshaw, of Otley, Yorkshire. Mr. Walshaw was a keen wireless enthusiast, and his station, 5CU, was well known to many amateur transmitters.

RECENT INVENTIONS.

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings London, W.C.2, price 1s. each.

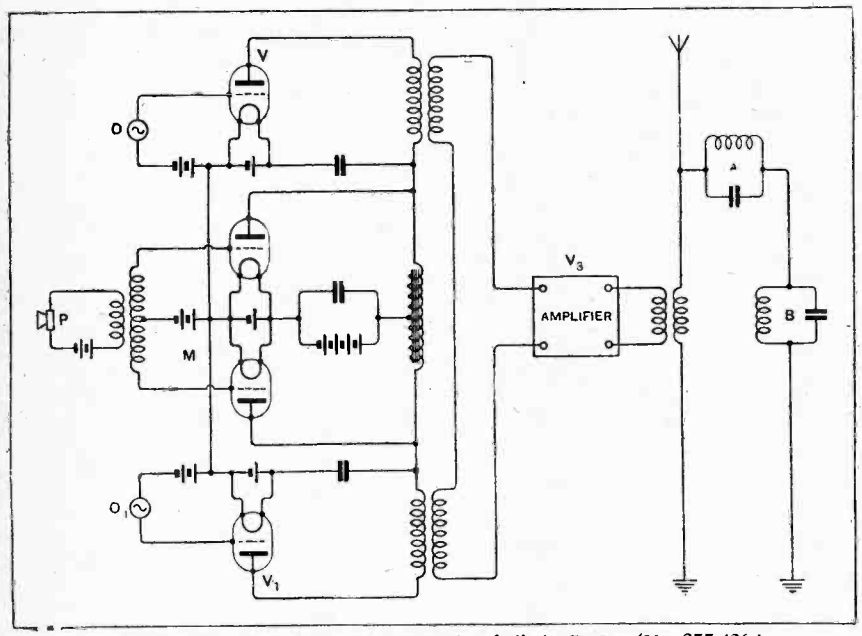
Short-wave Signalling. (No. 277,426.)

Application date: June 17th, 1926.

The invention relates to a method for preventing fading, and is based upon the observed fact that two signals, both having wavelengths in the neighbourhood of 60 metres, but separated by, say, 10,000 or 15,000 cycles, do not fade simultaneously. For such frequencies, it is found that the periods of maximum and minimum intensity neither coincide, nor do they follow any consistent rule of fluctuation.

Therefore, by transmitting the same signal on two different carrier-waves varying in frequency by a few thousand cycles, a steady ratio of signal strength can be ensured at the receiving station. Two high-frequency sources O, O_1 adjusted to the desired frequency difference, are connected in the grid circuits of valves V, V_1. The amplified output is transferred through a power panel V_3 to the common aerial, which is given two degrees of freedom (so as to radiate both carrier waves alike) by the insertion of loop circuits A B tuned to the two frequencies in question.

A common signal from the microphone P is impressed upon each carrier by a modulator M comprising two valves arranged in push-pull relation. As the signal currents are applied in phase opposition with respect to the two carrier currents, the plate current in amplifier V tends to increase at the same time as that in V_1 diminishes. At the receiving end, each carrier-wave is separately rectified, and the low-frequency components, after first being brought back into phase coincidence, are fed to the receiving device in parallel Patent issued to Standard Telephones and Cables, Ltd.



Short-wave transmitter for overcoming fading effects. (No. 277,426.)

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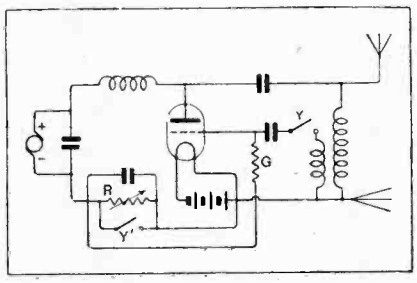
Wireless Transmitters. (No. 271,447.)

Convention date (Holland): May 22nd, 1926.

In order to ensure an emission of constant frequency during manipulation, the grid-leak resistance G, instead of being connected to the filament as usual, is taken to the negative side of an auxiliary and variable resistance R inserted on the negative side of the high-tension supply. When the signalling key is not being pressed, the contacts Y, Y', situated in the main grid circuit and the leak circuit respectively, are open, so that the current through the valve is dependent upon the value of the resistance R. By suitably adjusting R, the negative grid bias can be maintained at a constant value whether the signalling key is being operated or not.



Keying system for a valve transmitter. (No. 271,447.)

Further, if the high-tension supply fluctuates, any resulting variation in plate current changes the negative grid-bias derived from the resistance R, which therefore acts as an automatic regulator. The signalling key controls the contacts Y, Y', and since these are located in circuits carrying comparatively small currents, the keying operation is simplified and the speed of manipulation increased. Patent issued to Nederlandsche Seintoestellen Fabrik.

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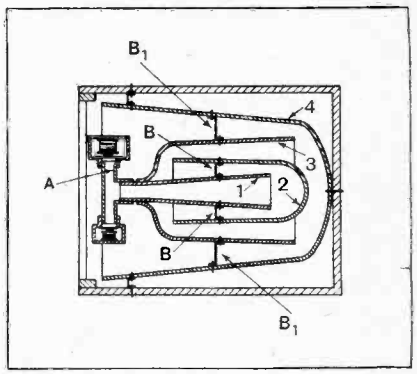
Loud-speaker Horns. (No. 253,503.)

Convention date (U.S.A.): June 9th, 1925.

The horn is made in compact form by nesting a number of sections one within the other in known manner. Each section is, however, so constructed as to be resonant to a frequency band different from that of the others, so that the overall frequency response is uniform.

As shown in the figure, four cylindro-conical sections 1 to 4 are arranged about a common longitudinal axis. The first section 1 is screwed into the outlet of a sound box A, the same screw-thread also supporting the section 3. Section 2 is



Loud-speaker horn of compact construction. (253,503.)

spaced away from section 1 by a number of U-shaped brackets, whilst a similar series of Z-shaped brackets connect sections 3 and 4. The entire scale of audible frequencies may be divided into a lower and an upper range. The total length of the sinuous air-channel is adjusted to have a fundamental frequency equal to the middle of the lower range, whilst the length of the channel from the sound box A to the mouth of the section 2 resounds to the middle of the upper range. This ensures an evenly-balanced reproduction over the entire span of audibility. Patent issued to the Marconi Wireless Telegraph Co.

By Our Special Correspondent.

A Microphone Rumour—The Flow of Talent—Is There a Drought?—Bardell v. Pickwick—Overdoing "Atmosphere"—5SW and News.

Microphones.

The other day a little rumour was started to the effect that the B.B.C. engineers were not quite satisfied with the microphones at present in use, and that experiments were to be conducted with another form of instrument. At this point rumour held its tongue and we were left guessing as what new marvel was to supplant the Reisz.

The engineers at Savoy Hill tell me that there is no truth in the suggestion that any change is contemplated.

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Even the "Mike" Will Turn.

The Marconi-Reisz has been assailed on the grounds that it is too directional and too sensitive. The former charge is hardly substantiated by experience; I believe that one of these microphones has been known to swing round (there may have been extenuating circumstances) with its back to the speaker, without any apparent difference in the output.

Over-sensitivity is not a serious crime, and can easily be atoned for in the control room.

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Cost of a Change.

Pretty nearly a hundred microphones are in use by the B.B.C. at the present time, and, of these, quite twenty are to be found at Savoy Hill. I am told that each instrument costs the B.B.C. about £35, part of this figure consisting of a special royalty applicable only to instruments used for broadcasting. (Thus a microphone for public address purposes costs considerably less.)

A change to a new type of microphone at all stations would mean a loss of between three and four thousand pounds sterling.

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A Task for the Chancellor.

Those who have been watching the discussion on controversial broadcasting will certainly tune in to 5GB at 8.25 p.m. on Friday next, when Mr. Winston Churchill's response to the toast of "His Majesty's Ministers" at the Civil Service dinner will be heard from that station.

It is not suggested, of course, that the Chancellor of the Exchequer will consciously diverge from the region of political impartiality, but no one will deny that his subject is fraught with dangers. The way in which he steers through the rocks and shallows will be closely observed by an eager multitude of listeners.

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Is There a Drought?

Some people are beginning to ask very seriously whether we are on the eve of a drought—a drought of broadcast talent. Other people are asking, with equal seriousness, when the present drought is going to end.

The flow of talent has never been so copious as to satisfy everybody—including those who pay their annual ten shillings—but it has been fairly constant over a long period. True, the stunt department seems to have gone into retirement, but that may be because new stunts are being incubated. Let us not disturb the sitting hen. And any deficiency in stunts is being fully counterbalanced by the volubility of the Talks department, which neither rests nor sleeps.

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Fatigue.

There is, however, a growing suspicion that the flow of talent is not quite so spontaneous as once it was. There is a sameness, a greyness, a lack of high lights.

All this betokens one thing: fatigue. There is such a malady as artistic overwork, and I am inclined to think that the malady is attacking Savoy Hill.

The only salvation lies in the direction of enlisting new talent to give the old talent a rest. But where is the new talent?

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The Hopeful Dawn.

The dawn promises to break in a direction which would have been unsuspected a year or two ago.

The international programmes relay scheme, which has received rather too

FUTURE FEATURES.

London and Daventry (5XX).

FEB. 12TH.—Swedish National Concert.
FEB. 13TH.—Two plays, military band, and dance music.
FEB. 14TH.—Bardell *v.* Pickwick Centenary.
FEB. 15TH.—"Merrie England"
FEB. 16TH.—Charlot's Hour.
FEB. 17TH.—National Symphony Concert relayed from People's Palace.
FEB. 18TH.—Military Band Concert.

Daventry Experimental (5GB).

FEB. 12TH.—"The Childhood of Christ," a sacred trilogy by Berlioz.
FEB. 13TH.—Orchestral and Vocal Programme.
FEB. 14TH.—Wagner Programme.
FEB. 15TH.—"The Folly of George," a play by Matthew Boulton.
FEB. 16TH.—A Tennyson Programme.
FEB. 17TH.—A Gloucestershire Programme.
FEB. 18TH.—Orchestral Concert.

Cardiff.

FEB 13TH.—5WA Holds Court, a Contest of Song to celebrate the fifth anniversary of the opening of the station

Manchester.

FEB. 15TH.—"The Brass Doorknob," a drama by Matthew Boulton.

Newcastle.

FEB. 13TH.—"Round the Town"

Glasgow.

FEB. 14TH.—"Valentine for Ireland," an informal programme of song, verse, and story by Irish artistes.

Aberdeen.

FEB. 15TH.—Orchestral Concert organised by the Aberdeen Group Toc H., relayed from the Music Hall.

Belfast.

FEB. 14TH.—Symphony Concert conducted by Sir Henry Wood.

much of a boost during the last few weeks, undoubtedly suggests a supply of talent which might well be deemed inexhaustible. The only drawback (not mentioned in the Press) is the inevitable delay before the scheme can be realised.

That the B.B.C. has great hopes in this direction is evident to anyone who is able to gauge the temper of those behind the scenes. The Programme Department has visions of an Aladdin's Cave, replete with goblets of transcending talent ready to gush forth at a wave of the hand.

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Comforting Visions.

Such visions must be very comforting, and I am not at all sure that their fabric is baseless. The international applications of broadcasting are bound to grow, and, given a freedom from war in the years to come, the establishment of programme exchanges is pretty well assured.

But, to whatever extent the Continent supplies us with music, we may be sure that dear old Savoy Hill will still give us plenty of Talk.

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Are "Pirates" Soft-hearted?

On two or three recent occasions, when the Post Office has succeeded in tracing an oscillator, it has been found that he is also a "pirate." There is nothing surprising in this, for the man who is prepared to take his entertainment for nothing should be quite ready to give gratuitous discomfort to his neighbours.

No pirate who is worthy of the name should betray "softness"; it can undermine the strongest character.

Bardell versus Pickwick.

February 14th, St. Valentine's Day, is this year the centenary date of the world-famous breach of promise trial, Bardell versus Pickwick. The trial will be reconstructed by selected members of the Dickens Fellowship on this anniversary, and broadcast from 2LO and 5XX. The producer is Frank J. Staff.

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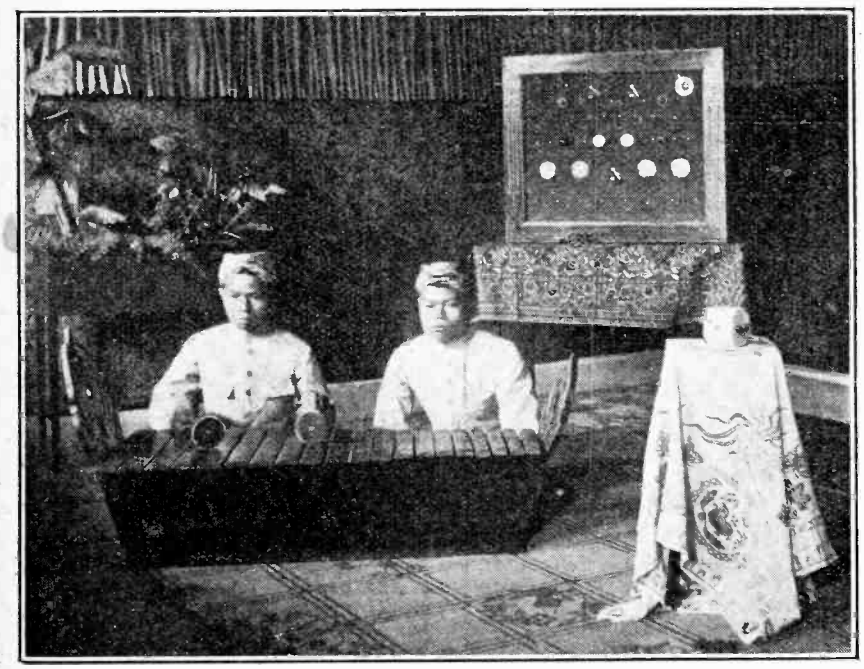
The Fetish of "Atmosphere."

Environment and "atmosphere" have, I suppose, an important influence on the outlook of a broadcast artiste, but there can surely be too much of it, especially when it is put on with a trowel. In America the environment idea is being done to death.



BANDOENG CALLING. The "Foundations of Music" are evidently an item on the programmes of the Bandoeng (Java) Broadcasting Station, the studio of which is seen above. Note the Reisz microphone and the control panel.

No one would expect a temperamental artiste to be at his best in a railway waiting room or a fowl run. He would not be happy. But is he likely to be much happier in the pseudo-mediæval pleasure palaces that seem to be popping up in America?

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Green and Gold.

Here are some extracts from a description of the newly opened studios of the National Broadcasting Co. in Washington.

"The entrance to the new quarters opens into a reception room decorated in furnishings of the period of Charles II., creating an atmosphere of simple grandeur. . . . Off the reception room is a small ladies' (*sic*) lounge, furnished in French provincial style and decorated in a pastel shade of green. In contrast, the walls are finished in a shade of pale orchid. . . .

"The smaller studio is known as the Gold Room, so called because of gold-coloured velour drapes with which it is hung. . . . The floor is covered with two-tone cork tile in the form of a checkerboard.

"The large studio is known as the Green Room. . . . Mottled gold and green tints decorate the walls and ceiling, and rich green velour drapes add a touch of beauty to the room. Four amber leaded glass casement windows which lend a soft warm light to the room are also hung in green velour."

I know a man who would prefer the waiting room at Wigan.

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At Savoy Hill.

Fortunately, no one at Savoy Hill has yet succumbed to the "environment" germ. The studios bespeak restraint. There is comfort without luxury. The artiste is thus able to give his mind to the work in hand, without being overawed by the trappings of super-civilisation.

But perhaps the germ is on the way. Let us change the subject!

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Bishop of London to Broadcast.

The Bishop of London will broadcast "The Week's Good Cause" on Sunday next, February 12th, and his appeal will be on behalf of the National Police Court Mission of the Church of England Temperance Society.

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A Tuneful Light Opera.

For sheer tunefulness it would be hard to find a rival to Sir Edward German's light opera "Merrie England." This is to be broadcast for the first time in its entirety on February 13th through 5GB. A repeat performance will be given from 2LO, 5XX and other stations on February 15th.

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The Silences of 5SW.

The Australians, who appear to be the only regular listeners to 5SW on its present wavelength, are spared the Second News Bulletin. Unfortunately, there are not, I believe, any cheap sailings to Australia.

Hitherto 5SW has transmitted piano music while the other stations were meting out the news, but a number of residents in the Chelmsford district have complained of jamming, so these little recitals are being abandoned. 5SW now closes down during news periods.

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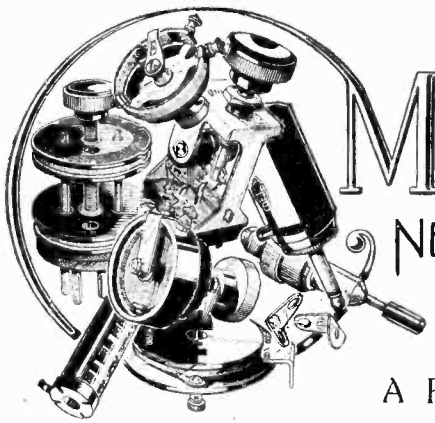
A Bouquet from America.

Cardiff's new form of radio drama, the radiologue, has received a host of appreciations, which include one from a new correspondent in Massachusetts, who writes: "I think the radiologue sketch was fine and the best I have heard for a long while. The radio stations broadcast about the same thing here, but they have got to go a long way to catch up with the Old Country."



MANUFACTURERS' NEW APPARATUS

A Review of the Latest Products of the Manufacturers.

BURGESS BATTERIES.

In America the Burgess Battery Company enjoys an enviable reputation for the production of high-grade dry batteries of every type. Not only are their batteries widely used for broadcast reception, but also in many of the low-power transmitting stations operated by members of the A.R.R.L. Burgess batteries were used in the short-wave transmitter taken by the Macmillan polar expedition.

Through the courtesy of Messrs. Rothermel Radio Corporation of Great Britain, Ltd., 24-26, Maddox Street, London, W.1, we have been able to test specimens of the 45-volt "Super" H.T. ("B") battery and the 4½-volt grid bias ("C") battery.

Burgess "B" and "C" batteries.

A fair life test with adequate recovery periods would extend over many months, so a simple discharge test was made to obtain some idea of the ability of the battery to supply the currents required under modern conditions and the constancy of the output under load. First, the open circuit voltage was read and turned out to be 47.5 volts; so many batteries are below their rated E.M.F. that it is gratifying to find one so much above the stated figure.

A load of 32 milliamps brought the terminal voltage down 1 volt to 46.5, and after three hours the current and voltage stood at 30 and 44.7 respectively. Without giving any time for recovery, the current was reduced to 9.5 mA and left on all night (13 hours). In the morning the milliammeter stood at 9.2 and the voltmeter at 44.0, a very creditable performance.

After a recovery period of about four hours the battery was again subjected to a three-hour test at 30 mA, when it repeated its previous performance under similar conditions.

No suitable test other than a standing life test can be applied to the grid bias battery, but on the assumption that it is of the same quality as the H.T. battery its life should be a long one. As in the case of the H.T. battery, the terminal voltages were higher than the rating, the various tappings working out as follows: 1.6 volts (1½), 3.1 volts (3), 4.65 (4½).

The insulation of both batteries is excellent, the cases being impregnated with paraffin wax and the top filled in with hard brown wax.

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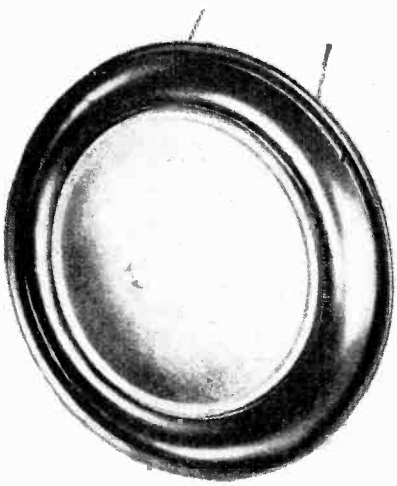
AMPLION JUNIOR CONE.

The design and appearance of this loud-speaker are such that it can be used in any room without disfiguring the furnishing scheme in any way. The model A.C.2 is 13¼in. in outside diameter, and it is intended that it should be hung from the picture rail by the silk cord provided.

The cone diameter is only 9in., yet the quality is surprisingly good. We found that the results were somewhat modified by the position on the wall and also by the angle which the speaker makes with the wall; in all positions the results were good, but some were better than others, and a few experiments should be tried before deciding on the final position for hanging.

The instrument is simple and robust in construction, and includes the Amplion adjusting nipple and spring terminals. The price of the A.C.2 model is £1 17s. 6d.



Amplion Junior "Hanging Type" loud-speaker.

TRADE NOTES.

Bakelite Limited.

The above is the new name of the Damard Lacquer Co., Ltd., and Mouldensite, Ltd., who, as a result of a scheme of amalgamation, have joined forces. The company's headquarters are at 68, Victoria Street, London, S.W.1, and the works are, as hitherto, at Birmingham and Darley Dale. The arrangement also provides for the supply of Redmanol materials by Bakelite Limited.

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The Royal Choice.

Messrs. Graham Amplion, Ltd., announce that an Amplion Cone Speaker Model A.C.9 has been chosen by H.R.H. Princess Helene, mother of the King of Roumania, and also by His Majesty the King of Denmark.

SHORT WAVE TRANSMISSIONS.

Stations Throughout the World Working Below 100 Metres.

THE following list is compiled from the information available up to the present date and comprises the stations which transmit fairly regularly on wavelengths below 100 metres. As the result of the recent Radio-telegraphic Conference it is possible that several of these wavelengths may be altered. We shall, therefore, welcome any authoritative information correcting or supplementing that given below.

The stations are arranged alphabetically according to their call-signs, as we believe this will be found the most acceptable method for easy identification. We have, in the case of experimental stations, omitted the usual continental prefix, but retained that indicating the country (e.g., U 2XAD and not NU 2XAD, and A 2FC not OA 2FC). Where transmissions are sent out at regular times these are in many cases indicated in brackets following the usual wavelength.

Call-Sign.	Station.	Wavelengths and Remarks.
AFI	Konigswusterhausen	26.3.
AFJ	,,	53.5.
AFU	,,	39.7.
AGA	Nauen (Teleph. and Morse)	14.9, 12.25, 13.5, 14.25, 16.0, 26.0.
AGB	,,	25.5, 26.6, 27.0.
AGC	,,	17.2 (*broadcasts occasionally*), 26.0, 39.8, 40.2.
AGJ	,,	56.7 (*broadcasting occasionally after 1800 G.M.T.*).
AGK	,,	11.0, 20.0 (*2 kW.*).
AIN	Casablanca, Ain Bordja	51.0 (*weather reports, 0830 and 1930 G.M.T.*).
AKA	German Naval Vessel, M.81	54.0.
AKB	,, ,, M.82	54.0.
ANC	Tjililin, Java	26.2, 40.2 (*Morse*).
AND	,, ,,	18.8, 28.8, 37.5 (*Morse*).
ANDIR	Malabar, ,, (Military (Aerodrome)	38.5.
ANE	Bandoeng, ,,	17.4 (*Morse and Teleph*).
ANF	Tjililin, ,,	20.3, 36.5 (*Morse*).
ANH	Malabar ,,	17.4. (*Morse and Teleph*). (*broadcasts Saturday, 1200–1700 G.M.T., and at other times as then announced*), 27.0, 32.0
ANK	,, ,,	19.4, 30.20 (*Exp. Tests*).
AQE	SS. *Sir James Clark Ross*	33.5.
ARCX	Norwegian Whaler *Nielsen Alonso*	30.5 (*after 0700 G.M.T.*).
ARDI	SS. *C. A. Larsen*	32.0.
AYG	Guayra, Venezuela	31.8.
A 2FC	Sydney, N.S.W.	32.0 (*broadcasting*).
A 2ME	Sydney, Australia	28.50 (*broadcasts Sun., 1830–2000 G.M.T.*).
A 3LO	Melbourne	29.8, 32 or 36 (*broadcasts Sun., 1830–2030 G.M.T.*).
BAM	Tahiti	40.0.
BVJ	R.N. College, Dartmouth	46.0.
BWW	Gibraltar, North Front (Naval Station)	35.0.
BXW	Seletar, Singapore (Naval)	35.0.
BXY	Stonecutters Island, Hong-Kong	35.0.
BYB	Whitehall R.C. (Naval)	35.0.
BYC	Horsea (Naval)	35.0.
BYZ	Rinella, Malta (Naval)	35.0.
BZC	Portsmouth Signal School	35.5.
BZE	Matara, Ceylon (Naval)	35.0.
BZF	Aden (Naval)	35.0.
B82	Uccle, Belgium	40.0.
CF	Drummondville, Montreal (Beam Station)	32.0 (temporary).
CG	,, ,, ,,	16.501, 32.128.
CH	Quilicura, Chile	15–20.
CRHA	Lourenço Marques, Portuguese East Africa	18.360.
CRHB	Praia, Cape Verde Islands	18.094.
CRHC	Loanda, Angola	18.182.
DCP	SS. *Cap Polonio* (German)	25.0, 34.0.
DNSC	Royal Danish Dockyard, Copenhagen	47.0.
DS	H.M.S. *Renown*	36.0.
EAM	Madrid	30.7.
FAMJ	French SS. *Jeanne d'Arc* (French Navy)	26–60
FL	Eiffel Tower	32.0, 75.0.
FTJ	SS. *Jacques Cartier* (France)	75.0.
FW	Ste. Assise, Cie Radio, France	14.28, 23.25 (*traffic with Buenos Aires*), 25.0, 41.95 (*traffic with Buenos Aires*), 43.0.
FUA	Bizerta-Sidi-Abdallah, Tunis	42.5, 56.0, 73.0.
FUE	Mengam, France	38.5.
FUL	Beyrouth-Djedeide, Lebanon	28.0–80.0.
FUM	Montebourg (Air Station)	37.0.
FUT	Toulon-Mourillon, France	36.5.
F 8GA	Clichy	30.0.
F 8GB	St. Assise, Paris (S.F.R.)	75.0 (*S.F.R. Bulletins*).
F 8GC	Radio LL, Paris	60.0 (*broadcasting*).
GBH	Grimsby (Beam Station)	25.906.
GBI	Grimsby (Beam, Indian Circuit)	16.216, 34.168.
GBJ	Bodmin (Beam, S. Africa Circuit)	16.146, 34.013.
GBK	Bodmin (Beam Station)	16.574, 32.397.
GBL	Leafield (P.O. Station)	17.5, 21.5, 24.0, 30.0, 56.0.
GBM	,, ,,	17.5, 21.5, 24.0, 30.0, 56.0.
GBO	,, ,,	17.5, 21.5, 24.0, 30.0, 56.0.
GDKB	SS. *Dorsetshire*	24.0, 41.7.
GFA	Air Ministry, London	44.0.
GFR	Winchester (R.A.F. School)	20.0.
GFY	Royal Air Force, Henlow	76.0.
GLG	,, ,, ,,	15.740, 15.707.
GLH	Dorchester (Beam Station)	22.091 (*American Circuit*).
GLQ	Ongar (for communication with New York, Buenos Aires and Rio de Janeiro)	24.5.
GLS	Ongar	15.0.
GLSQ	SS. *Olympic*	20.0.
GLW	Dorchester (Beam Station, South American Circuit)	15.707.
GLYX	SS. *Derbyshire*	37.0.
G 2BR	Chelmsford	15.0, 17.0.
G 2NM	G. Marcuse, Caterham	32.5 (*broadcasting Tues., Thurs., Sat., Sun., 0600–0700, and Sun., 1600–1800 G.M.T.*).
G 2YT	Poldhu	25.0, 32.0, 60.0, 92.0, 94.0.
G 5DH	Dollis Hill (P.O. Station)	21.7, 27.6, 35.3, 47.0.
G 5SW	Chelmsford (B.B.C. Exp.)	24.0 (*broadcasting 1.30, 2.30 and 7.30 p.m., onwards*).
HBC	Berne, Switzerland	31.2.
HJG	Bogotá, Colombia	22.0.
HVA	Hanoi, Tonkin	32.0.
HZA	Saigon	25.0.
H 90C	Telegraphic and Radio Service, Case No. 63, Poste Transit, Berne	32.0 (*relays Berne, Mon., Thurs. and Sat., 2000–2100*).
H 9XD	Radio Club of Zurich	32.0, 35.0.

Wireless World

FEBRUARY 8th, 1928.

Call-Sign.	Station.	Wavelengths and Remarks.
ICC	Coltano	18.0.
ICD	Rome (Cento Celle)	63.0.
ICF	Messina, Sicily	49.0.
ICJ	Bengasi, Cyrenaica	26.0, 53.0.
ICK	Tripoli	45.0.
ICO	Derna, Cyrenaica	54.0.
ICU	Tobruk, Cyrenaica	54.0.
ICX	Massawa	47.0.
IDO	Rome, San Paulo	33.0–37.5.
IDX	Amara, Erythrea	32.5, 64.0.
IHF	Catania, Italy	55.5.
IST	Chisimaio, It. Somaliland	38.0.
I1AX	Rome, Via Savoia 80	45.0 (*broadcasts occasionally*).
I1FC	Royal Frederico Cesi School, Rome	33.0, 34.0.
I1MA	Rome, Via Bramante 3	43 (*Sundays, 1700–1930 G.M.T.*).
I1RG	" Radiogiornale, Lake Como	10.0, 18.0, 35.0, 65.0.
JB	Johannesburg	32.0 (*broadcasting*).
JBK	Kagoshima, Japan	30.0, 40.5, 70.0.
JES	Osaka, Japan	24–71.
JEW	,, ,,	24–71.
JFAB	Taipeh, Formosa	39.5 (*0900 G.M.T.*).
JHL	Hiroshima, Japan	32.0, 58.0, 74.0.
JKV	Kanasawa, Japan	37.5 (temporary).
JKZB	Tokio Electric Co.	20.5.
JOC	Otchishi, Japan	43.0.
JPP	Tokyo, Japan	16–73.
JPS	Sapporo, Japan	29.0, 38.0, 60.0.
JYB	Tokyo, Japan	16–73.
JYZ	,, ,,	16–73.
J1AA	Iwatsuki, Japan	40.5.
J1PP	Tokio	20.0, 21.5, 35.0.
KAV	Norddeich	39.0, 68.0.
KDKA	East Pittsburg, Pa. (Westinghouse E. & M. Co.)	26.3, 42.95, 62.5 (*broadcasts from 2300 G.M.T.*).
KDO	SS. *Esparta* (United Fruit Co., U.S.A.)	33.0.
KDZ	Point Barrow, Alaska	21.4, 42.08, 74.77
KEB	Oakland, Calif. (G.E. Co.)	18.62, 21.8.
KEG	Vancouver, Washington (Pacific Air Transport)	45.0.
KEL	Bolinas, Calif. (R.C.A.)	14.1, 29.3, 95.0.
KEMM	,, ,, ,,	14.29, 28.58.
KESS	,, ,, ,,	14.40, 28.80.
KET	,, ,,	99.0.
KEU	Los Angeles, Calif. (Pacific Air Transport)	45.02.
KEUN	Bolinas, Calif. (R.C.A.)	16.93, 38.38.
KEWE	,, ,, ,,	14.08, 28.15.
KFD	Denver, Colorado (G.E. Co.)	17.7, 24.3.
KFHW	SY. *Poinsettia*	40.0.
KFQU	Holy City, Calif.	31.0, 53.0, 63.0.
KFVM	SS. *Idalia*	17.0, 37.0, 74.0.
KFWB	Los Angeles, Calif.	40.0.
KFY	Poinciana, Florida	68.4.
KFZG	Port Barrow	45.32, 69.25.
KFZH	Fairbanks, Alaska	44.71, 68.32.
KFZQ	SS. *Robador*	37.5.
KGBB	U.S. SS. *Ungava* (R. B. Metcalf)	22.0, 37.0.
KGDU	SS. *Four Winds*	35.03.
KGE	Medford, Oregon (Pacific Air Transport)	46.06.
KGFT	Portable Station, Texas	50.0.
KGH	Hillsbro', Oregon (Fed. Telegraphic Co.)	36.52, 46.99.
KGT	Fresno, Calif. (Pacific Air Transport)	46.06.
KIO	Kahuku, Hawaii (R.C.A.)	90.04.
KKC	Palo Alto, Calif. (Fed. Telegraphic Co.)	17.0, 27.5.
KLL	Bolinas, Calif. (R.C.A.)	21.85.
KMM	,, ,, ,,	14.29, 28.58.
KMV	Bandini, Calif. (Western Air Express Inc. Morse)	49.5.
KNN	Honolulu (Mackay, R. & T. Co.)	17.2, 23.0, 23.7, 28.0, 34.4, 46.0, 47.4, 56.0.
KNR	Clearwater, Calif. (Fed. Telegraphic Co.)	29.5, 49.15.
KNW	Palo Alto, Calif. (Mackay, R. & T. Co.)	16.7, 17.0, 24.0, 33.4, 34.0, 48.0, 51.0.
KQS	Lone Pine, Calif. (City of Los Angeles)	45.77.
KQT	Los Angeles, Calif. (City of Los Angeles)	45.77.
KRP	Salt Lake City, Utah (Western Air Express Inc.)	49.5.
KSS	Bolinas, Calif. (R.C.A.)	14.40, 28.80.
KSZ	McCamey, Texas	48.05.
KTA	Guam (Mackay R. & T. Co.)	18.0, 21.8, 22.0, 23.5, 36.0, 43.6, 44.0, 47.0.
KTF	Midway Island (Mackay R. & T. Co.)	21.6, 33.2, 43.2, 66.4.
KUN	Bolinas, Calif. (R.C.A.)	16.93, 33.88.
KUY	Bear Creek, Alaska	82.0.
KVR	Las Vegas, Nevada (Western Air Express Inc.)	49.5.
KWE	Bolinas, Calif. (R.C.A.)	14.08, 28.15.
KWJJ	Portland, Oregon	53.54 (¼ *kW.*).
KWT	Palo Alto, Calif. (Fed. Telegraphic Co.)	34.86, 48.05, 49.97, 58.10.
KWV	Bakersfield (Pacific Air Transport)	66.48.
—	Lyons, Radio Lyon	39.5 (*broadcasting 1700–1800 G.M.T., except Sundays*).
LA1E	Meteorological Hut, Bergen	43.0.
LA1M	Meteorological Inst., Oslo	45.0.
LCHO	Telegraph Administration, Oslo	33.0.
LP1	Buenos Aires	34.0.
LPZ	,, ,,	36.0, 75.0.
LY	Bordeaux, Lafayette	32.0.
—	Matagora (Spain). Cie Transatl. Espagnola	70.0.
NAA	Washington	24.9, 37.4, 74.7.
NAJ	Great Lakes, Illinois	40.0, 76.0, 34.0.
NAL	Navy Yard, Washington, D.C.	20.0, 30.6.
NAS	Pensacola, Florida	40.0.
NBA	Balboa, Canal Zone	51.0.
NEL	Lakehurst, N.J.	80.0.
NEPQ	U.S. SS. *Relief*	20.0.
NERM	U.S. SS. *Los Angeles*	70.0–84.5.
NFV	U.S. Marine Corps, Quantico, Va.	77.4, 77.5.
NIRX	U.S. SS. *Canopus*	75.0.
NKF	Naval Lab., Bellevue, Anacostia	16.0, 17.0, 20.8, 21.0, 25.5, 41.3, 54.4, 61.0, 71.3, 81.5.
NKL	Arlington	29.0, 37.4, 74.7.
NOSN	U.S. Submarine Base Coco Solo, Panama	40.0.
NPC	Puget Sound, Washington	37.0.
NPG	San Francisco, California	16.49, 32.98.
NPL	U.S. Training Ship, San Diego, California	71.7.
NPM	Honolulu, Hawaii	35.0 and 36.8.
NPO	Cavite, Philippine Islands	68.0, 70.0.
NPU	Tutuila, Samoa	37.0–40.0, 53.0.
NQC	San Diego, California	75.0, 86.0.
NQW	U.S. SS. *Mexico*	40.0.
NRRG	Winter Park, Florida	39.5, 82.0.
NRRL	U.S. SS. *Seattle*	40.0.
NUQB	U.S. SS. *Pope*	75.0.
OCBA	Bamako (Soudan)	41.50.
OCBV	French Military Station at Bevrouth	58.0.
OCCO	Conakry (French W. Africa)	33.0.
OCDA	Dakar (French W. Africa)	35.0.
OCDB	Djibouti	72.0.
OCDJ	Issy-les-Moulins	33.0 (*1008–1028 G.M.T.*), 65.0 (*corresponding with OCDB*), 32.0 (*Time Signal, 0756 and 0955*).
OCMV	French Military Station, Mont Valerien, Suresnes (Seine)	39.0, 44.0, 46.0 (*at 1000, 1100, 1230, 1330, 1600, 1900, 2000, 2100 and 2200 G.M.T, on either 600 cycles or D.C.*).
OCNG	Nogent-le-Rotrou	29.0, 32.0, 45.0, 48.0, 72.0.
OCRB	Rinck, Meteo Aviation, Rabat, Morocco	36.0.
OCRF	Reggu, Morocco	71.0 (*2130–2145 G.M.T.*).
OCRU	Rufisque (French West Africa)	39.0.
OCTN	Mourillon, Toulon	20.0 (*series of "a" from 1530–1540 G.M.T.*), 33.0 (*series of "b" from 1545–1555 G.M.T.*), 57.0 (*series of "c" from 1600–1610 G.M.T. daily, except Sundays*), 34.5 and 15.0.
OCTP	The Military Station of Nogent-le-Rotrou.	
OCTU	Tunis la Casbah	48.0, 50.0.
OHK	Vienna	39.5, 40.6.
OLQ	SS. *Slamat*	19.0, 22.5, 37.0.
—	Paris, Radio LL	61.0 (*broadcasting*).
—	,, Radio Vitus	37.0 (*broadcasting Wed., Fri., Sun., 2100–2245 G.M.T.*).
PCA	Amsterdam	33.33.
PCG	Malabar, Java	17.0.
PCH	Scheveningen Port	20.0, 20.6, 20.69, 21.127, 28.800, 29.226, 29.283.
PCJJ	Hilversum, Holland (Philips Lamp Works)	30.2 (*broadcasting*).
PCLL	Kootwijk, Holland	46.0, 32.0, 18.0 (*broadcasts Wed., 1400–1600 G.M.T. and occasionally on Mon. and Fri.*) and other wavelengths below 60 metres (*40 kW.*).
PCMM	Ministry of Posts and Telegraphs, Kootwijk	25.0, 27.5, 36.0 and other wavelengths below 60 mtrs.
PCPP	Kootwijk, Holland	27.0 and other wavelengths below 60 metres.
PCRR	,, ,,	20.0, 25.0, 37.0 and other wavelengths below 60 mtrs.
PCTT	,,	21.0, 29.5 and other wavelengths below 60 metres. (*10 kW.*).
PCUU	Dutch Colonial Ministry, The Hague	34.0.
PKD	Koepang	32.0.
PKE	Amboina	24.0.
PKH	Soerabaja, Java (D.E. Indies)	23.0.
PKP	Medan	21.5, 31.5.
PKX	Java	27.0, 32.0.
POF	Nauen	13.5, 18.0.
POX	,,	20.0.
POY	,,	25.0.
POZ	,,	47.0.
POS	Alfragidi, Lisbon (Beam)	18.270.

Call-Sign.	Station.	Wavelengths and Remarks.
PQW	Alfragide, Lisbon (Beam)	15.641.
PTQ	Quartel-General, Brazil	30.5.
PVC	Curacao	15.0–20.0.
RABL	Habarousk	22.0.
RAU	Tashkent	23.0, 34.0.
RCRL	Central Lab., Leningrad	27.0.
RCT	Sebastopol	64.0.
RDI	Petrozavadosk	34.2.
RDRL	Leningrad	28.5.
RDW	Moscow	83.0.
RKV	,,	21.0, 34.0.
RLT	Tommot	23.0.
RRP	Nijni Novgorod	20.0–42.0.
RTRL	Tiflis	22.0–42.0.
SAA	Karlskrona	44.0.
SAB	Göteborg	36.5.
SAD	Flottans Stations, Stockholm	31.0–51.0.
SAJ	Karlesborg, Sweden	50.0.
SDK	SS. *Kiruna*	54.0.
SFR	Paris	75.0, 85.0.
SGT	Motorship *Suecia*	42.0, 50.0.
SIC	SS. *Masilia*	42.0, 51.5.
SKB	Motorship *Gripsholm*	37.5.
SMHA	Stockholm	41.0.
SOJ	Brazilian SS. *Jaquarao*	100.0.
SOK	Moskwa Sokoleniki Radio	37.0.
SPM	Radio Laboratory, Ministry of Posts, Helsingfors	47.0.
SPR	Sepetiba, Rio de Janeiro, Brazil	22.180 (*meteorological reports, 1530 local time*).
SPU	Santa Cruz (Beam)	15.576.
SPW	Rio de Janeiro	29.3.
SPX	,, ,,	40.5.
SPI	,, ,,	17.0, 44.5, 47.0.
SUC2	Abuzabal (Cairo)	47.0.
TFA	Reykjavik, Iceland	42.5, 49.5.
TSB	Norwegian SS. *Helder*	46.5, 51.0.
TUK	Tomsk, Siberia	20.0.
TVE	SS. *Solderyk*	31.0.
U 1XAO	Belfast, Maine	40.0, 56.0, 60.0, 70.0.
U 1XAB	Portland, Maine (Congress Square Hotel Co.)	63.79 (*250 Watts*).
U 1XR	Manila, Philippine Islands	30.0.
U 2XAA	Houlton, Maine	22.99 (*broadcasts after 2300 G.M.T.*).
U 2XAC	G.E.C., Schenectady, N.Y.	50.0.
U 2XAD	,, ,, ,,	21.96 (*broadcasts Mon., Wed., Fri., 2300; Sat., 1900–2200 G.M.T.*).
U 2XAF	Schenectady, N.Y., G.E.C. transmitting programme from WGY	32.7 (*broadcasts Tues., Thurs. and Sat., 2300*), 42.79.
2XAI	Newark, N.J. (Westinghouse Electric Co.)	43.0.
2XAL	New York, short-wave transmitter of WRNY (Experimenter Publ. Co.)	30.91.
U 2XAO	Belfast, Maine	40.0, 56.0, 60.0, 70.0.
U 2XAP	New York (Bull Insular Line)	18.3, 18.7, 36.6, 37.5.
U 2XAW	G.E.C., Schenectady, N.Y.	3.0–20.0, 15.0.
U 2XBA	Newark, N.J. (Short-wave Station of WAAM)	65.18 (*broadcasts Mon., Wed., Fri., 2355—0500*).
U 2XBB	New York (R.C.A.)	1–5 (*1 kW.*).
U 2XBC	Rocky Point, N.J. (R.C.A.)	14.09 and 5.35–18.74.
U 2XBI	,, ,, N.Y. (R.C.A.)	1–15 (*10 kW.*).
U 2XE	Richmond Hill, N.Y. (Short-wave of WABC)	22.1 (*broadcasts after 2300*).
U 2XG	Rocky Point, N.J. (Western Electric Co.)	16.02 (*broadcasts Mon. and Fri after 1700 G.M.T.*).
U 2XH	Schenectady, N.Y.	50.0.
U 2XI	,, ,,	30.0, 35.0, 38.0.
U 2XK	South ,, Schenectady, N.Y. (General Electric Co.)	65.5.
U 2XN	Rocky Point (R.C.A.)	5–80 (*150 Watts*).
U 2XS	,, U.S.A.	14.93 (*80 kW.*).
U 2XT	,, ,, N.Y. (R.C.A.)	16.17 (*80 kW.*).
U 3XL	Bound Brook, N.J.	60.0 (*broadcasting* (30 *kW.*)).
U 3XQ	Mountain Lakes, N.J.	37.95, 75.9.
U 4XK	San Juan, Porto Rico (Bull Insular Line)	18.3, 18.7, 36.6, 37.5.
U 5XH	New Orleans (Tropical Radio Telegraphic Co.)	42.0.
U 6XAI	Inglewood, California	66.04 (*broadcasts 2400 G.M.T., onwards*).
U 6XAR	San Francisco, California	33.00 (*broadcasts 2400 G.M.T., onwards*).
U 6XI	Bolinas, California	29.3.
U 6XO	Kahuhu, Hawaii	90.0.
U 8XJ	Columbus, Ohio	54.02.
U 8XK	East Pittsburg (Westinghouse Co.)	26.8 (*Mon. and Fri. 1900–2100 G.M.T.*).
U 8XS	East Pittsburg, Pa.	67.0, 96.0.
U 9XU	Council Bluffs, Iowa	61.06 (*broadcasting*).
VAS	Louisburg, Nova Scotia	52.0 (*Press Reports*).
VGJL	SS. *Canadian Commander*	43.0.
VIS	Sydney	22.0, 26.0, 32.0, 43.0, 51.5.
VIT	Townsville, Queensland	22.0, 42.0.
VIZ	Ballan, Melbourne (Beam Station)	25.728.
VJZ	Rabaul, New Britain	22.0, 26.0, 32.0, 42.0.
VKQ	Garden Island, Sydney	35.0.
VNB	Klipheuval, South Africa (Beam)	16.077, 33.708.
VQF	Kuching, Sarawak	32–38.
VWZ	Kirkee, Bombay (Beam)	16.286, 34.483.
VZDK	SS. *Jervis Bay*	33.0.
WABC	Richmond Hill, N.Y. (Atlantic Broadcasting Cpn.)	64.0 (*broadcasting* (½ *kW.*)).
WAJ	Rocky Point, N.Y. (R.C.A.)	22.24, 44.48.
WAQ	Newark, N.J. (Westinghouse Elec. & Mfg. Co.)	44.03.
WBO	Dearborn, Mich. (Ford Motor Co.)	44.62.
WBU	Rocky Point, N.Y. (R.C.A.)	14.09.
WBZ	Springfield, Mass. (Westinghouse E. & M. Co.)	50.0 70.0 (*broadcasting*) (*20 kW.*).
WCFL	Chicago, Ill. (Fed. of Labour)	37.24.
WCGV	Brooklyn, N.Y.	54.0 (½ *kW.*) (*broadcasts after 2300 G.M.T.*).
WCSH	Portland, Maine	63.79 (½ *kW.*).
WDJ	Harrison, Ohio (Crossley Radio Corporation)	21.4, 26.3.
WDS	Rocky Point, N.Y. (R.C.A.)	15.86, 31.73.
WEAJ	,, ,, ,,	22.24, 44.48.
WEAO	Columbus, Ohio (Ohio State University)	54.02.
WEDS	Rocky Point, N.Y. (R.C.A.)	15.86, 31.73.
WEEM	,, ,, ,,	16.41, 32.84.
WEFX	,, ,, ,,	15.79, 31.39.
WEGT	S. Juan, Porto Rico (R.C.A.)	21.75, 65.3.
WEHR	Rocky Point, N.Y. (R.C.A.)	15.93, 31.96.
WEM	,, ,, ,,	16.41, 32.84.
WEOP	,, ,, ,,	21.57, 43.14.
WEP	Cape Charles, Virginia (Norfolk Cape Charles Radio Telegraph Co.)	99.9.
WEPE	Rocky Point, N.Y. (R.C.A.)	21.63, 43.33.
WEQA	,, ,, ,,	14.13, 28.26.
WEQB	,, ,, ,,	16.71, 33.42.
WEQC	Rocky Point, N.Y. (R.C.A.)	16.78, 33.37.
WEQX	,, ,, ,,	14.85, 29.71.
WEQY	,, ,, ,,	14.91, 29.83.
WFV	Poinciana, Florida (Florida R/T Co.)	70.51.
WFX	Rocky Point, N.Y. (R.C.A.)	15.70, 31.59.
WGI	Alpena, Mich. (Alpena Marine Radio Service)	98.3.
WGN	Rocky Point, N.Y.	75.0.
WGT	S. Juan, Porto Rica (R.C.A.)	21.75, 65.3.
WGW	Vieques, Porto Rico (Bureau of Insular Telegraphs)	52.0.
WGY	Schenectady, N.Y. (G.E. Co.)	35.0.
WHD	Sharon, Pa. (Westinghouse Co.)	49.0.
WHK	Cleveland, Ohio	66.04 (½ *kW.*).
WHR	Rocky Point, N.Y. (R.C.A.)	15.93, 31.96.
WHW	Highland Park, Ill. (Wireless Telegraph & Communication Co.)	45.02.
WIK	New Brunswick, N.J.	21.48, 21.5.
WIR	,, ,, (R.C.A.)	74.0 (*20 kW.*).
WIZ	,, ,, ,,	43.35 (*broadcasts occasionally from 2300 G.M.T.*).
WJD	New York, International News Service	37.01.
WJZ	Bound brook, N.Y. (R.C.A.)	18.17.
WKC	Newark, N.J.	17.5, 27.9.
WKI	,, ,, (Fed. Telegr. Co.)	17.3, 27.9.
WKK	Cuba, Porto Rico (Bureau of Insular Telegraphs)	52.0.
WLL	Rocky Point, N.Y. (R.C.A.)	16.57.
WLW	Cincinnati, Ohio (Crossley Radio Corporation)	52.02 (*2200–0400 G.M.T. except Fri.*).
WNBT	Elgin, Illinois	33.5 (*special Time Signals*).
WND	Ocean Township, N.J. (American Telephone & Telegraphic Co.)	13.88, 16.35, 22.38, 32.69, 46.48.
WNU	New Orleans, Louisiana	26.0, 40.0 (*Press Reports*).
WOBD	SS. *Radio*	37.0, 43.74, 77.0.
WOBV	U.S. SS. *Nippekontu*	36.2, 72.4.
WOP	Rocky Point, N.Y. (R.C.A.)	21.57, 43.14.
WOWO	Fort Wayne, Indiana (Main Auto Supply Co.)	22.80 (*1 kW.*) (*broadcasts after 2300 G.M.T.*).
WPE	Rocky Point, N.Y. (R.C.A.)	21.63, 43.14.
WQA	,, ,, ,,	14.13, 28.26.
WQB	,, ,, ,,	16.71, 33.42.
WQC	,, ,, ,,	16.78, 33.57.
WQN	,, ,, ,,	51.5, 54.5, 57.0.
WQO	,, ,, ,,	35.03, 44.0.
WQQ	,, ,, ,,	14.8.
WQX	,, ,, ,,	14.85, 29.71.
WQY	,, ,, ,,	14.91, 29.83.
WRB	Miami, Florida (Florida Radio Telegraph Co.)	70.74.
WRNY	Coteysville, N.J. ("Radio News")	30.91 (*broadcasts Mon., Wed., Fri., 1930–2215 G.M.T.; other days, 2355–0500*).
WSS	Rocky Point, N.Y. (R.C.A.)	16.0, 20.0.
WTT	,, ,, ,,	16.02.
XDA	Mexico City, Mexico	34.0 (*Press Reports, 0500 G.M.T.*).
XEK 4AP	German Aeroplane	42.5.
YZ	Fort d'Issy, France	45–47.
ZWT	Bremerhaven	53.0.
ZZ	Fort d'Issy (Portable)	45–47.

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.

STATION IDENTIFICATION.

Sir,—Being a supporter of Mr. C. F. Carr's identification of foreign stations scheme, I cannot accept all the views put forward by Capt. Eckersley in your issue of January 11th.

In the scheme I have mentioned there will be no unusual noises, and nothing in the nature of a code. Instead of the announcements being in the national tongue they will simply be made in the Esperanto equivalent, so that rules out Capt. Eckersley's suggestions to the contrary.

We are told that "seachers" are in the minority, but there was a time when they were far more in the minority than now. Are we to assume that this will always be the case? Surely it is quite safe to anticipate the growth of foreign listening.

It was because there was a certain lack of foresight in the broadcasting world that Capt. Eckersley went to Geneva to try and straighten out the muddle which had grown.

At the moment we think that the listener is hampered by the identification problem, that is why we are endeavouring to put the matter right before Geneva has to be called in upon our problem.

The suggestion that the climax of a play or a piece of music is spoilt by an announcement, whether Morse, ringing bells, or any other method, would be, and will always be, the same to such folk as would dislike to be disturbed out of the mood in which the play or music leaves them. In this instance Mr. Carr's scheme would be no worse than what we are now having.

Capt. Eckersley's comments on the listeners of foreign transmissions are again rather short-sighted, for there will always be a very large percentage of listeners who could not, with any certainty, definitely state that they were receiving a particular station, as the difference between some stations on their tuning dials would be very, very small.

From Capt. Eckersley's remarks we are left to believe that we are apparently to be "fed with a spoon." We shall have to wait until the all-powerful B.B.C. think it fit that we should hear such and such an item which would be relayed in England by telephone cables, or should they decide otherwise we should not be allowed to hear it.

I am not in any way trying to depreciate the efforts of the B.B.C. to establish a really first-class broadcasting service, but I think that the foreign listener should be encouraged to listen where he pleases, as previously stated, for as time improves our receivers, and components become cheaper, so will foreign listening increase. W. H. MATTHEWS.

B.E. Radio Committee. Sec. G.B. Internacia Radio Asocio.
Chadwell Heath, Essex.
January 17th, 1928.

Sir,—I have read with great interest your readers' views on identification of stations, also Capt. Eckersley's article. I might state I agree with what Capt. Eckersley sets forth in your journal. What good will it do anyone to identify a foreign station if they cannot speak the language? One way of overcoming the trouble is for those who want to collect and name the stations received is to calibrate their receivers. I have done this to my 5-valve set. I receive about 40 stations on the loud-speaker and can locate 38 of these without any knowledge of foreign languages. R. N. BRYERS.

Dublin.
January 13th, 1928.

DATE OF THE RADIO EXHIBITION.

Sir,—I have read with interest the correspondence concerning the "Date of the Radio Exhibition" which has been published in *The Wireless World* recently.

Being in the wireless trade myself I quite agree that the "Show" could be held at an earlier date with advantage.

I have, however, been informed that the N.A.R.M.T. have booked the hall for so many years in advance! I do not know if this statement is correct, but it will be understood that if this is so, the exhibition cannot possibly be held at any earlier date for the next few years, at any rate.

I should be glad to know if the above statement is correct from someone in authority. JAMES N. CAVE.

Farnham, Surrey. Operator 2BUW.
January 18th, 1928.

GROUSES FOR 1928.

Sir,—In your editorial of the 18th inst. you almost invite your readers to grouse. May I submit to you my New Year's grouse? Why is it that manufacturers do *not* hesitate to advertise and show newly designed articles and components without arranging beforehand to have an adequate supply to meet a likely demand? It looks as if they have so little faith in their productions that an immediate and wide demand takes them completely by surprise and finds them totally unprepared, with the result that great irritation and inconvenience is caused to the buying public. Here is one of my own experiences as an illustration. On November 2nd, 1927, I ordered, through my dealers, 3 meters from a well-known radio firm. After waiting patiently for a couple of weeks I appealed to them direct and received a courteous reply, informing me that the firm was 40,000 orders behind on delivery, and I was offered the choice of cancelling the order or of waiting another few weeks. The meters were good, their price reasonable, so I decided to wait. But please note that up to date, nearing the end of January, 1928, I am still waiting. I may add that wireless manufacturers are not the only culprits in this respect. I recently ordered a small saloon car of well-known make and merit, and was told that I should probably have to wait some three months for delivery. I submit that a quarter of a year is an unreasonable time to have to wait for delivery of widely advertised articles, and I appeal to all manufacturers to add to the science of manufacture also the art of salesmanship.

Amberley, Sussex. JAN DAUM.
January 20th, 1928.

Sir,—I am an obedient reader of your quite excellent paper, and duly obey all your instructions for "better reception." This naturally costs a fairly considerable amount of money, and if it were not for the thousand and one people like myself your advertisers would cease to advertise, so I feel justified in my complaints.

I attended the Manchester Exhibition and was duly impressed by four things: A "super" mains transformer and valves to suit it; a pick-up; a moving coil L.S., and another loud-speaker movement.

I immediately (through my dealer) ordered the transformer, the valves, and the pick-up. To this day I have not had *one* of these, although I never cease to remind the dealer. I asked for further details at the Show of the L.S. movement and heard no more. I asked for a quotation for a casting for the

moving coil loud-speaker, received the quotation, sent 10s. and have heard no more.

Also, the dealer I refer to wanted a £90 set for a customer, who wanted an oak case and one or two slight alterations as his mains were not standard.

He received a superior letter to the effect that no deviation from the standard was possible.

So this is business! And yet one of your correspondents says "why grumble?" Why not? HENRY J. SECKER.

Sandiway, Cheshire.
January 19th, 1928.

EMPIRE BROADCASTING.

Sir,—You may be interested to know that the B.B.C. transmissions from Chelmsford have been successfully received in this country, which is situated in one of the most unfavourable areas for reception.

The Christmas programme was picked up at 15.15-16.00 G.M.T. Strength was poor, though the announcement beginning "This is the London studio calling" was quite audible. Music followed. It is worth recording that reception of telephony from PCJJ and America has not been possible at this time of the day, though PCJJ is excellent all the evening after about 18.30, and Schenectady is excellent after 23.00-24.00.

5SW was also heard at about 17.30 on December 30th, testing with 2XAD—reports on 2XAD's transmission of 29th inst. alternating with gramophone records. Both speech and music were very clear and distinct at about optimum headphone strength, the speech being perhaps slightly better than the music.

17.30 is still very early in the evening for good telephony reception here, and I think the results obtained are very encouraging, and promise well for the future success of 5SW.

I entirely agree with your recent announcement *re* flogging a dead horse, but there are still some aspects of the case for Empire Broadcasting which do not seem to be receiving due attention. Are any steps being taken to place the Empire S.W. station on a proper financial basis, by arranging for its upkeep at the expense of Dominion and Colonial listeners? This is a matter of prime importance to ensure satisfactory attention to their needs, and to relieve listeners at home of expenditure from which they receive no return.

Two recent announcements in the wireless press call for comment. The B.B.C. is said to have stated that difficulties in the way of Empire broadcasting are those of reception rather than of transmission. If this is so, regular programmes should begin at once, for if they are available, the very numerous Colonial listeners and would-be listeners will attend to the problems of reception, which in any case are by no means formidable. The original exploitation of the short waves is due to amateurs, and they can be trusted to produce improvements in receivers.

Another statement is to the effect that 5SW may change its wavelength to 14 metres. I hope this is only a rumour, for I consider that such a step would be a grave error. Experience all over the world has shown that the 20-30 metres band gives excellent results, as demonstrated by PCJJ and Schenectady. Most S.W. sets in existence, and new circuits published in the wireless press have their lower limit at 15 or 20 metres, and in practice the set as built often does not reach down to this limit. If 5SW's final wavelength is to be as low as 14 metres, most existing sets will have to be scrapped, and the accounts of excellent circuits which have been published will be wasted.

Successful transmission and reception on 20 to 30 metres is an accomplished fact, and 5SW should begin regular programmes on this band at the earliest possible date. Work on 14 metres is still a subject for experimentation.

H. A. DADE, F.R.C.S.

Research Branch, Department of Agriculture,
Aburi, Gold Coast Colony, West Africa.
December 31st, 1927.

PROGRAMMES.

Sir,—I should like to emphasise and re-emphasise every word of Mr. Lowe's letter in your January 4th issue, concerning the inane "American" singing which mars some really good dance music. Why not cut out the "singing," for it usually makes it difficult for one to keep step in dancing, and the *manner* in which some of the vocalists render their efforts makes one wish they had been drowned when they were pups! I usually turn these days to Germany, Denmark or Sweden for my dance music, where it is rich and musical, and played with musical instruments, and where sleepy, "softly soppy" voices do not break in and intrude. I am just a little concerned sometimes, when listening to some of the idiotic sentiments expressed vocally in our dance music, whether we are not, as a nation, inviting another Flood upon mankind!

Generally speaking, English programmes are good, and I speak as one having had a fair experience of the real trouble and difficulty in arranging programmes in ordinary concert work. One cannot satisfy everybody, and it is for each of us to realise that we are not the only pebbles on the beach. The constant demand for "humour" overlooks the fact that the existing stock of humour would only last about a month if featuring in the majority of items, and it would strain the constitution of our greatest humorist or comedian to make up fresh gags every day for a month on end.

Thornton Heath. ALEX. SIM.
January 11, 1928.

OPTIMISTIC PERFORMANCE CLAIMS.

Sir,—I can fully confirm Mr. W. A. E. Rowett in all his statements in your current issue regarding the capabilities of the 0-v-2 circuit. On an outdoor aerial this circuit should overload an ordinary speaker on the 5XX transmission almost anywhere in England. It does so here at 200 miles, and on an indoor aerial (in a bungalow) at that. Also, Mr. Rowett's "quiet L.S. strength" is obtainable on two valves at any time on the aforesaid indoor aerial. If it were worth the trouble to erect an outdoor one I would confidently expect two valves to operate my loud-speaker on 5XX as a matter of course.

The above remarks occasionally include German transmissions—but *not* 5GB. ROBERT A. IRVING.

Carlisle,
January 20th, 1928.

Sir,—Your issue of *The Wireless World*, January 18th, contains a letter from Mr. W. A. E. Rowett on the performance of 3-valve receivers and disagreeing with the views of Mr. S. G. Black and Mr. F. Appleton.

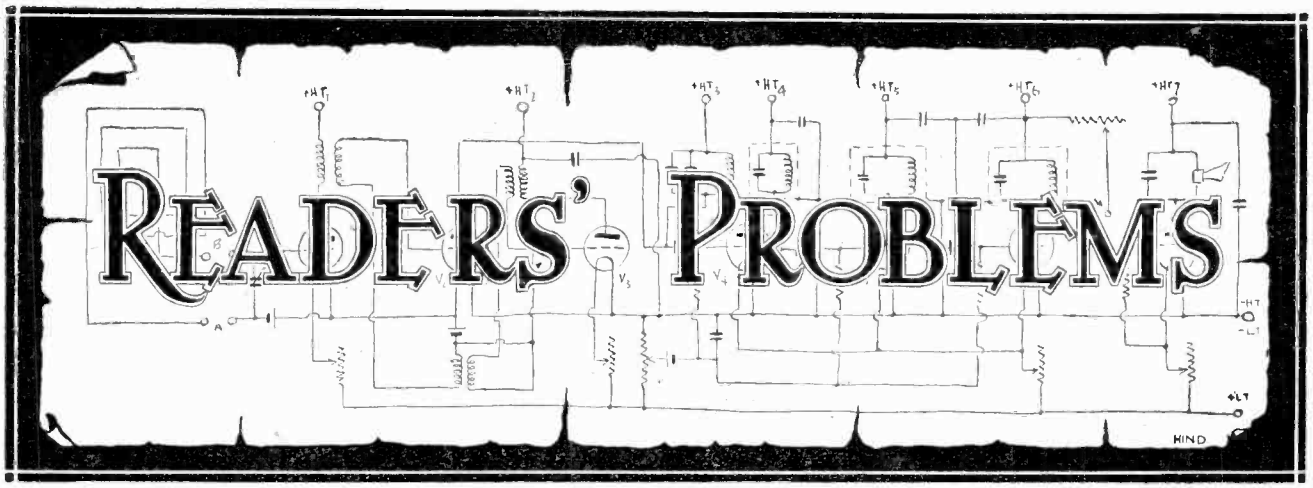
Allow me to sincerely disagree with Mr. Rowett—I have been a follower of radio for the past six years and have constructed many sets of various designs, including a 1-valve (Det) which was capable of receiving K.D.K.A. on 100 metres and also 68 metres in 1922—five years ago this performance was very rare. I have confirmations in my possession to-day from the Pittsburgh Station to show anyone who cares to see them. I have also been a keen visitor to the famous transmitter 2K.F., who established the first 2-way communication with the U.S.A., and from his personal knowledge I have experienced and learnt a lot.

From my experience I view Mr. Rowett's position a very favourable one, he being many miles, by air, from the nearest B.B.C. station, and therefore any "hook up" of 3 valves would give him alternative stations on the speaker, but let him operate a 3-valve receiver within the 10-mile radius of a station pumping out 3 kilowatts, then give us the number of stations *identified* and *logged* he can receive on the speaker audible at least 6 feet from the instrument.

I have not heard of one yet! Unless one operates a set of more than 3 valves and marketed at a price of £25 and upwards.

Look to the American receivers! They can leave us behind in performance because they know too well that a set in New York must be capable of cutting through the numerous locals or is useless. Finally, give the radio fans a *short wave* station in London and radio will have a new life, this from all points including the manufacturers in every branch, not forgetting *The Wireless World* (more *inexpensive* hook ups for shortwaves). "BRITISHER."

Tooting, S.W.17,
January 19th, 1928.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Aerial Capacity and its Effect on Tuning

My receiver has been giving satisfaction for many months past, but recently it became necessary to transfer the set from one room to another, and since then a peculiar effect has been noticed. The local station (2LO) is now received at poor strength, while 5GB, not previously heard, comes in at excellent strength. Can you please explain this effect and advise me how the local station could be heard as formerly? A. M.

It would appear that since transferring your receiver to another site the lowest wavelength to which it can be tuned is much higher than formerly, and the local station does not come within the tuning range. The reason for this is probably due to the extension leads, which you have found necessary to add to the aerial and earth, increasing the inductance and capacity of the aerial system so that its fundamental wavelength is now higher.

To compensate for this it will be necessary to change the aerial coil for one of fewer turns. Alternatively, you could connect a 0.0002 mfd. fixed condenser between the aerial and the aerial terminal of your receiver but retaining the same coil as formerly.

○○○○

Power Output.

I have a three-valve receiver with detector and two stages of resistance-capacity-coupled L.F. valves working a moving coil type of loud-speaker. I wish to add a two-valve L.F. amplifier for the purpose of increasing volume. Can you give me, please, a circuit diagram, or a reference to a back issue, of a suitable amplifier? J. K. C.

We should be doing you a disservice by recommending the addition of extra L.F. amplifying valves to a receiver embodying two stages of L.F. amplification. Generally speaking, the moving coil type of loud-speaker requires a much greater input than those of other types, and it is found necessary usually to employ either parallel valves or push-pull amplification in the output stage.

The latter method is considered to be the more efficient, as this enables a big output to be obtained with a limited value of high tension. However, this matter was discussed at greater length in an article entitled "The Last Stage," published in our issue of November 30th last, than would be possible here.

The theoretical circuit diagram of a typical push-pull amplifier was given in Fig. 1 on page 589 in our issue of October 26th last.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

Adapting a Smaller Capacity.

I have a 0.0003 mfd. variable condenser and desire to include this in a circuit where a 0.0005 mfd. variable condenser is specified. If I connect a 0.0002 mfd. fixed condenser in parallel with the variable the total capacity will be 0.0005 mfd. Could this combination be used for tuning the circuit, please? F. B. L.

By connecting the fixed condenser in parallel with the variable the total capacity will be increased to the desired value; however, the minimum capacity of this combination will be slightly greater than 0.0002 mfd., so that this arrangement would not be very satisfactory in practice. If you are prepared to jettison some of the higher and lower wavelengths of the broadcast band you could use the 0.0003 mfd. variable condenser and add a few turns to the coil.

○○○○

Extra Long Wave "All-wave Four" Transformer.

I have an "All Wave Four" receiver and desire to receive Paris (F.L.) and Berlin (4,000 metres), but the long-wave transformer designed for this set does not cover the wavelengths required. Can you please supply me with the winding data of a suitable transformer? G. F. J.

It will be necessary to construct a special H.F. transformer for wavelengths over 2,000 metres, and this can take the same general outline of that described for the Daventry wavelength. The length of the former should be 4½in., and 400 turns of No. 36 S.S.C. wire must be wound on for the secondary winding. The primary and neutralising windings should consist of 72 turns each and must be accommodated over the low potential end of the secondary coil. The plug-in coils required for the aerial and closed circuits will be Nos. 300 and 400 respectively.

A Useful Arrangement.

I wish to convert the last stage of my receiver to the push-pull system, but am in some difficulty concerning the output transformer, since at times I shall require to operate a moving coil loud-speaker with a low resistance coil, this requiring a step-down transformer, and at other times I wish to operate an ordinary type of high resistance loud speaker, and shall be glad if you can help me to solve the difficulty as inexpensively as possible.
R. C. D.

The circuit diagram which we give in Fig. 1 should adequately meet your needs. A step-down output transformer will be required, such as the Ferranti OP4c. This will be for the purpose of driving the low resistance loud-speaker, the other output terminals being for the high resistance instrument. The two 2 mfd. condensers are not essential for preventing the flow of D.C. through the high resistance loud-speaker, since in any case no flow will take place as this loud-speaker connects to points which are at the same D.C. potential. However, they are useful in case either of the extension wires of this loud-speaker at any time came into contact with earth, when, of course, trouble is likely to occur as the H.T. terminal of the amplifier will probably be earthed through the normal wiring of the set. It may be pointed out that if the output transformer were of the 1 : 1 ratio, then the two pairs of output terminals would be the same, that is, they would only be suitable for operating a high-resistance type of loud-speaker.

o o o o

"1,000 Ohms" Chokes.

I propose to build a battery eliminator, and have a number of 1,000-ohm chokes which I should like to use. Would these be suitable? T. B. L.

It is difficult to realise what exactly you mean when you state that your choke is of the 1,000-ohm type. This figure may either represent its D.C. resistance, or its A.C. resistance at a given frequency. We rather think that the figure represents D.C. resistance, and if the choke you have in your possession is of the type which we think it is, we should not advise its use. If you can give us further information concerning the choke, however, we shall be glad to advise you more definitely.

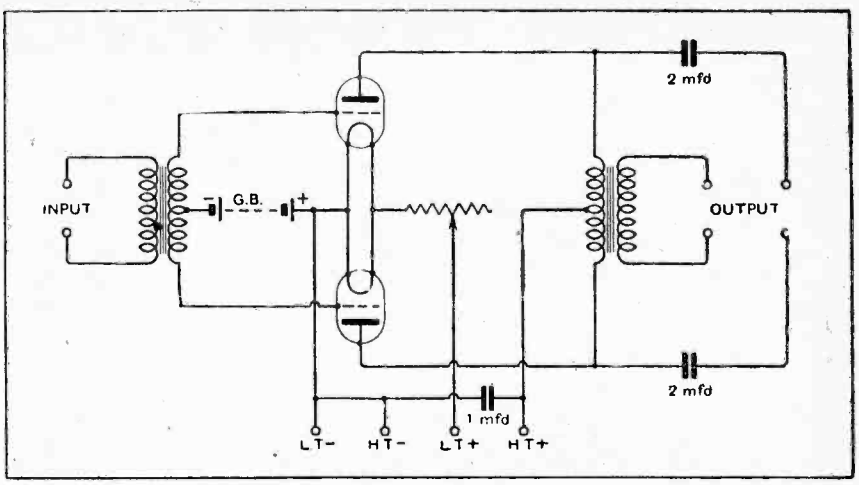


Fig. 1.—Push-pull circuit for high- and low-resistance loud-speakers.

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Ohm's Law Again Vindicated.

I propose to charge my 120-volt H.T. battery by connecting it to my 240-volt D.C. mains in series with a 240-volt 20-watt lamp. By calculation from Ohm's law I take it that I shall obtain a charging current of $\frac{1}{12}$th of an ampere. Can you confirm this? R. N.

You are mistaken in thinking that you will get so great a charging current as $\frac{1}{12}$th of an ampere. The current passing through any lamp can, of course, be determined by using the simple formula: Current $= \frac{\text{Wattage}}{\text{Voltage}}$. You have evidently done this, and the answer is, of course, $\frac{1}{12}$th of an ampere. This current would actually flow through your 20-watt lamp if you connected it to the mains direct for lighting purposes. However, you must consider the back E.M.F. of your H.T. battery, which is roughly 120 volts, and this must be subtracted from the mains voltage, leaving you with 120 volts actually across the lamp. Now 120 volts is not sufficient to push $\frac{1}{12}$th of an ampere through the lamp, and therefore you will get a far less charging current, and must use a lamp of lower resistance, that is, greater wattage, if you desire to pass the current you mention.

o o o o

Simplifying the "Super Seven."

I propose to construct "The Wireless World Super Seven" but with the omission of the H.F. amplifier before the first detector valve as I require a selective receiver for frame aerial reception of the medium distant stations. Do you recommend this modification, please, and will it be necessary to make any additional alteration other than that indicated above and the foreshortening of the baseboard and panel?
R. B. C.

A six-valve super-heterodyne receiver constructed on the lines indicated by you will give good loud-speaker results from a number of stations and considerably more at telephone strength. Apart from the omission of the first valve and its associated circuits, it is recommended that the grid circuit of the first detector valve should be modified in the manner shown in Fig. 2 on this page. The grid condenser and grid leak can be omitted and the low potential end of the frame circuit returned, *via* a 1½-volt grid cell (G.B.$_1$), to the negative filament of the first detector valve. It is very important to return this lead to the negative of the valve-holder and not to the nearest point of low potential although this would be, perhaps, slightly more convenient. The oscillator coils L_2 and L_3 can remain as recommended, but it may be found advantageous to increase slightly the number of turns on the coil L_4. The most suitable value must be found by trial and error, but as an indication we would suggest a B1 in the Gambrell range.

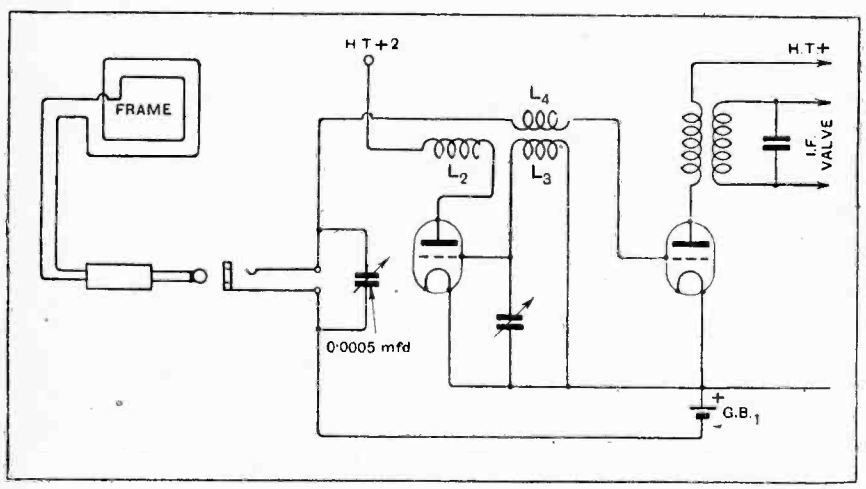

Fig. 2.—Modifications necessary in cutting out the first valve of "The Wireless World Super Seven."

The Wireless World AND RADIO REVIEW

(15th Year of Publication)

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

CONTENTS OF THIS ISSUE.

LONG OR SHORT WAVE BROADCASTING.

IN his recent paper to the Institution of Electrical Engineers, an abstract of which appears in this issue, Capt. Eckersley, Chief Engineer of the B.B.C., makes reference to long-wave broadcast transmissions, and compares the advantages and disadvantages of the Daventry 5XX station with transmitters of the normal broadcast wavelength band. From time to time Daventry, 5XX, has been criticised, and we understand at the Washington Conference a very determined though unsuccessful attempt was made to deprive the B.B.C. of the Daventry wavelength. Because on that occasion it was possible to retain it, we must not be too confident that efforts will not be made repeatedly to deprive us of 5XX.

When 5XX was Projected.

At the time that 5XX was first contemplated we did not look upon the scheme with favour because we realised the extent to which it would complicate the design of apparatus for broadcasting. We felt then that the endeavour should be made to cover the whole country with stations working within a waveband for which receivers could be conveniently produced, but now that Daventry has been established and has become, as Capt. Eckersley says, the station upon which it is estimated 50 per cent. of listeners rely, and serving 90 per cent. of the rural areas of the country, it would be a disastrous step if the station were abandoned.

The Washington Conference Again.

Even if it can be shown that with the new Regional scheme the whole country will be served by stations working on the ordinary broadcast band, we should still be justified in retaining 5XX, because it is the only station which can be received reasonably clear of spark interference in localities where this trouble is experienced, and the Washington Conference settled that we in this country are to have spark stations with us for a good many years to come. Other countries put forward proposals for spark stations to be replaced by more up-to-date equipment, but Great Britain objected on economic grounds, and finally it was agreed that the spark stations should stay.

If it were not for the lack of available channels on the long waves we would be inclined to recommend that the Regional scheme should include the establishment of a second Daventry to assist in the distribution of the broadcasting service, but we believe it would be very difficult with stations already working on wavelengths of that order to fit in another high-power broadcast transmitter which would be clear of interference.

5XX and American Sets.

In our issue of October 19th last year we commented on a letter from a reader who suggested that with the introduction of the Regional scheme the Daventry 1,600-metre station should be abolished, partly on the grounds of the difficulty of designing satisfactory sets for the reception of both Daventry and the ordinary broadcast band. We said then that in our opinion it was highly important that the B.B.C. should cease to chop and change with wavelengths and make alterations in other directions which necessitated modification in the design of commercial receivers. In America the wavelength band has not been altered since the introduction of broadcasting, and the wavelengths being all of much the same order, the manufacturer and designer are in a position to get down to mass production methods without fear of any serious changes. When, at the Washington Conference, the rumour got about that Daventry 5XX was likely to be abolished, it caused a good deal of satisfaction amongst American manufacturers, who saw the opportunity of being able to find a new market for their mass-production receivers, which will not be popular in this country so long as 5XX is an important factor and provides us with the best of the programmes

QUICK-CHANGE BROADCAST RECEPTION

A Hartley Circuit with Wavetrap and Switching for Alternative Programmes.

By H. F. SMITH.

THERE are definite signs that amateurs are beginning to weary of the practice of changing coils for receiving different wavebands. In all probability, the comparatively recent expression of a general desire for something easier and quicker is due to the fact that a considerable number of listeners had their first taste of real alternative programmes on the inauguration of the 5GB transmissions. The tendency to discard plug-in coils was apparent at the last Olympia Show; in this matter the home constructor is following the manufacturers' example. Doubtless the long-distance enthusiast, who is unwilling to risk any sacrifice of sensitivity, will continue to use interchangeable inductances, but we may expect to see a more general adoption of switching in sets intended for local broadcast reception.

As far as lightly damped circuits with one or more stages of high-frequency amplification are concerned, it must be admitted that the introduction of a switch changeover is likely to cause some falling-off in efficiency, however carefully it may be carried out. Conditions are different in a conventional detector-L.F. combination with reaction and grid circuit rectification. Here we have damping due to grid currents, and also, in amount depending on design, to aerial loading. Any small additional losses caused by a reasonably well-arranged switch are practically negligible, and may be offset by an increase in reaction.

The popular Hartley detector circuit, in which a single centre-tapped coil serves the dual purpose of aerial tuning inductance and reaction coil, lends itself particularly

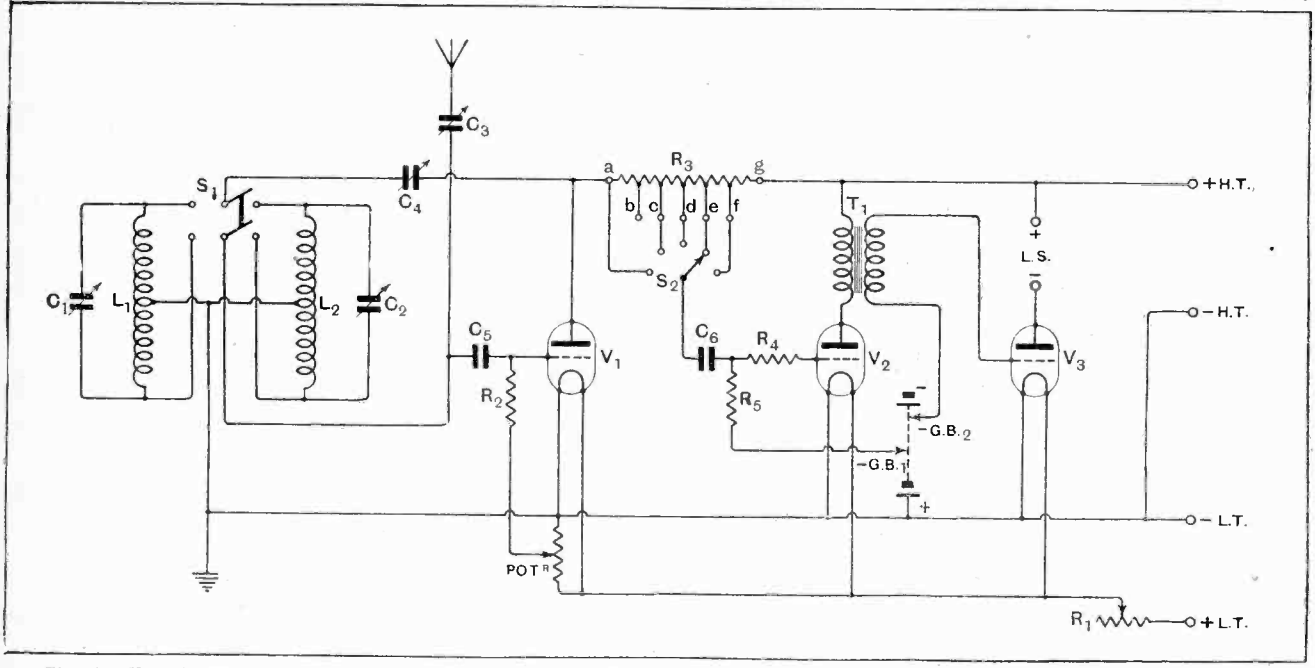


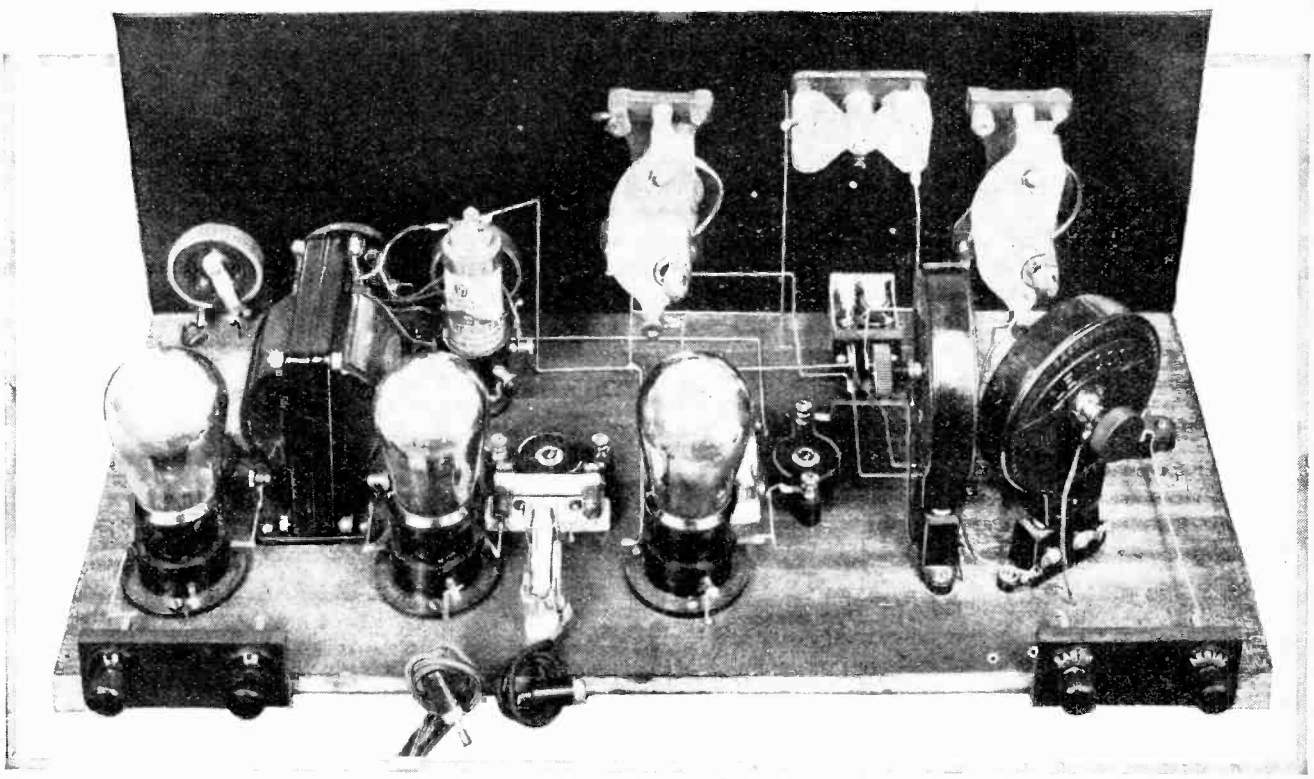
Fig. 1.—The theoretical circuit diagram. C_1, C_2 0.0005 mfd.; C_3, semi-variable condenser, 0.00025 mfd.; C_4, reaction condenser, 0.0001 mfd.; C_5, 0.0003 mfd.; C_6, 0.01 mfd.; R_1, filament rheostat, 2 ohms; R_2, 2 megohms; R_3, tapped anode resistance, 60,000 ohms; R_4, H.F. damping resistance, 100,000 ohms; R_5, 1 megohm.

Quick-change Broadcast Reception.—

well for use in a receiver of the type to be described. Ready-made commercial coils may be used, wiring is simple, and both sensitivity and selectivity are fully up to the standard to be expected from a set without H.F. amplification. Sensitivity is, of course, largely due to the use of reaction, the smooth control of which is a feature of the circuit. In the "wipe-out" area surrounding a broadcasting station, lack of selectivity will always be a problem without the help of several tuned circuits, but, fortunately without any great additional complication or expense, it is possible to introduce a wavetrap into our receiver. Referring to the circuit diagram given in Fig. 1, it will be seen that two separate grid coils, L_1 and L_2, with their associated tuning condensers, C_1 and C_2, are provided. By means of the switch S_1 either of these tuned circuits may be thrown into the aerial-grid circuit; the coil and condenser not in use for reception may be coupled to the "working" inductance, and tuned to the wavelength of an interfering station, whose signals will be completely eliminated provided that they are not excessively strong.

A semi-variable condenser is inserted in series with the aerial lead in order to reduce damping. This has the effect of improving selectivity, and at the same time ensuring that adequate reaction control will be obtained. The best setting of the series condenser can only be arrived at by trial and error; as a rule, it will be in the order of 0.0001 mfd. on the medium broadcast band.

It will be observed that the usual H.F. choke in the detector valve (V_1) anode circuit has been omitted. Its function is adequately performed by the resistance R_3 (the first L.F. coupling), and at the same time a very frequent trouble, in the form of uncontrollable oscillation due to choke resonance on the long wavelengths, is avoided. Control of volume, when the strength of incoming signals is excessive with minimum reaction, is obtained by applying to the first L.F. grid, through the multi-stud switch S_2, something less than the total signal voltage developed across the coupling resistance. When the switch arm makes contact with the stud connected to point *a* (that end of the resistance joined to anode, V_1), full available voltage is applied to the L.F. amplifier, and signals are of maximum strength. Their intensity is progressively reduced as the switch is moved towards the tapping marked *f*. It will be seen that one tapping is idle; the switch used has five active points (one stud is connected to the arm), and it is considered that the variation provided without using the sixth tapping is ample. C_6 is the usual coupling condenser, with its associated leak R_5. R_4 is a damping resistance inserted in order to reduce the voltage of H.F. impulses applied to the L.F. amplifier. The second L.F. stage is coupled by means of a transformer, and is quite conventional.



View from the rear. The coupling between the coils is adjustable.

Control of Detector Grid Voltage.

A single rheostat, R_1, controls the filaments of all three valves and at the same time acts as an on-off switch. This arrangement is quite satisfactory with modern valves of the types likely to be used in a receiver of this kind. The rheostat need not, in ordinary circumstances, have a resistance greater than some 2 ohms,

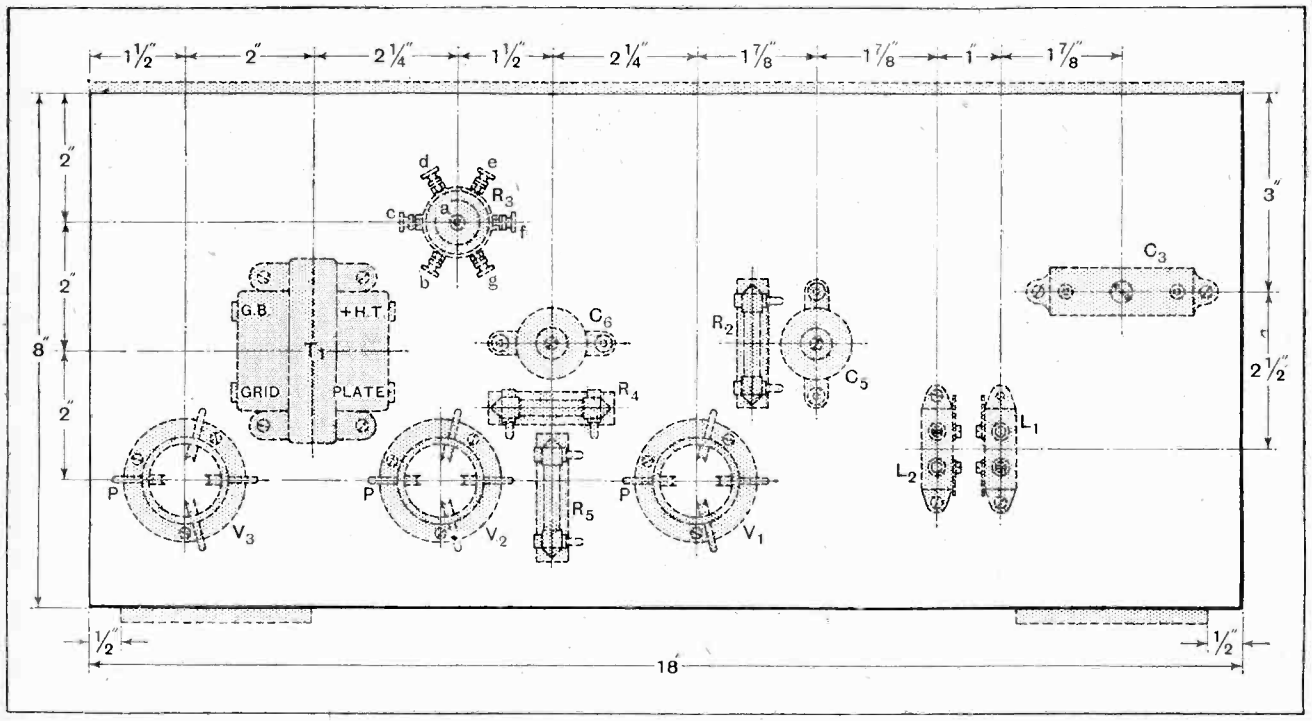


Fig. 2.—Arrangement of components on the baseboard. Values are given in Fig. 1.

although a slightly higher value will do equally well, provided it has a low minimum resistance.

The potentiometer for controlling detector grid voltage is a justifiable refinement; it affords a ready means of making that happy compromise between the valve operating conditions giving best detection and those permitting of the smoothest reaction control. In this set its use is particularly desirable, as a common H.T. voltage is applied to all valves, on the assumption that some 100-120 volts will be used. There seems to be little point in complicating matters by providing separate supplies; moreover, it must be remembered that the H.T. voltage actually on the detector plate is reduced by the amount "dropped" across the coupling resistance.

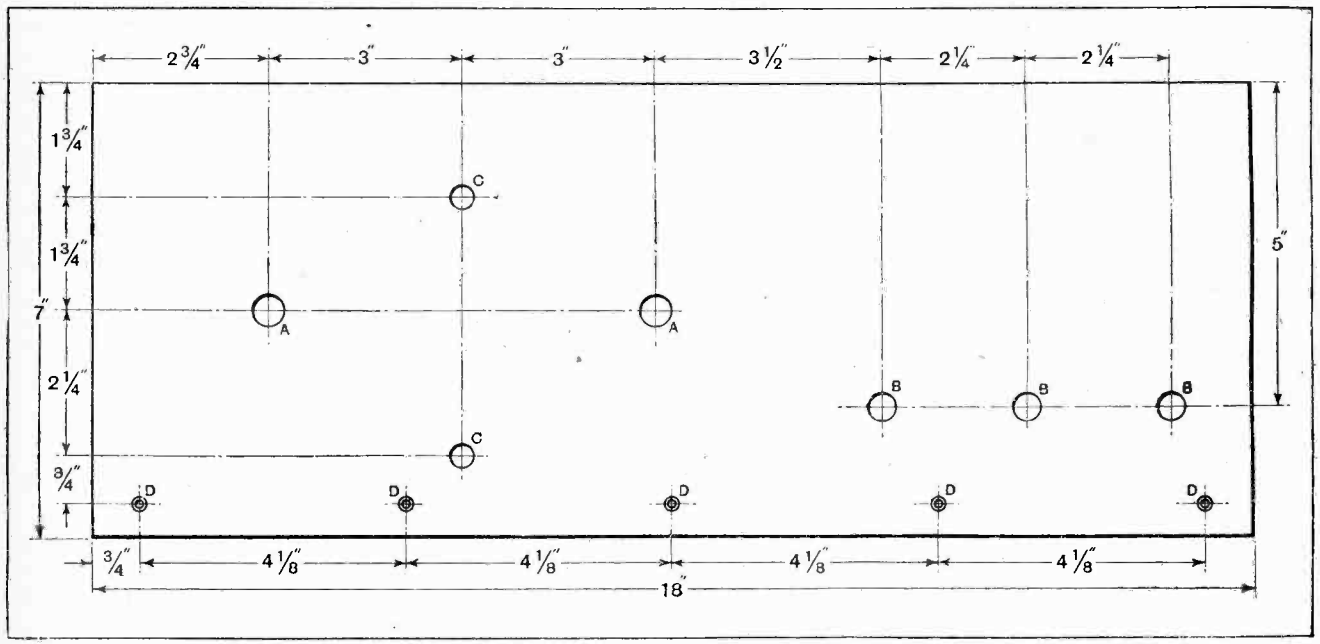


Fig 3.—The front panel, showing positions of holes. A, 1/2in. dia.; B, 7/16in. dia.; C, 3/8in. dia.; D, 1/8in. dia., countersunk for No. 4 wood screws.

B 12

Quick-change Broadcast Reception.—

The first step in construction is the preparation of the baseboard. This is of wood ⅜in. thick, cut to dimensions as given in Fig. 2. Two battens, measuring 8in. long by ⅜in. thick by 1in. wide, are screwed to the underside at each end, primarily to provide space for wiring, and also to prevent warping. The panel should next be drilled, the positions and sizes of holes being as in Fig. 3. It should be noted that holes for the screws which will secure the panel to its cabinet are omitted, as their positions will depend on the arrangement of the backing fillets which are usually fitted by the manufacturers of ready-made cabinets.

Hints for Wiring.

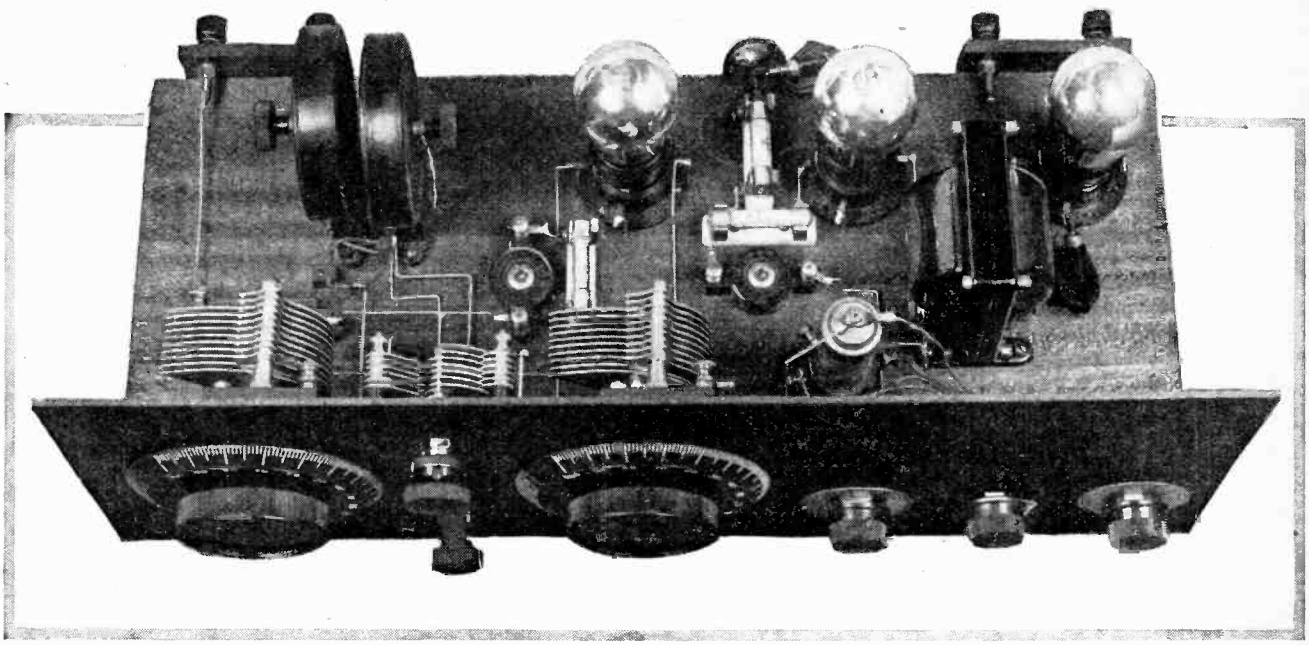
The set as illustrated was made up with a Paxolin panel having a pleasing imitation mahogany surface; whatever material is used should have good insulating properties, as the three variable condensers and the spindle of S_2 are all at high potential. Metal panels are hardly suitable for this circuit.

Two terminal strips, the first for aerial and earth connections and the second for output terminals, should now be prepared; their dimensions are identical, and are as shown in Fig. 4. It should be pointed out that these strips may be omitted if the terminals are fitted to the panel; this procedure, though unobjectionable from the electrical point of view, tends to mar the appearance, as all connecting leads are no longer out of sight behind the cabinet.

The components should now be mounted on baseboard and panel, the positions for those on the former being clearly shown in Fig. 2. It will be as well to complete the greater part of the baseboard wiring before screwing on the panel, as a number of leads are passed through the wood to avoid congestion on the upper surface. This is indicated in Fig. 5, the practical wiring plan, in which those parts of the connecting wires under the baseboard are shown by dotted lines, the points where they pass through being denoted by small circles. None of these leads are at high potential, except that to the H.T. positive battery lead; this wire should be covered with a length of sleeving, but the others will not require more insulation than that provided by the wood, assuming it to be reasonably dry.

A small ebonite block, shown at *h*, serves to anchor one of the flexible leads to the coil-holder L_1 at the point where this lead is joined to a solid wire. This holder is wired with "flex" and secured to the baseboard with a single screw, in order that the axis of its coil may be varied in relation to that of L_2.

The connections between the tapping terminals of R_3 and the volume control switch S_2 are omitted to avoid complication of the drawing. The terminals lettered *a*, *c*, *d*, *e*, *f*, should be joined by means of short lengths of thin rubber-covered flexible wire to points on the switch bearing a corresponding letter. As already explained, terminal *b* is free. Particular care should be taken to



View from above. The coils are in position for absorption of interfering signals.

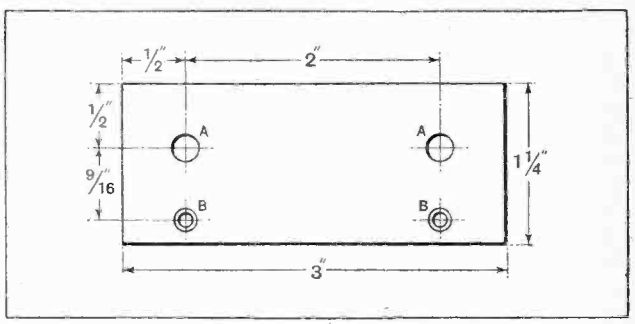


Fig. 4.—The terminal panels. A, 7/32in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws.

Quick-change Broadcast Reception.—

see that one side of C_6 is correctly connected to the stud which is joined by a metal strip to the switch arm.

The connections to the centre points of the tuning coils should also be flexible; as to whether they terminate in plugs or not depends on the type of coil. Fittings, as shown, are provided with the "Lewcos" inductances which were used; these carry sockets moulded into their insulated coverings.

Four insulated leads for connection to the external L.T. and H.T. batteries are connected to appropriate points on the wiring as shown; they are secured to the underside of the baseboard by a clip, and are passed out through a single hole in the back of the cabinet. Three more wires carrying plugs at their extremities for insertion into the grid bias battery sockets are also attached to the points indicated.

A word of explanation should be offered regarding the "Ormond" Midget condenser (C_4) used for reaction control. This component has one set of moving vanes and two of fixed, and there are alternative methods of connecting it. If maximum capacity is required, fixed plates are joined together, and the external circuit is connected to these and the moving vanes. Generally speaking, however, sufficient capacity for our purpose is obtainable if connection is made to the fixed plates only, leaving the

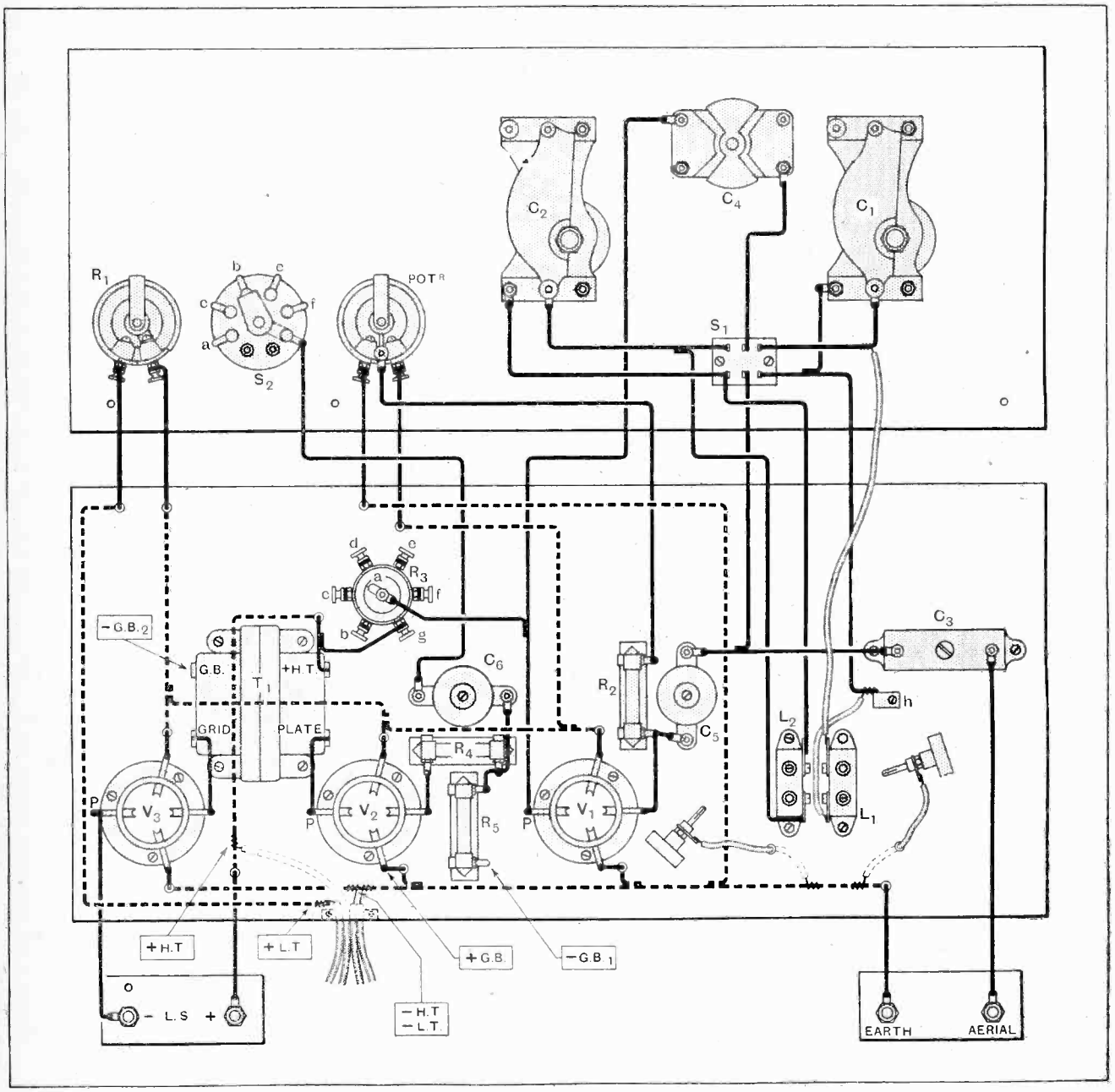


Fig. 5.—The practical wiring plan. The taps on R_3 connect to similarly-lettered points on switch S_2.

LIST OF PARTS.

2 Variable condensers, 0.0005 mfd. ("Simplicon," Williams & Moffat, Ltd.).
1 Variable condenser, 0.0001 mfd. ("Midget," Ormond Eng. Co.).
1 Semi-variable condenser, 0.00025 mfd. ("Formodenser," Formo Eng. Co.).
1 Panel, 18in. × 7in. (Paxolin).
1 Tapped resistance, 60,000 ohms (R.I.-Varley).
1 6-stud switch ("Zampa," Mic Wireless Co.).
1 Push-pull switch, D.P.D.T. ("Utility," Wilkins & Wright, Ltd.).
1 Rheostat, 2 ohms ("C.E. Precision," C. Ede & Co., Ltd.).
1 Potentiometer ("C.E. Precision," C. Ede & Co., Ltd.).
4 Indicating terminals: "Aerial," "Earth," "LS+," "LS−" (Igranic).
3 Grid leak holders (A. F. Bulgin & Co.).
1 Grid leak, 2 megohms (Ediswan).
1 Grid Leak, 1 megohm (Ediswan).
1 Resistance, 100,000 ohms (Ediswan).
1 Transformer (A.F.3, Ferranti, Ltd.).
3 Valve holders (Excelsior Motor Co., Ltd.).
1 Fixed condenser, 0.01 mfd. ("C.D.M.," C. D. Melhuish).
1 Fixed condenser, 0.0003 mfd. ("C.D.M.," C. D. Melhuish).
2 Single coil holders (Sterling).
5 Wander plugs (Lissenin).
1 Baseboard, 18in. by 8in.

Approximate cost, without coils and accessories, £6 : 0 : 0.

In the "List of Parts" included in the descriptions of THE WIRELESS WORLD receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

rotating ones free. This, in effect, gives two condensers in series, and, up to a point, halves the risk of short-circuiting, which must always be avoided in a Hartley arrangement. As a further precaution, a fixed condenser of 0.0003 mfd. or larger may be connected in series with the variable capacity, thus obviating all possibility of a high-tension short-circuit. Both sides of the reaction condenser are at high oscillating potential, so it is desirable to fit a small extension handle, as shown in the photograph at the head of this article. This handle is made from a strip of ¼th inch ebonite sheet, drilled with a hole to pass the condenser spindle, to which it is secured by the knob. Before fitting, it is softened by immersion in hot water and bent in such a way as to clear the tuning condenser dials through its swing of 90 degrees.

Apart from the points dealt with above, it is considered that little is likely to arise which will puzzle even a beginner. The greater part of the wiring is short and direct, the only section of it calling for any special attention being the anode circuit of the detector valve, which is of necessity the most complex part of the receiver.

The Right Valves.

We now come to the selection of suitable valves; taking first the detector (V_1), it is recommended that an "R.C." type, with an impedance of some 70,000 ohms, and a voltage factor of 35 or so, should be used. Typical examples in this class are the Mullard P.M.1a, P.M.3a, P.M.5b, Marconi D.E.H.210, D.E.H.410, D.E.H.610, and Cossor 210 R.C., 410 R.C., 610 R.C. For the first-stage L.F. amplifier it is difficult to better a good "20,000 ohm" valve, or one with an impedance in that order, such as the Mullard P.M.1 H.F., P.M.3, P.M.5X, Marconi D.E.L.210, D.E.L.410, D.E.L.610, or Cossor 210 H.F., 410 H.F., 610 H.F. For the output stage, the user will be guided by his facilities for supplying energy, and should choose a super-power valve if possible.

The inductances of the coils L_1 and L_2 will depend, of course, on the wavelengths of the stations to which it is desired to listen. Generally speaking, the average user over a large part of the country can rely on good and consistent signals from at least one medium-wave station and from Daventry 5XX. Thus, L_1 and L_2 may have, respectively, 60 and 200 turns. London listeners, whose alternative is provided by 5GB, may find it more convenient to insert two No. 60 coils, and to keep one circuit tuned to this station and the other to 2LO. For the reception of Continental long-wave stations, or of 5XX on the rare occasions when it is transmitting an alternative programme, a larger coil may, of course, be fitted (a confession that we have perhaps not *quite* finished fumbling with coils!).

The Absorption Wavetrap.

The actual position of the coils in the sockets is immaterial; clearly it does not matter whether the long- or short-wave coil is thrown into circuit when the knob controlling switch S_1 is pushed in. For preliminary tests, their axes may be set at right angles by twisting the movable holder. The variable series condenser should be set at an intermediate value by screwing its knob down and then relaxing pressure by a full turn or so. After everything has been proved in order by tuning in the nearest station, the second circuit is put into operation by means of the switch. Should the alternative transmission be "jammed" by the local station, the next step is to move the coils together, to retune, and then to rotate the out-of-circuit condenser until the unwanted signals disappear. Except in cases of the most severe interference, this simple absorption wavetrap is a very real help, and justifies the extra cost of a second tuned circuit, which, it will be realised, is primarily fitted to provide an easy way of changing wavelength.

It must not be forgotten that the setting of the series aerial condenser C_3 has a bearing on selectivity, which will be increased as its capacity is reduced. It is thus permissible, when interference cannot otherwise be eliminated, to set this condenser at a value lower than that giving loudest signals.

The usual high-capacity H.T. by-pass condenser has been omitted, for the reason that it serves little useful purpose when we use either a low-resistance high-tension accumulator battery or an eliminator already provided with condensers across the output terminals. With a dry battery supply, which will develop a considerable internal resistance after a period of use, it is recommended that the usual 2 mfds. capacity should be connected across the H.T. leads.

DISTRIBUTION OF BROADCASTING STATIONS.[1]

Wavelength Allocation and the Regional Scheme.

IT is hoped that the broadcast receiver will in time be looked upon as an ordinary domestic appliance and that designers of receiving sets will concentrate on high quality rather than large quantity, so that the problem before the transmission engineer will be to give uninterrupted reception. Thus we may conveniently define the area around the station as its "service area," meaning a district within which certain guarantees of service can be given. Under "service area" four categories may be defined.

(1) "Wipe out" area, where the field strength is greater than 30 millivolts per metre. A listener within this area can be absolutely guaranteed a service from the local station, but will require a receiver of special design for distant reception.

(2) "A" service area, in which the field strength is greater than 10 millivolts per metre. A listener within this area can be guaranteed service in spite of the usual sources of interference, and will have a good chance of listening to distant transmissions with properly designed receiving apparatus.

(3) "B" service area, with a field strength greater than 5 millivolts per metre, giving crystal reception with a good outdoor aerial.

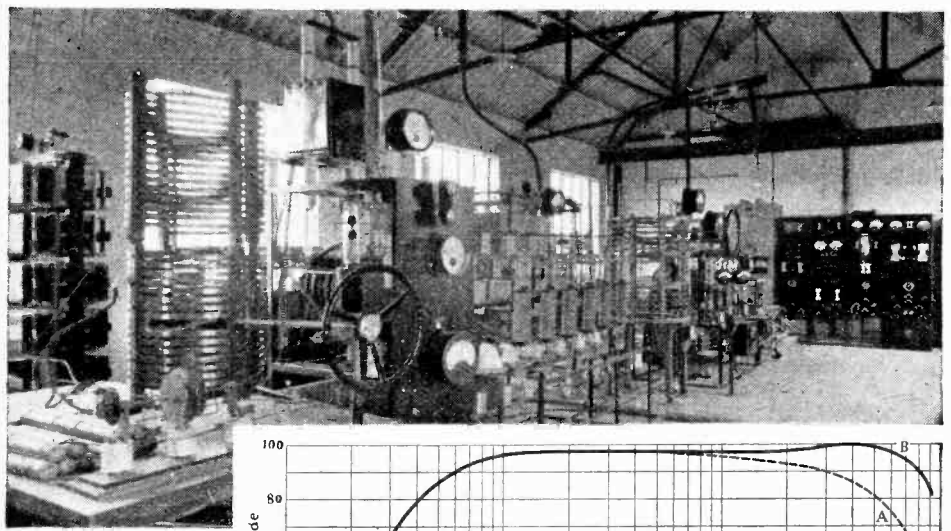
(4) "C" service area, with a field strength greater than 2.5 millivolts per metre. Reception may be subject to interference, though the listener will be assured of 80 per cent. service.

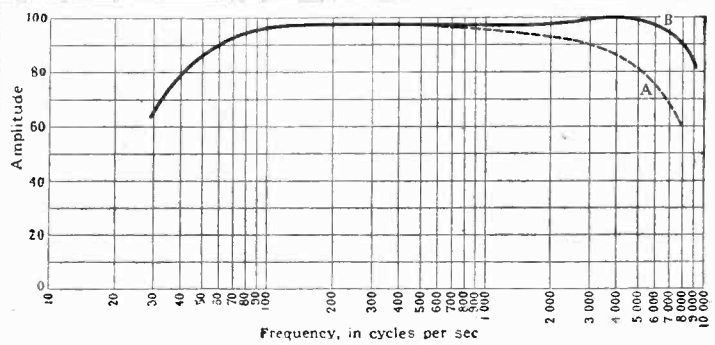
As fading may set in outside a radius of 80 to 100 miles the obvious ideal is to make a "B" service area of approximately this radius. As regards power, wavelength and aerial dimensions, comparative tests show that a change in aerial dimensions necessary to produce an increase in field strength of 30 to 50 per cent. at a distance of 70 miles is equivalent to the use of the smaller aerial with a power increase of between 1.7 to 2.25 times.

Limitation of Wavelengths.

The subject of wavelength separation is governed by the requirements of the maximum audio frequency it is hoped to transmit. The human ear will appreciate frequencies as high as 15,000 vibrations a second. It will be perfectly satisfied with a musical reproduction if frequencies up to 10,000 a second are present in correct proportion. Considerable satisfaction is given even when this upper figure is reduced to 5,000 vibrations a second. The author believes, however, that until all frequencies between 30 and 10,000 are present in the correct proportion we shall still fall short of the perfect illusion of reality in mechanical reproduction. Assuming this to be true, and also assuming microphones and loud-speakers to be capable of faithfully dealing with such frequencies, the maximum difference between sideband and fundamental frequency in a broadcasting transmitter must be plus or minus 10 kilocycles. Theoretically, therefore, to prevent the side bands of the station heterodyning with the carrier wave of another at any time, a separation of 20 kilocycles between fundamental frequencies is essential; to prevent side bands heterodyning, 30 kilocycles is necessary. Between and including

[1] Summary of Part I. of a paper read by Captain P. P. Eckersley, M.I.E.E., before the Wireless Section, Institution of Electrical Engineers, February 1st, 1928.





The transmitting plant of the experimental station 5GB Daventry. The frequency characteristic of its modulation shows a covering of audio-frequencies between 50 and 8,000.

Distribution of Broadcasting Stations.—

the frequencies of 500 to 1,500 kilocycles (200 to 600 m.), 51 stations could be accommodated with 20 kilocycles separation. Fifty-one stations for all Europe would involve their power being of the order of several hundreds of kilowatts. Taking into account the mushroom-like growth of small power stations all over the Continent and their small initial cost, it is obvious that even a 10-kilocycle separation of fundamental frequencies is insufficient, but that a less separation cannot be tolerated practically. There is thus room for roughly 100 stations, and at the time of the setting up of the Union Internationale de Radiophonie there existed more than 150, and more stations were being built. On the proposal of the author it was decided to adopt a compromise. Of the 100 available wavelengths, 84 were to be allotted according to an agreed formula for the exclusive use of the more important European stations, while the remaining 16 were to be shared by the surplus stations. Britain has nine exclusive wavelengths, and counting Daventry long-wave station there are ten wavelengths in all available for British broadcasting.

Alternative Programmes.

On the question of providing alternative programmes by the use of twin wavelength stations, the following conclusions were reached :—

(1) That if the frequency separation of two equal strength transmissions is greater than 100 kilocycles, the amount of further separation makes little difference to the extent of the interference between them.

(2) That with a 20-50 ohm aerial system and direct coupling either to valve or crystal the resonance curves are not sharp enough to prevent mutual interference between two transmissions of equal strength.

(3) That " reaction " with valve sets, and coupled circuits and low-loss coils with crystal sets, sharpened the resonance curve sufficiently to give the required selectivity, but at the expense of the receiver frequency-response curve (*i.e.*, quality might be impaired).

(4) That high-frequency valve magnification, in nearly all cases met with, gave sufficient selectivity and, if properly designed, gave better side-band reception than if pure reaction was used direct on the detector valve. Side-band cut-off and distortion of the frequency characteristic, however, existed.

(5) That it is necessary where the strength of signal is great to reduce the size of the aerial to prevent "wipe out" by the unwanted signal.

(6) That, in conclusion, it is with most types of set met with impossible to produce sufficient selectivity to select between two equal strength transmissions without some distortion of the frequency characteristic, and that many valve sets at present in use introduce distortion of this character in some degree.

(7) That, however, the best and, in most cases, the only solution of the problem is to introduce some form of band filter. In its very simplest form this consists of a closed circuit in series with the aerial and tuned to the frequency of the unwanted transmission. This attachment is so simple and cheap, and so obviously efficient from every point of view, that its adoption by the public to make alternative programmes available neither imposes a hardship nor militates against first-class reproduction.

It is not redundant here to discuss how selectivity without side-band cut-off can be obtained. The series connection of many tuned stages produces in the result small effects around the tops of the resonance curve but large effects on their skirts, and so tends to produce sharp cut-off after a limiting frequency. It is advisable to introduce fairly heavy damping in each stage. To mistune a series of circuits—one up, one down, one up—according to the author's observations on his own set, improves the upper frequency reproduction. It does not, however, improve the selectivity to frequencies outside the 10-kilocycle band; in fact, it reduces this desirable quality although it does help to give better actual reproduction on a one-programme basis. It is suggested that the next advance in receiver technique is so to design the high-frequency side that a square filter curve results, giving linearity of response over the desirable 10 kilocycles but selectivity by abrupt cut-off.

A Few Stations of High Power

It is desirable to give to every listener within a nation an alternative programme. There exist a limited number of channels, and it must therefore at once be obvious that there can be few centres of distribution and that high-power stations must be employed at these centres.

An ideal scheme might seem to base itself upon the erection of a giant central station radiating out from one point as many programmes as there are available channels. That is, if there were ten available channels, one wavelength might be allotted permanently to the lighter type of entertainment, another to news, another to symphony music, another to modern music, another to opera, and so on. From a programme service point of view, such an arrangement might be considered ideal, but technically it is unsound. First, the power of the station would have to be hundreds of kilowatts, and even then the service area might not extend more than 100 miles, due to fading. There would be an enormous wipe-out zone in which the use of highly selective sets would be necessary if any other foreign station were required to be listened to. Dense centres of population are apt to be found 300 and 400 miles apart, and it is almost essential to give an "A" service over large towns and cities owing to the prevalence of electrical disturbances of all sorts in such localities and because "A" service areas have previously existed there.

The Regional Scheme.

On a single-programme service there must be as many centres of distribution as there are available channels. The provision of alternative programmes means a halving of the number of wavelengths available in order to obtain the number of centres of distribution.

The above reasoning underlies the proposed so-called " regional scheme " for broadcasting in Britain in which existing stations will be done away with and substituted by high-power twin-wavelength stations outside cities previously possessing single transmitters. The scheme assures to every listener an alternative programme, gives to the selective valve set user a choice of as many programmes as may be occurring simultaneously—albeit some

Distribution of Broadcasting Stations.—

will fade and be interrupted—and makes the field strength over the country as uniform as it can possibly be under existing conditions.

It is important in siting these stations to take account of the dislocation that will inevitably occur. Scientifically it would be right to site the station so that the wipe-out area fell upon sparsely populated and the "A" service are upon densely populated areas. The majority of stations existing to-day produce a wipe-out area over large cities. A reduction in field strength under the new scheme may be right scientifically while wrong psychologically. It is better therefore to arrange for the least possible reduction in actual signal strength in any area, and even if this results in interference between two programmes this is better than that the ordinary listener should hear nothing. There are two receiving problems to face when changing the distribution system to the dual-programme type, viz., sensitivity and selectivity. It is important to solve one of these for the listener by making the general level of signal strength on change-over as high as possible. The listener, encouraged by hearing something, will soon equip himself with the necessary wave-trap.

Zeesen Short-wave Station.

The new Telefunken short-wave transmitter at Zeesen is now working regularly on 37.65 metres from 10.00 to 12.00 and from 18.00 to 21.00 G.M.T. The nominal power is 50 kW. and the call-sign AFK.

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Melbourne Short-wave Transmission.

A correspondent reports the reception on January 29th of the Melbourne short-wave broadcasting station 3LO, on 32 metres, the signals coming through at excellent strength between 7.30 and 8.30 p.m. The entire programme of gramophone records and news items was audible from 6.30 p.m. onwards, but the last hour was far the best. Time signals from the Melbourne Observatory, followed by the striking of a clock, were clearly heard at 8.0 p.m. G.M.T. These were followed by a short news bulletin, the station finally closing down at 8.32 p.m.

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Message from the Schooner "Bowdoin."

Commander D. B. McMillan, whose schooner *Bowdoin* is familiar to most amateurs under the call-sign WNP, and is now icebound in Anetalak Bay, Labrador, maintains constant touch with stations in Massachusets, Connecticut, Illinois, and NE 8AE at St. Anthony, Newfoundland. He has also been in two-way communication with England, France, Belgium, Germany and nearly every other country in Europe, with Cuba, Porto Rico, Morocco, South Africa, Argentine, and ships in the Atlantic and Pacific. Commander McMillan states that they listen nearly every day to broadcasts from England, France, Spain and Germany all of which come in very clearly. The *Bowdoin* is equipped with Zenith short-wave transmitters and receivers and a standard broadcast receiver. Her position at present is near the centre of the band of maximum frequency of the aurora borealis, but experiments tend to show that the aurora has little influence on radio reception or transmission.

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Short-wave Stations at Rocky Point.

Among the short-wave stations included in the list published in our issue of February 8th were a number at Rocky Point, New York, owned by the Radio Corporation of America, and having the call-signs WDS, WEDS, WEM, WEEM, WFX, WEFX, etc. (11 stations), the wavelengths and particulars of which appeared in the November supplement of the official "Berne List." We understand, however, from the R.C. of A. that these stations are not yet in operation, but are expected to be all completed during the current year. Each transmitter is of the standard R.C.A., 40 kW. type, and will be operated by remote control from the Central Office, at 64, Broad Street, New York City, as part of their Transatlantic wireless communication system. Directive aerials are being erected, but are not yet definitely assigned to particular transmitters. The call-letters are in groups of two (*e.g.*, WDS, WEDS), the intermediate letter "E" indicating that the second wavelength of the transmitter covered by the three-letter call is being used.

TRANSMITTERS' NOTES AND QUERIES.

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Belgian Amateurs.

Mr. Louis Era, EB 4BC, the well-known District Manager, in Antwerp, of the Reseau Belge, has lately been in two-way communication with a number of stations in Australia and New Zealand, including 2MH and 3L5 in Australia, 2AB, 3AU, 3FE, and 4AO in New Zealand, besides many stations in Europe and America. He informs us that OZ 3AX, Mr. F. A. Twemlow, of 119, Rossall Street, Merivale, Canterbury, N.Z., is expected to arrive in London on March 15th, by s.s. "Orsova," and will be glad to meet friends in London, both those he knows personally and those with whom he has been in wireless communication.

Mr. Era states that shortly after sunrise in Belgium, when the western hemisphere is still in darkness, his signals are reported considerably stronger in New Zealand than in Australia, from which he infers that they take the longer westerly route across the Atlantic and Pacific oceans in preference to the daylight path across Europe and India.

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EB 4WW, Mr. G. Regnier, of Liege, wishes to inform British amateurs that he is at present doing his military service and will be away until October. He is, however, using a small 4-watt portable transmitter with the call-sign XEB 4WW, with which he hopes to keep in touch with many of his friends in this country, and with which he communicated with GI 6YW in Belfast.

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General Notes.

The short-wave station of the Grenfell Hospital base at St. Anthony, Newfoundland, whose call-sign is NE 8AE, will be glad to have reports from British amateurs on their signals.

The station is operated by Mr. Dearlove, who maintains regular daily schedules with NU 2HV at 02.00, NU 2AG at 04.00 G.M.T., and with EG 2XY every Sunday at 01.30 G.M.T. on 45 metres. He also sends out CQ daily on 36 metres, and occasionally works on 42.5 and 20.5 metres. The input is from a rotary converter providing 7 to 100 watts to a 50-watt Mullard short-wave transmitting valve.

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Mr. J. Hum, 5UM, 17, Eastwood Road, Muswell Hill, N.10, asks us to state that he is willing to check the wavelengths of any transmitter between 150 and 200 metres to within an accuracy of 0.25 of a metre.

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New Call-signs and Stations Identified.

2KM	C. Stainton, 37, New Bridge Rd., Hull, transmits on 45 metres and welcomes reports. (Change of address.)
2ZH	H. S. Edwards, 53, Glovers Rd., Small Heath, Birmingham, transmits on 150–200 metres at week-ends and welcomes reports and co-operation.
5YN	E. Y. Nepean, Lodlers, Andover Rd., Winchester. Transmits on 45 metres between 12.00 and 16.00 G.M.T. on Sundays and will welcome co-operation.
6BW	A. B. Whatman, The Cottage, Twyford, Winchester.
6BX	J. Bateman, 19, Chapel St., Queensbury, Bradford, Yorks.
6HJ	E. James, 22, Bisterne Avenue, Walthamstow, E.17, works in connection with 6KA (K. F. Hardie) for duplex telephony experiments.
6YL	Miss B. Dunn, Lilystone Hall, Stock, Essex.
2ALG	(ex 6VJ) W. J. Featherstone, 213, Ella St., Hull.
2APM	(ex 5TA) V. I. N. Williams, "Merok," Lees Rd., Bramhall, Cheshire.
AG RANN	Azerbaijan Radio Amateur Society, Baku, Azerbaijan Republic.
AI 2ZX	Wireless Section, R.A.F., Kohat City, North West Frontier, India, transmits on 41 metres.
ER 5LL	G. Bellu, Str. Carol 89, Campina, Roumania.
FB 8HL	M. Durand, T.S.F. Locale, Tananarivo, Madagascar.
NE 8AE	Grenfell Mission, St. Anthony, Newfoundland, transmits on 40–45 metres, usually at about 18.00 G.M.T.

BATTERY CIRCUITS IN MULTI-STAGE AMPLIFIERS.

The Danger of Unintentional Couplings in Battery Leads.

By A. L. M. SOWERBY, M.Sc.

MODERN advances in coil design, together with the high efficiency of the valves that are now available, render the detail design of a high-frequency amplifier a matter for the very greatest care. The smallest inadvertent coupling between successive tuned circuits, whether introduced into grid or plate circuits, has the effect of making it impossible so to adjust the neutralising condensers that stability is obtained over the whole range of the tuning condensers. Coils in vogue a few years ago had such a high resistance that the removal, by unintentional couplings, of a dozen ohms or so was a benefit rather than otherwise, but the best of modern coils have not a dozen ohms to lose, so that the smallest stray coupling may be expected to lead to hopeless instability.

Amateurs often experience difficulty in obtaining complete neutralisation in their sets in spite of meticulous care in the screening of all tuned circuits. This article, dealing with the likelihood of inadvertent coupling due to battery leads providing a common resistance, is a contribution of some importance to the problem of stabilisation.

The possibility of these stray couplings is largely obviated by the new habit of using a screen enclosing each stage separately in a closed metal box, but there remain several traps for the unwary. Especially subtle are the traps in the battery supply circuits which lead from accumulator, high-tension battery, and grid-bias battery to the valves, for in these circuits it is extremely easy to introduce inadvertently some small resistance which, by being common to two circuits in which high-frequency currents are flowing, couples these two circuits together.

An example of the type of mistake to be avoided is given in Fig. 1, which is intended to represent one stage of high-frequency amplification in a fully shielded receiver. The thick lines represent the screening boxes, which are earthed and serve also as L.T. − and H.T. − leads. The resistance R is inserted in the filament circuit of the valve to drop one volt, in order to provide the necessary grid bias for the valve without necessitating a grid-bias battery. Since it carries no appreciable H.F. current, and is not common to any other grid circuit, it is not shunted by a condenser. The plate circuit of the valve is normal, and is completed by a big condenser connected by inch-long wires between the H.T. + point on the transformer and the copper screen (earth).

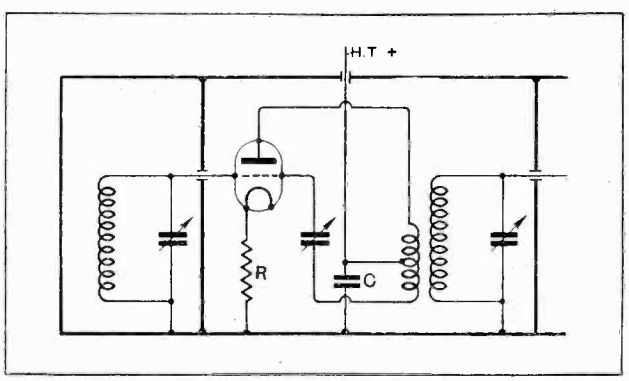


Fig. 1.—A stage of screened high-frequency amplification in which R may cause instability, since it is common to grid and anode circuits.

When wiring up an arrangement of this sort it seems that almost unnecessary care has been taken to eliminate all stray couplings; even on paper it looks sound enough at first sight. But if grid and plate circuits are carefully traced out, what is found?

Grid circuit: Grid, tuned circuit, R, and to filament.

Plate circuit: Primary, C, R, and to filament.

That innocent looking resistance R is common to both circuits; the circuits are therefore coupled despite all the precautions that have been taken.

Instability will not, in this particular case, ensue as a result, for the coupling is in such a direction as to check oscillation. Nevertheless, the coupling is harmful, for where is the use of making low-loss coils and then adding to their effective resistance in this way? Fortunately the cure is obvious, for it is only necessary to take the earthed side of C direct to the filament of the valve instead of to the screening box, thereby cutting R out of the plate circuit.

Sometimes, however, the fault is considerably more difficult to detect. Fig. 2 represents an amplifier, completely "canned," which in practice refused to be stabilised. All the various by-pass condensers were proportioned suitably, the screening boxes fitted well and were screwed into position, and the one high-frequency (grid) lead through the *double* walls of metal separating one tuned circuit from the next continued in each case for less than half an inch into the second can. The only other holes in the boxes were two small ones through which L.T. + and H.T. + leads passed, and a third through which the neutralising condenser could be adjusted by means of a slender screwdriver. The by-pass condensers on the H.T. + leads were connected to the wire within an inch of the point where it entered the can, and H.T accumulators were used to supply the anode current. Yet, with all these precautions, the receiver could not be stabilised.

Those who like problems may perhaps feel disposed to study the diagram and try to locate the fault before reading on. The writer managed to solve the problem by a *reductio ad absurdum* method. A careful inspection of a diagram drawn direct from the wiring of the set itself provided convincing evidence that the only possible source of trouble, apart from the possibility of insufficient screening, lay in the L.T. + leads, for these were the only

Battery Circuits in Multi-stage Amplifiers.—

ones not protected by by-pass condensers. Accordingly a ½ microfarad was connected, in each compartment, between the point where the lead entered the box and the box itself. On replacing the screening boxes the receiver gave no further trouble, permitting itself to be neutralised readily, and remaining perfectly stable even when both aerial and earth were disconnected.

It is clear that the L.T. + leads running through from one compartment to another, and earthed only through the valve filament and a ten-ohm fixed resister, were conveying high-frequency voltages from one tuned circuit to another. To confirm this, the experiment was tried of inserting into adjacent compartments the two ends of a piece of wire, employing the holes through which the neutralising condensers were adjusted, and bushing them temporarily with systoflex. Provided that this wire reached more than about two inches into each compartment it was sufficient to render the receiver hopelessly unstable, but on allowing it to touch the metal screening box at any point there was an instant return to model behaviour. In making this experiment it was noticed that as long as the wire was entirely outside the screens there was no sound in the telephones on allowing it to touch the cans, but the moment any part of it passed through the hole, a loud scratching was heard every time it came into contact with the metal. This was simply an aural indication of the H.F. voltages induced into the wire when in proximity to the tuned circuit, and shows forcibly how extraordinarily careful one has to be in attending to every detail of a powerful amplifier. If amateurs have experienced difficulty in obtaining perfect stabilisation, they would be well advised to see that the screening is perfect and to avoid coupling due to battery leads.

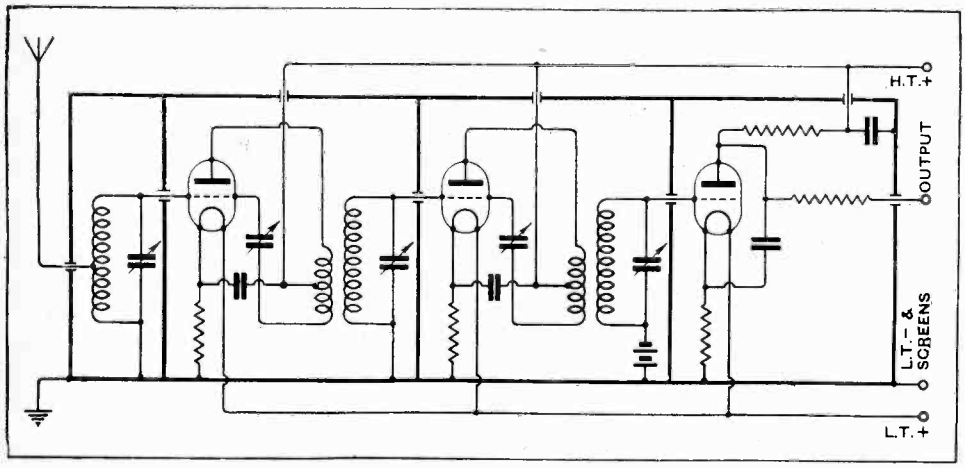


Fig. 2.—A multi-stage high-frequency amplifier in which the L.T.+ leads were found to be conveying H.F. voltages from one tuned circuit to another and thus preventing neutralisation.

METHODS OF IMPROVING SELECTIVITY.

IT is usual for the seeker after selectivity to be advised to add either a loose-coupled aerial circuit or a wave-trap to his existing receiver, ignoring the fact that, if the latter is of the popular O-v-1 or similar type, in which the first valve is a reacting detector, the resulting combination can only be controlled by an expert.

Uncontrollable Oscillation.

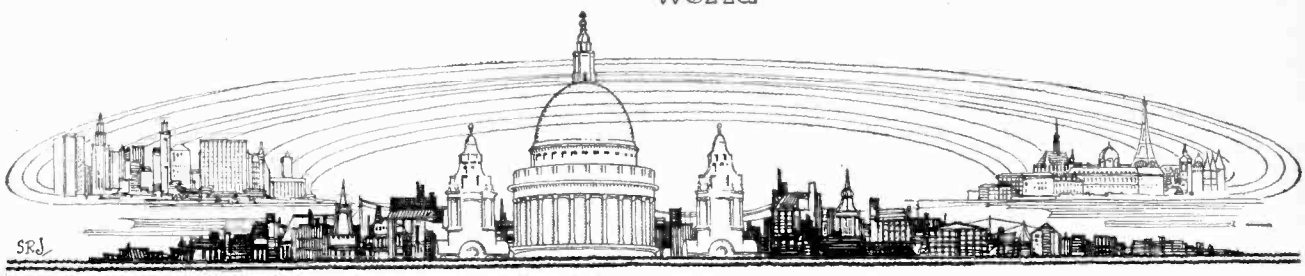
Suppose aerial and secondary circuits are tuned to the same wavelength, and that the reaction coil is coupled fairly closely to the secondary. The energy supplied by the reaction coil is distributed between the two tuned circuits, and the aerial circuit, being of higher resistance, absorbs the greater part. If now the coupling between the aerial and secondary coils is loosened, or if either is tuned to another wavelength, the aerial circuit will absorb far less energy, with the result that the receiver will promptly burst into the most violent oscillation. Similar unexpected results are liable to follow on any other adjustment that may be made; loosening the reaction coupling has even been known, by altering the tuning, to cause oscillation to begin. The reason for this peculiar behaviour is that all four adjustments are interdependent, so that no one of them can be altered without upsetting the remaining three.

With a wave trap much the same results are found, the controls being similarly interdependent.

The troubles inherent in a number of tuned circuits coupled to one another can only be overcome by arranging that, while the first circuit is coupled to the second, the second is not coupled to the first. This apparent impossibility is achieved by interposing a valve between them, so that the alteration to the original receiver takes the form of the addition of a stage of high-frequency amplification of modern neutralised type. If reaction is still considered necessary, it must be applied to the grid-circuit of the detector, or the old trouble of the dependence of tuning and reaction controls upon one another will recur. With adequate screening and accurate adjustment of the neutralising condenser, an almost complete independence of the two tuned circuits, even with reaction pushed to the limit, can just be achieved.

When to Use Loose-coupling.

If, after the addition of the stage of high-frequency amplification, the selectivity is still insufficient, there will now be no difficulty whatever in manipulating a loose-coupled aerial circuit or a wave-trap, provided that the coupling between it and the first grid circuit is sufficiently loose to ensure that the tuning of these two circuits is really independent.



CURRENT TOPICS

Events of the Week in Brief Review.

"PIRATE" PREFERS PRISON.

As an alternative to paying a fine of 20s. for operating a wireless set without a licence, Charles Brown, of Stratford, elected, last week, to go to prison for thirteen days.

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ANTICIPATING THE REGIONAL SCHEME ?

The National Union of Welsh Societies is continuing its campaign for the establishment of an all-Welsh broadcasting station.

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WIRELESS ON SUNDAY.

Norman Shaw, the Scottish lighthouse keeper, who was discharged last May for refusing to attend wireless instruction on Sunday, was recently refused unemployment benefit. His claim has now been allowed by the Umpire of the Ministry of Labour.

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LECTURES ON "ATMOSPHERICS."

A course of six lectures on "Atmospherics" is being delivered by Mr. R. A. Watson Watt, A.M.I.E.E., F.Inst.P., on Mondays, at 6 p.m., at the East London College, Mile End Road, E.1. The first lecture was given on Monday last, February 13th. Demonstrations are given of the actual wave form of atmospherics, and the cathode ray direction finder will be shown in operation. The fee for the course is 10s. 6d., but free admission tickets are available for engineering students of the University of London.

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SPEECHES ACROSS THE ATLANTIC.

The Transatlantic telephone system is to form a link to-morrow (Thursday) between the Institution of Electrical Engineers, London, and the American Electrical Institute in New York. The proceedings will, as nearly as possible, be conducted as a "joint session" between the two societies, and it is hoped that an interchange of speeches will take place between Mr. Archibald Page, President of the I.E.E., and the President of the Electrical Institute. We are informed that the lecture theatre in the I.E.E. headquarters, Savoy Place, will be equipped with loud-speakers to enable the assembled company to hear what is said on the other side of the Atlantic.

CASTINGS FOR MOVING-COIL LOUD-SPEAKERS.

To complete the list now undergoing compilation, manufacturers of castings for the moving-coil loud-speaker recently described in *The Wireless World* are requested to forward their names to the offices of this journal.

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CAT-MADE STATIC.

While the leading lights of science have been earnestly engaged in seeking the origin of atmospherics, it appears that, in not a few cases, the real cause must have been literally "under their noses." This, at all events, is the opinion of a Washington experimenter, N. D. Parham, who points out, in a letter to the American Radio Manufacturers' Association, that there is a good deal of electricity generated in a cat's fur. Although this form of generator is more or less quiescent at normal periods, Mr. Parham considers that interference may be caused when pussy parades on the backyard fence. In this case the more common audio-frequency manifestations may apparently be augmented by feline radio-frequency phenomena.

BOOKMAKERS WHO HATE WIRELESS.

Hot on the heels of the news, published last week, that Chinese speculators are using short waves to facilitate "smart work" on the money exchange comes the information that the Hamburg police have arrested three men whose wireless activities appear to shine a little lower still in the moral spectrum. It is alleged that the men under arrest have used a receiving set to pick up the results of French horse races, thus being enabled to make bets with local bookmakers before the results arrived by telegraph.

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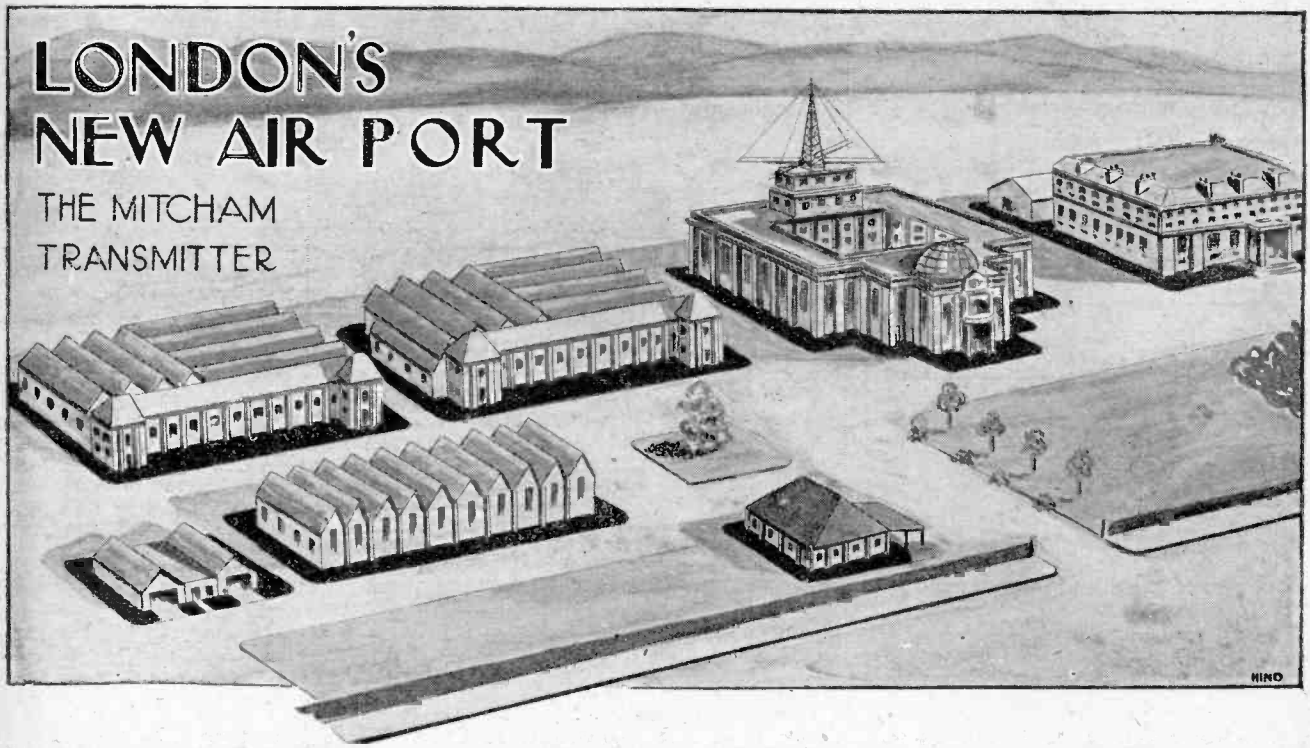
TELEVISION TO AMERICA.

The Baird Television Development Company gave a demonstration of Transatlantic television on Wednesday last, February 8th, when a Press representative was permitted to witness a Baird "televisor" in operation at Hartsdale, a suburb of New York. The images were sent from the company's laboratories in Long Acre, London, *via* a short wave transmitter at Purley. According to the journalist's report, the images were recognisable as faces, but identification was impossible.

PICTURE RECEPTION IN THE HOME. Dr. Alfred N. Goldsmith, Consulting Engineer to the American National Broadcasting Co., photographed with his home picture receiver. Sensitised paper is attached to a revolving drum on which a needle point of light is projected. It is stated that the instrument can be connected to an ordinary broadcast receiver.

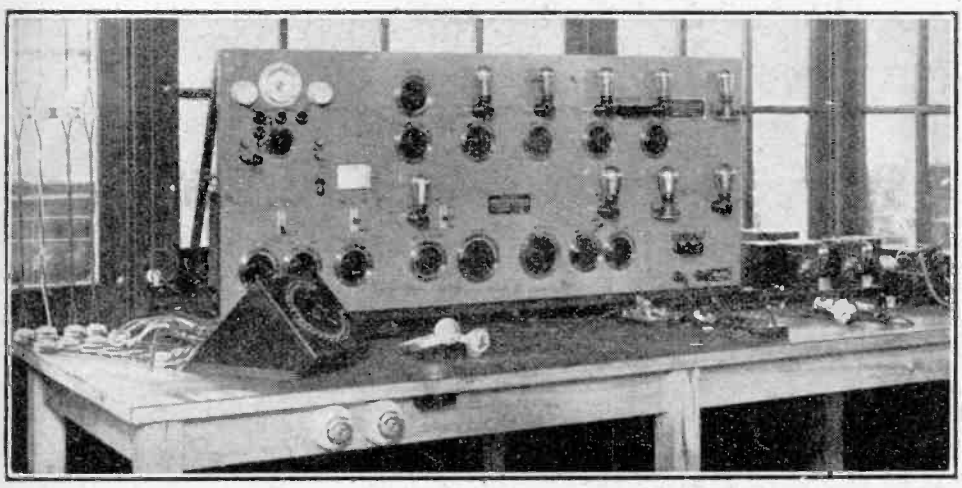


New High-Power Transmitting Equipment for Speaking to Aircraft in Flight.

By W. G. W. MITCHELL, B.Sc.

(*Concluded from page 132 of previous issue.*)

IN addition to the new direction-finding equipment which has been installed at the Croydon Aerodrome for the locating of aircraft, a transmitter has been set up for communicating with the machines in flight. To avoid obstruction to aircraft in landing, and to lessen interference with wireless reception, the transmitting aerials and plant have been erected at Mitcham Common, two miles away from the Croydon Aerodrome. Inter-communication is provided at the Control Tower by ten pairs of telephone lines rented from the Post Office; six pairs go direct to the transmitters at Mitcham, one pair is used for telephone communication with Mitcham, one pair to the Aerodrome private exchange; two pairs are spares. The responsibility of providing complete weather charts of the chief aerial routes falls on the meteorological staff. Weather information is reported by wireless from stations and aerodromes on a wavelength of 1,400 metres. Reception is carried out in the route signalling room, an ordinary single wire aerial being used. The receiver (3-v-3 type) is the type developed by the Royal Air Force with special tuning arrangements.



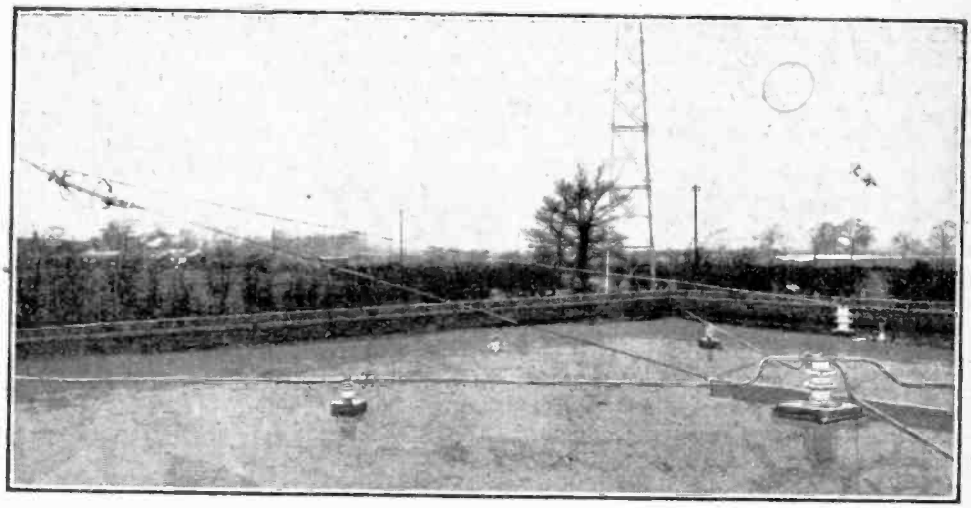
Direction-finding equipment installed at Croydon. The scale denoting the angle of direction is to the left of the receiver-amplifier panel.

It should be made clear that ground wireless messages, point-to-point signalling traffic such as departures, arrivals, delays en route and weather traffic, are all worked on the 1,400 metre wave. Direct communication with aircraft in flight is carried out on the aircraft wave of 900 metres.

The "Duty Office" on the ground floor of the main buildings is the clearing house for all routine messages, and intercommunication is provided between this office and the Control Tower

London's New Air Port.—

at Croydon, and also between the Meteorological Office and the Control Tower by pneumatic tube, so that all messages are written and are on record. Besides office accommodation for the staffs of the various air lines operating from or to Croydon, there is a customs clearance office and immigration office. Sleeping accommodation is provided for the wireless and meteorological staff when night flying is in progress.



One of the masts and aerial leading-in wires at the Mitcham transmitter.

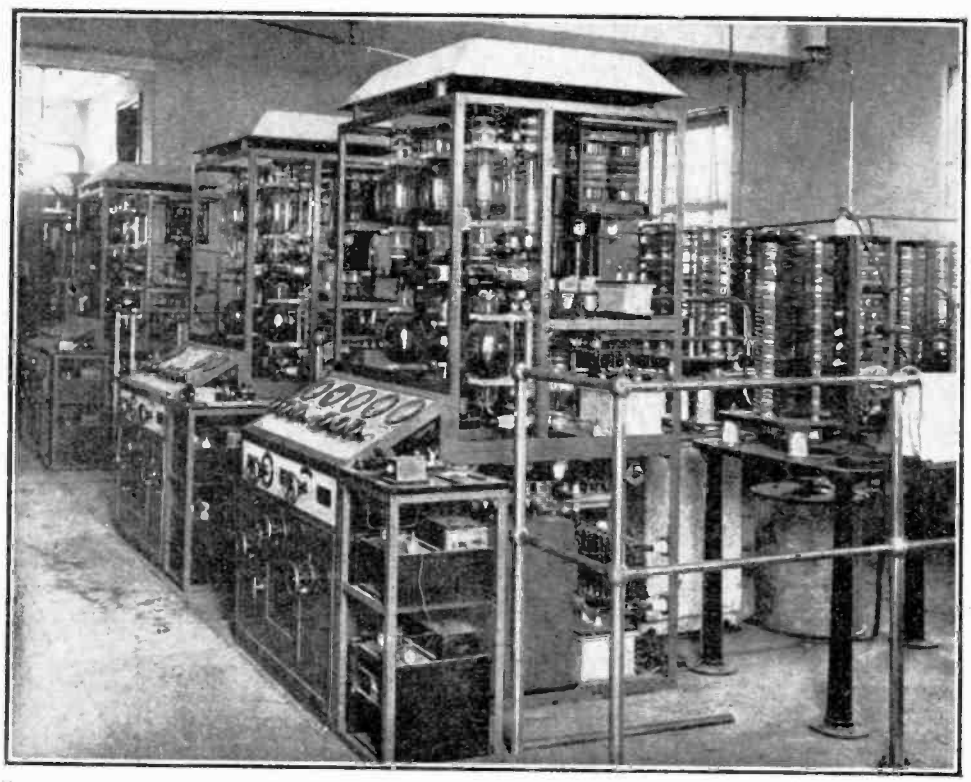
Four Transmitters.

As we have already indicated, the transmitting plant is housed at Mitcham Common. The layout of this station is unusual—four steel lattice masts 130ft. high form the four corners of a square with sides of 250ft., between which the aerials are slung. These are of the 4-wire sausage type, each with separate lead-in to the 3 kW. transmitting sets housed in the building, which is centrally placed with regard to the masts.

There are four separate transmitting sets. One is used for 900 metre telephony, a second for 900 metre telegraphy, the third for 1,400 metre C.W. (route messages), and the fourth can be brought into operation as a spare.

The plant has been designed and erected for the Air Ministry by Marconi's Wireless Telegraph Company. The input of each set is 3 kW., and independent drive circuits have been incorporated to maintain constancy of frequency and wavelength. The valves employed are one magnifier type M.T.2 (filament volts 17), two modulators type MT7B (15.5 volts), one sub-modulator type MT4B (12.5 volts), two rectifiers type MR6 (16 volts), and one drive circuit valve type MT4 (12.5 volts).

Filament and anode current for the transmitting valves is obtained from the local alternating current supply mains (440 volts, 50 cycles) through suitable transformers, and special arrangements are made for smoothing the H.T. delivered at 3,000 volts for the anode current. A standby petrol generator can be brought into use in case of breakdown. The earthing system is shown in the diagram and is neatly devised so that it is brought to a common insulator on the roof and thence through the roof by stout copper tube under the ceiling to each set. This arrangement makes a very satisfactory and neat job.



A corner of the transmitting room at Mitcham.

The building itself is about 40ft. square, is of brick construction provided with central heating, and is self-contained for sleeping arrangements when night flying is in progress or at other times of emergency.

A description of London's Air Port would hardly be complete without some refer-

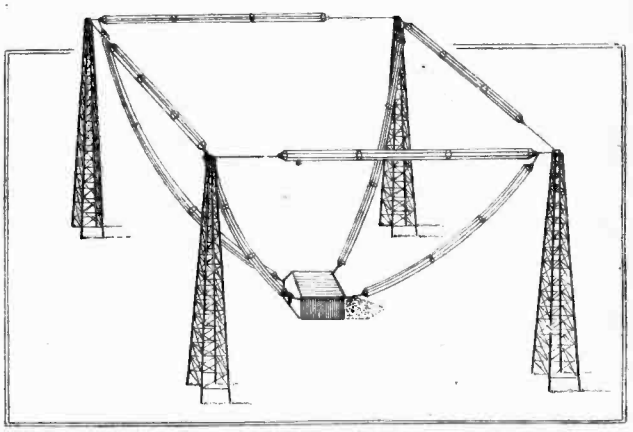
London's New Air Port.—

ence to the wireless equipment under the pilot's control in the aeroplane. It is, as it were, the other end of the story. In the larger machines carrying more than five passengers the regulations require that a trained wireless operator must be carried. The wireless set is then stored in some convenient part of the aeroplane and operated by remote control. In the smaller machines it is operated by the pilot. The trailing aerial, which is controlled by a winch, is 200ft. when fully let out, and has a weight of 1½ lb. attached at the end. When low-lying clouds make it necessary for the pilot to fly near the ground difficulty is often experienced in using the full length of aerial, and reception and transmission is in consequence very limited in range and sometimes not possible at all; under normal flying conditions a maximum range to the direction-finding receiver of 150 miles is expected for messages passing from air to ground.

Internation Reports.

Radiotelephony is used for all direction-finding work except on German machines. The bearings are therefore taken on the carrier wave to give greater working range, while in the case of the German machines using Morse the bearings are taken as a series of V's. Power is derived from a wind-driven generator, a low-tension battery being floated across the output terminals for filament current.

It is interesting to note that a separate "weather-wave" of 1,680 metres is employed for international correlation of weather reports. Each country concerned transmits in meteorological code for ten minutes in each hour, and a comprehensive survey is sent hourly by the Air Ministry to the Croydon Aerodrome. Such is the magnitude of the system employed to ensure accuracy of forecast.



Four separate aerials are used for telegraphy and telephony transmission on 900 and 1,400 metres.

NEWS FROM THE CLUBS.

H.T. from a 2-volt Accumulator.

"How to Obtain a Supply of High-Tension Direct Current from a 2-volt Accumulator," was the intriguing title of a lecture given by Mr. R. E. Rayner at a recent meeting of the Sheffield and District Wireless Society. The lecturer, who had evidently given a considerable amount of time and study to the matter, explained how his experiments had ultimately been successful, and had proved the feasibility of dispensing with the double labour of charging high- as well as low-tension batteries. At the close of his lecture Mr. Rayner demonstrated his apparatus, producing a supply of 9 milli-amperes at 150 volts without any accompaniment of ripple or hum. Several types of loud-speaker were successfully operated.

It is understood that Mr. Rayner's device is the subject matter of an application for Letters Patent.

The Hon. Secretary is Mr. T. A. W. Blower, Cannonfields, Hathersage, Sheffield.

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Cone Loud-speakers Compared.

During a discussion on cone type loud-speakers at the Tottenham Wireless Society's last meeting Mr. H. Dyer exhibited a remarkably efficient moving coil instrument with modifications which simplified the construction and fitting of the cone. A semi-free-edged cone loud-speaker with balanced armature was then described and demonstrated. The edge of the cone was fixed to the frame by a ring of thin rubber sheet, cut from a rubber apron procured from a popular sixpenny store. Both instruments handled great volume without distortion or overloading.

The most suitable dimensions of the paper cones and the best material for use formed subjects of discussion, and it was agreed that the grade of Bristol board recommended by Mr. F. H. Haynes (of *The Wireless World*) in his recent demonstration, could not be improved upon. This grade is known as "two sheet" Bristol board. Mr. Haynes had found that paper of this description varied in thickness, and that to be most efficient it should be about .01 inch in thickness. It was advisable, therefore, when purchasing to test the thickness with a micrometer.

The Hon. Secretary is Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 15th.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.17. Demonstration of Amplion loud-speakers, by Messrs. Alfred Graham, Ltd.

South Croydon and District Radio Society.—At 8 p.m. At the "Surrey Drovers'" Hotel. Lecture by Messrs. S. G. Brown, Ltd.

Golders Green and Hendon Radio Society.—At 8 p.m. At the Club House Willifield Way. Sale of members' surplus apparatus.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown. Demonstration and Lecture by Mr. Leonard Hartley, B.Sc.

THURSDAY, FEBRUARY 16th.

Kensington Radio Society.—At 8 p.m. Demonstration of Transformers, by Messrs. Ferranti, Ltd.

Slade Radio.—At 8.15 p.m. At 8, Victoria Road, Erdington, Birmingham. Demonstration of the B.T.H. R.K. Moving Coil Loud-speaker, by Mr. Clifford Smith.

Leyton and Leytonstone Radio Society.—Discussion on Forms of Reaction Control.

FRIDAY, FEBRUARY 17th.

Manchester Radio Experimental Society.—Elementary Class.

Leeds Radio Society.—At the University. Lecture: "Loud-speakers." by Mr. E. M. Washington.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Purity competition for members' sets.

MONDAY, FEBRUARY 20th.

Hackney and District Radio Society.—At 8 p.m. At the Electricity Showrooms, Lower Clapton Road, E.5. Electrical Reproduction of Gramophone Records.

Holloway Literary Institute Radio Society.—At 7.30. At the Holloway School, Hilldrop Road, Camden Road, N.7. Lecture by Messrs. S. G. Brown, Ltd.

TUESDAY, FEBRUARY 21st.

Hounslow and District Wireless Society.—At 8 p.m. At Trinity Hall, Bulstrode Road. Lecture and Demonstration, by Mr. Youle, of Messrs. The Marconiphone Co., Ltd.

Peckham Wireless Classes.

A wireless class is held every Friday evening at the Central Hall, High Street, Peckham, at 7.30, under the direction of Captain Jack Frost. The fee is 2s. per quarter, and new members are welcome.

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A Putney Club.

New members are warmly welcomed to the Putney Literary Evening Institute Radio Club. Hon. Secretary, Mr. H. G. Watkins, 35, Haldon Road, West Hill, S.W.18.

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Characteristic Curves.

The subject of valve characteristics provided a fascinating evening for members of the Bristol and District Radio Society on January 27th, when Mr. G. E. Burgess, of the Mullard Wireless Service Co., was the lecturer. After a brief description of the working principles of the valve, the lecturer described the filament of the modern dull emitter, proceeding to a discussion on characteristic curves. By means of a large diagram of the curve of a P.M.4 valve Mr. Burgess showed how alterations of H.T. and grid bias values completely changed the conditions under which the valve worked.

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Modern Sets Displayed.

The sets and components manufactured by the General Electric Co., Ltd., were interestingly described by Mr. Gough at the last meeting of the Bristol Society.

Among the fine range of apparatus on view were 3-, 4-, and 5-valve receivers, incorporating the gramophone reproducer equipment. Special interest was aroused by the new KL 1 and KH 1 valves on view, in addition to screened grid specimens. Mr. Gough, on behalf of the Company, very kindly presented an Osram screened grid valve for the Society's weekly valve ballot, and this was won by Mr. W. C. Jennings.

Visitors are warmly welcomed to the Society's meetings. The Hon. Secretary is Mr. S. J. Hurley, Arno's Vale, Bristol.

OUTPUT FROM D.C. ELIMINATORS.

Measuring Terminal Voltages of Units with Series-connected Resistances.

THERE are two principal methods of breaking down the voltage in D.C. mains eliminators. The one employs a potential divider connected across the mains from which the lower voltages are derived from suitably placed tappings on the resistance; the other makes use of separate resistances in series with each supply lead. The former has the advantage that, provided the steady current through the potential divider is large compared with the current drawn by the set, the output terminal voltages may be taken as being roughly proportional to the resistance values between the tappings and – H.T. The series resistance system, on the other hand, has the greater advantage that it is far more conducive to stability in the L.F. amplifier and is less likely to cause "motor boating" and parasitic oscillation, but the terminal voltages of the output are extremely uncertain, as they may vary when a valve is changed or even if the grid bias is altered. If a voltmeter is connected to the output terminals while the set is working, a spurious reading is obtained, since the load is augmented by the current taken by the meter. A true reading for the particular value of current drawn by the meter will be obtained if the H.T. lead to the set is disconnected, but it is unlikely that this current will coincide with that supplied to the set, so we are still in the dark unless the voltmeter takes *less* than the normal current, when we can load it up to the correct value. Most high-class meters take 15 to 20 milliamps, for a full scale deflection, so that this combination of circumstances is likely to exist only in the case of the power valve tapping.

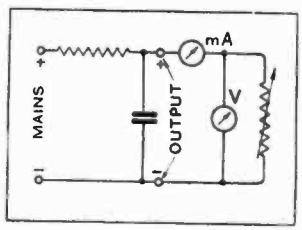


Fig. 1.—Ordinary meters may be used to measure terminal voltage when the working load is equal to or greater than the current taken by the voltmeter.

The proper arrangement of connections to meet this case is shown in Fig. 1. The additional loading resistance is connected in parallel with the voltmeter, and is adjusted until the milliammeter shows a reading corresponding with the anode current normally taken by the last valve. The voltmeter will then indicate the true terminal voltage, less a negligibly small fraction of a volt due to the resistance of the milliammeter. If one is fussy one can always find what this error amounts to by shorting the milliammeter and noting the change in the voltmeter reading; in nine cases out of ten no movement of the needle will be discernible.

The Valve as a Loading Device.

But what of the valves other than the power stage, all of which take currents less than the best moving coil voltmeter; how are we to arrive at the H.T. voltage supplied to them? An electrostatic voltmeter would meet the case, but it is unlikely that the experimenter will have access to one having the necessary scale of readings.

Another method is, however, available which makes use of materials in the hands of every experimenter. The components necessary are a voltmeter for reading H.T., a milliammeter for anode current, a power valve, and the usual batteries. The valve is then calibrated, using batteries throughout to find the H.T. voltages corresponding to various anode currents; it will be obvious that we can then arrive at the terminal voltages on the eliminator by measuring the anode current and reading off the corresponding H.T. values which we obtained when using batteries. We can also vary the load on the eliminator by changing the grid bias of the valve, thus increasing or decreasing the anode current.

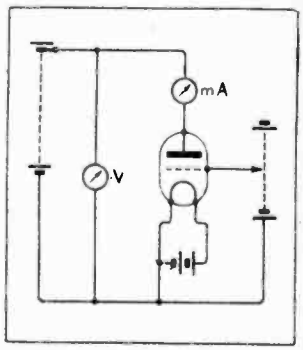


Fig. 2.—Calibrating a valve for measuring terminal voltages when the load is less than the current taken by a high-grade voltmeter.

It is convenient for the purpose of this test to re-plot the conventional valve characteristics in a different form. In ordinary valve curves anode current is plotted against grid bias, each curve corresponding to a fixed value of H.T.; for our present purpose we require curves plotted with H.T. volts against anode current, each curve corresponding to a fixed value of grid bias. Leaving the grid bias wander plug in the – 1½-volt socket (we do not require to know the exact value provided it remains constant), the H.T. voltage is increased step by step, and the corresponding anode current taken in each case. The grid bias is then increased to – 3 volts, and a fresh set of reading taken for H.T. volts and anode current, and so on. Fig. 2 shows the circuit connections for calibrating the valve, and a typical series of readings is given in Table I.

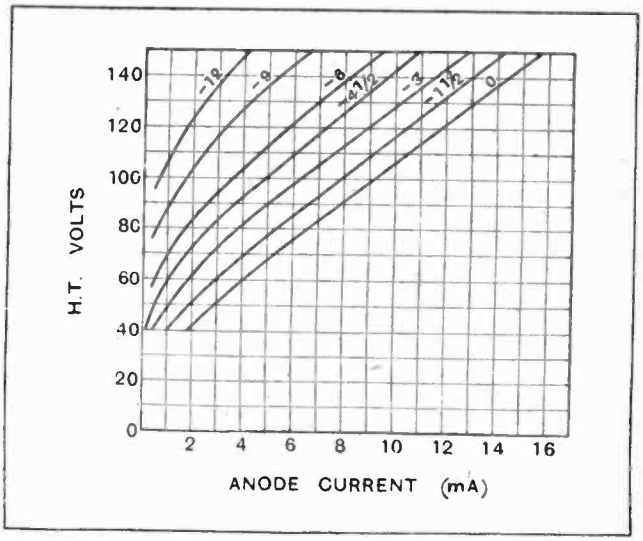


Fig. 3.—Curves plotted from data obtained with the circuit o Fig. 2; each curve corresponds to a different value of grid bias.

TABLE I.—D.E.5. FILAMENT VOLTS 5.5.

Grid Bias (Volts).	H.T. (Volts).						
	40	60	80	100	120	140	
0	1.8	4.1	6.5	9.3	11.8	14.5	Anode current (mA).
−1½	1.0	3.0	5.3	8.0	10.4	13.0	
−3	0.4	1.9	3.8	6.3	8.8	11.5	
−4½	0.1	1.0	2.7	4.9	7.3	9.7	
−6	—	0.5	1.7	3.6	5.8	8.2	
−9	—	—	0.4	1.7	3.3	5.4	
−12	—	—	—	0.7	1.7	3.3	

TABLE II.

Grid Bias.	Anode Current (mA).	H.T. (Volts).
0	6.9	83
−1½	6.5	88
−3	5.7	96
−4½	5.3	103
−6	4.6	110
−9	3.5	122
−12	2.6	131

Curves drawn from these figures are shown in Fig. 3. From these it will be seen that by varying the grid bias the load can be varied from 0.1 to 1.9 mA. at 40 volts, and from 3.3 to 14 mA. at 140 volts. These are the sort of loads which are usually drawn at the voltages

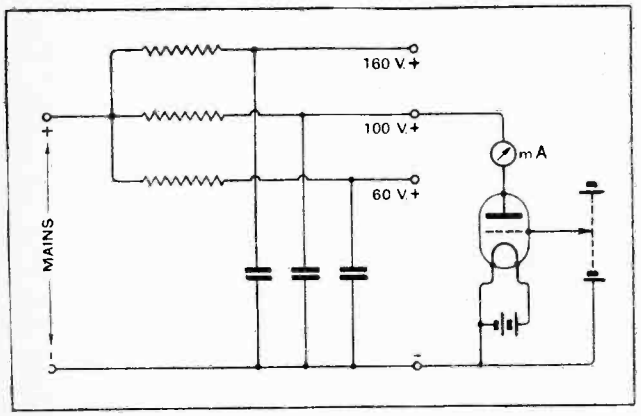


Fig. 4.—The calibrated valve connected to one of the output terminals of a D.C. battery eliminator.

mentioned; if higher readings are desired at 140 volts, the voltmeter method in Fig. 1 should be used.

Returning to a consideration of the curves of Fig. 3, let us take a concrete example to show the working of the method. We have an eliminator, one of the terminals of which is marked "100," and we wish to find at what current this voltage will be delivered, or, alternatively, what the terminal voltage will be when drawing a current of 3 mA.

The calibrated valve is connected as shown in Fig. 4, and readings of anode current are taken for each setting of the grid bias, thus varying the load between 2.6 and 6.9 mA. The values of H.T. corresponding to each anode current are read off from Fig. 3, and appear in the third column of Table II.

Plotting these values in the form of a curve (Fig. 5), we find that the terminal voltage is exactly 100 at 5.4 mA., and rises to 127 volts at 3 mA.

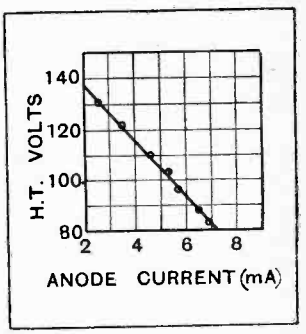


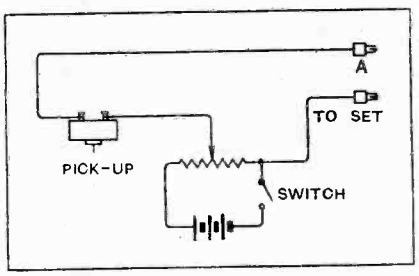
Fig. 5.—An example showing the variation of output terminal volts with load.

It should be clearly understood that these results apply to the conditions at the terminals of the eliminator, and do not necessarily give the true anode voltages at the valve itself, but the method can easily be extended to include the voltage drop in anode resistances or transformer windings by taking readings with the calibrated valve *in situ* in the set, the milliammeter being placed anywhere on the anode circuit. In this way it will be possible to check the grid bias on any amplifying valve and to correct it, with the aid of the makers' curves, by a series of successive approximations. F. L. D.

GRID BIAS AND THE GRAMOPHONE PICK-UP.

The use of a gramophone pick-up in front of the detector valve of a receiver, more especially modern receivers using anode bend rectifiers and well-designed amplifiers, is growing increasingly popular. It is customary to insert the connections from the pick-up at the low potential end of the grid tuning circuit either by means of a plug and jack or plugs and sockets. It is necessary also to halve the grid bias applied to the erstwhile anode detector valve, as it will now be called upon to act as an amplifier.

This latter operation is often a nuisance when the grid battery is



Method of employing external grid bias when using an anode bend detector as an amplifier to follow a pick-up.

fixed in a rather inaccessible part of the receiver cabinet. The difficulty can, however, be easily overcome by fitting an ordinary 300-ohm potentiometer, a 4.5-volt flash lamp battery, and a simple "on and off" switch into the cabinet of the *gramophone*. It will be noticed from the connections shown that it is only necessary to adjust the potentiometer once when the instrument is first put into operation, and again after several weeks' use when the battery potential has begun to fall. The effect of this local grid bias battery is to reduce the effective bias applied to the grid of the valve by the ordinary grid battery, and it is obvious that this effect comes into play immediately the two leads from the gramophone are connected up to the receiver. F. F. A.

VALVES WE HAVE TESTED

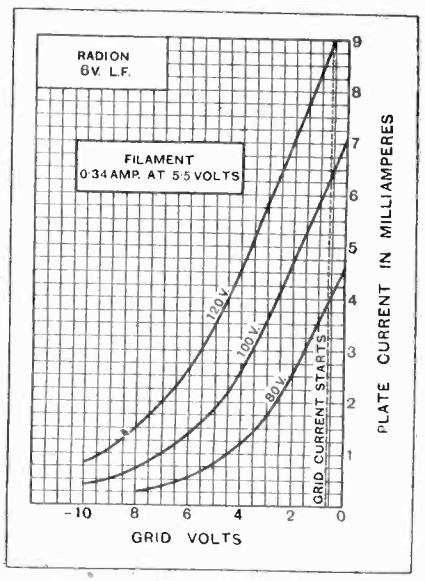
Three New Radion Valves and the Cosmos A.C. Valve.

Low Radion 6-volt Valves.

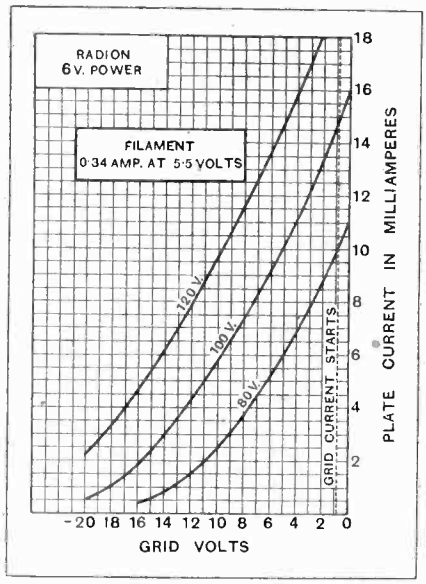
TWO valves of this range have been tested—the 6-volt L.F. and the 6-volt power valves. In both valves a V-shaped filament is used, and the grid and plate are in the form of flattened and truncated cones.

The filament consumption is rather nigh for valves of this class, both types being nominally 0.34 ampere, but the performances are quite up to standard, and a satisfactory mutual conductance is exhibited. The characteristic curves for both valves are shown, and the figures for the amplification factor and resistance are as follows :—

Amplification factor of the L.F. valve = 10; A.C. resistance = 9,000



ohms, giving a mutual conductance of 1.16 milliamperes per volt. These figures are obtained for a plate voltage of 100-120 and a negative grid bias of 3 volts.



Values of grid bias to use with various values of plate voltage, together with the steady plate current flowing at these grid bias values, are given in the accompanying table :—

TABLE I.

Plate Volts.	Grid Bias. Volts.	Plate Current. mA.
80	− 2	2.6
100	− 3	3.6
120	− 4	4.6

Filament volts, 5.5. Filament current, 0.33 amp. (measured). Low Radion, 6v. L.F. valve.

For the 6-volt power valve the following figures were obtained, and the grid bias values for various plate voltages summarised in Table II.

Amplification factor = 4.35; A.C. resistance = 4,750 ohms, giving a mutual conductance of 0.915 milliampere per volt. These figures are obtained for a plate voltage of 100-120 and a negative grid bias of 9 volts.

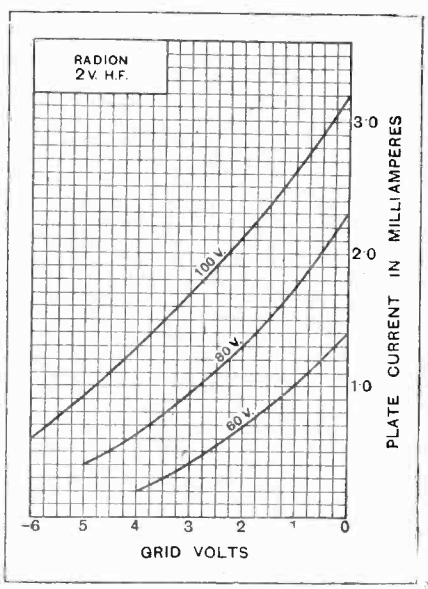
TABLE II.

Plate Volts.	Grid Bias. Volts.	Plate Current. mA.
80	− 4½	6.4
100	− 7½	7.8
120	−10½	9.2

Filament volts, 5.5. Filament current, 0.34 amp. Low Radion, 6v. power valve.

As with other Low Radion valves, each valve has its characteristics on the bulb in the form of a transfer. The characteristics there shown appear to be sufficiently near those obtained experimentally for the individual valves tested, thus showing that the manufacture should be fairly uniform.

On test both valves showed less than 0.1 microampere reverse grid current, thus indicating that they were quite hard.



Low Radion H.F. Valve (2-volt).

This 2-volt valve on test gave rather lower figures for the amplification factor and A.C. resistance, the actual

Valves We Have Tested.—

constants being: Amplification factor = 10.2; A.C. resistance = 26,000 ohms, giving a mutual conductance of 0.4 milliampere per volt. These figures were obtained from the characteristic curves for plate voltages 80-100 and with −3 volts on the grid.

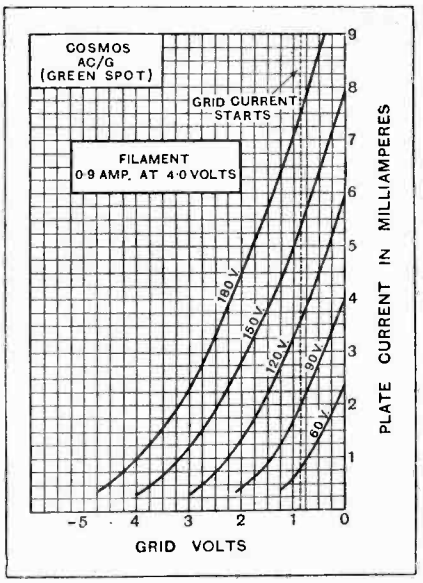
The valve is suitable for use as a H.F. amplifier, detector, or L.F. choke-coupled amplifier. As in the L.F. valve, the characteristics are given on a transfer on the bulb, and appear to agree reasonably well with those found on test.

The reverse grid current was less than 0.1 microampere, indicating that the vacuum was hard.

The Cosmos AC/G Green Spot Valve.

This valve is of the indirectly heated cathode type, and follows the usual Cosmos close-spacing construction. In any case a separately heated cathode valve should be much more efficient than a normal type where the heating current is passed through the filament, and when this is combined with the close-spacing construction a very efficient valve should be the result. The combination of these two features should show to the greatest advantage in valves of high magnification factor, as the mutual conductance is so very much better than for ordinary filamented valves.

The characteristics found on test for a Cosmos AC/G Green spot valve are shown in the accompanying curves.



The mutual conductance of the valve with high plate voltages is really extraordinarily high compared with even a S.P.50 blue spot, which also embodies the close-spacing construction, as the following table will show:—

Plate Voltage Range.	Grid Bias.	Amplification Factor	A.C. Resistance (ohms).	Mutual Conductance (mA/volt).
90–120	−1½	37.5	23,000	1.62
120–150	−1½	39	18,800	2.08
150–180	−2	39	17,700	2.18

The comparatively low A.C. resistance of the valve makes it quite suitable for transformer coupling as well as for resistance or choke coupling, though more than one stage of transformer coupling is not advised.

In common with all indirectly heated cathode valves, the grid current, once it starts, is rather excessive, therefore sufficient allowance of grid bias and, of course, plate voltage must be made when the valve is used as an amplifier, to avoid grid current with the largest input voltage that is likely to be met in a set.

Grid current commences at approximately −1 volt on the grid, so that, as far as amplification is concerned, all parts of the characteristics to the right of this point are not usable.

The heater voltage and current are 4.0 v. and 0.9 amp. respectively, and, although this power is normally intended to be supplied by means of an A.C. transformer, yet, even where A.C. power is not available, the valve is so good that it is worth feeding the heater from a four-volt accumulator, especially in a set which is used for gramophone reproduction as well as radio.

For detection the valve is equally suitable as an anode bend detector or as grid-leak detector, although in the latter case a *positive* bias of about 1½ volts (supplied by a grid cell) and low values of the leak are required. This latter requirement is due to the above-mentioned fact of the large grid current.

Full details as to methods of connection are found in the pamphlet supplied in the valve box, and the makers also give hints as to how to eliminate hum from the A.C. supply should it occur.

BOOKS AND CATALOGUES RECEIVED.

Der Niederfrequenz Verstärker.—The theory and practice of low-frequency amplification for the reproduction of speech and music. By Albrecht Forstmann and Hans Reppisch. Pp 366, with 211 diagrams and illustrations. Published by R. C. Schmidt and Co., Berlin. Price Rm.16.

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Der Neutrodyne Empfänger.—A short treatise on neutralisation and neutrodyne receivers, with notes on their practical construction. By Emil Jarasch. Pp. 88, with 40 diagrams and illustrations. Published by R. C. Schmidt and Co., Berlin. Price Rm.3.50.

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Un Amplificateur de Fréquence Intermédiaire, by L. Chrétien.—The general principles of intermediate-frequency amplifiers and directions for the construction of one type. Pp. 19, with 8 diagrams and illustrations. Published by La T. S. F. Moderne, Paris. Price 3 fr. 50.

History of Radio Telegraphy and Telephony, by G. G. Blake, M.I.E.E., F.Inst.P. Pp. 425, including explanatory foreword, references to 1,125 books, articles and patents, and over 200 illustrations and diagrams. Published by Chapman and Hall, Ltd., London. Price 25s. net.

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What's Wanted and Advice to Inventors, 2nd edition, with 339 suggestions for desirable inventions. Pp. 80. Issued by the Institute of Patentees (Inc.), London. Price 6d., post free 8d.

The British Journal Photographic Almanac, 1928, edited by G. E. Brown, F.I.C., Hon. F.R.P.S. Pp. 788, with numerous illustrations and 64 gravure reproductions. Published by H. Greenwood and Co., Ltd., London. Price 2s. net.

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S. G. Brown, Ltd., North Acton, London, W. The Brown Budget.

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The "Loud-Speaker" Co., 53, Chandos House, Palmer Street, Westminster, London, S.W.1. 112-page catalogue of leading wireless lines (wholesale only).

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Metro-Vick Supplies, Ltd., 155, Charing Cross Road, London, W.C.2. Art pamphlet dealing with the *Met-Vick* mains-operated five-valve set.

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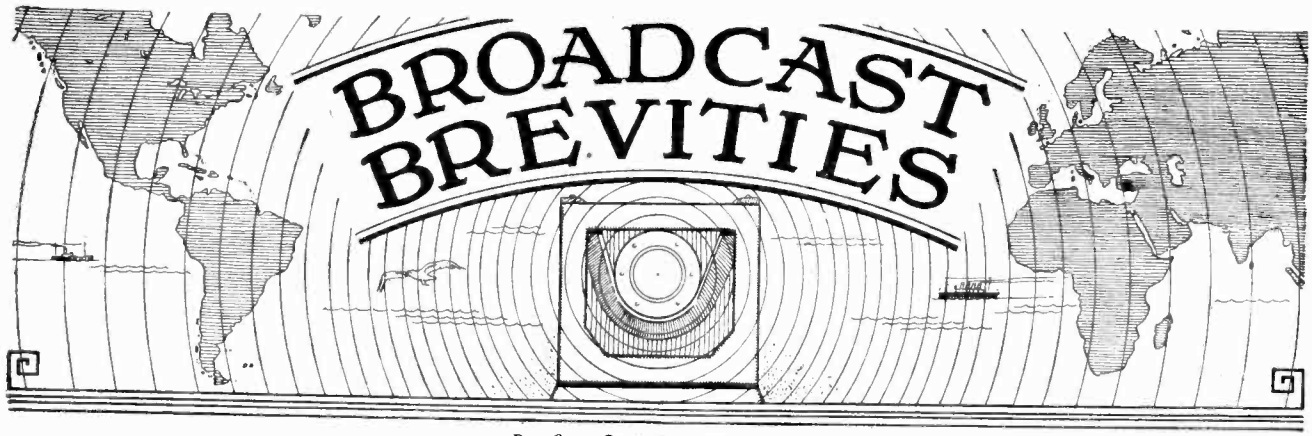
Nora Radio G.M.B.H., Charlottenburg 4, Berlin. Leaflets dealing with loud-speakers, mains receivers and general range of sets.



By Our Special Correspondent.

Weather and Wireless—More Umbrellas, Please—Gilbert and Sullivan Operas—B.B.C. Work at Clapham—"Caught Out"—Improved Variety Programmes—Instructing the Oscillator.

Blame it on Broadcasting.

The Matlock Improvement Association, in blaming broadcasting for the bad weather (as if good weather were to be expected in mid-winter!), displays more vehemence than originality.

Somebody, or something, it seems, must be doing the devil's work when an extra drop of rain falls, so why not place the blame on the newest scientific phenomenon. Wireless! Why didn't we think of it before?

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Weather Blether.

This process of ratiocination had its exponents long before wireless was thought of (incidentally proving that wet days existed before Marconi). Pepys' Diary, I believe, refers to four months of unrelieved wet weather. Apparently they were having a pretty humid season just at the time when gas was first used as an illuminant in Pall Mall, London. So gas was blamed. The introduction of lightning conductors also provided a safety valve for the weather wizards, who saw in the coincident floods a manifestation of the anger of Providence at being circumvented in the destruction of property. The newly invented electric lamp was also cursed as a provoker of rain

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The B.B.C. View.

These and many other instances can be adduced to show that the good folk at Matlock are not the first to suspect the ingenuity of man as a controlling influence over the weather.

I should like to leave it at that—but Matlock is Matlock; moreover, Matlock proposes a step which might very well rob me of a month's "copy." It is proposed that the Government forbid all broadcasting for a month in order to test the weather and wireless theory. To discuss such an idea is really waste of space; we have only to consider, among other things, that the total power expended on British broadcasting is less than that of a single high-power station such as Rugby. But there is, of course, a B.B.C. view on the matter.

Dangerous Possibilities.

I asked an official at Savoy Hill whether the Corporation welcomed the suggestion. "From a staff point of view, yes," he said. "We are not the people to object to a month's holiday, provided, of course, that salaries——"

Exactly. On other points he was less communicative. He refused to expand on the question of whether British listeners, enabled by the silence of their own stations to enjoy Continental programmes, would resent coming back to earth when the month was up. And he cowered before the suggestion that people might learn to do without broadcasting altogether.

Would they? I doubt it. It seems more likely that, even if broadcasting were found to be responsible for wet weather, people would decline to throw over an institution which has become a habit. They would just buy more umbrellas.

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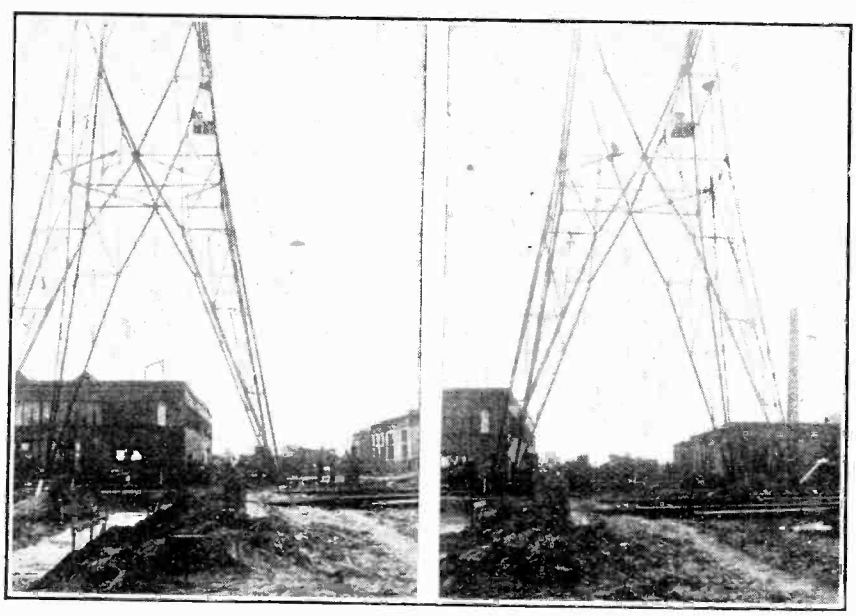
A Gilbert and Sullivan Item.

It is good news that the trustees of the Gilbert and Sullivan copyrights have lifted the restrictions on the broadcasting of the famous operas. The decision means that, with the exception of vocal renderings of the songs, these works may now be broadcast on payment of the ordinary copyright fee. Formerly only the overtures could be broadcast.

Many folk think that Sullivan's tunes are still ahead of all others in their power to satisfy the artistic ear without taxing the brain. As such they are admirable for broadcasting.



PORTABILITY: THE LAST WORD! Two interesting photographs, taken from the same spot, showing one of the large masts at Hilversum before and after removal last week. Owing to the extension of the buildings the mast had to be moved twenty-two yards without breaking the aerial wires. The mast, which weighs about 25 tons and is 200 ft. high, was shifted on greased rails.

A Forgotten Research Station.

It is believed that a popular B.B.C. entertainer nearly jumped out of his skin the other day when he opened his evening paper and read the headline: HOW CLAPHAM WILL REVOLUTIONISE BROADCASTING. "Wh—what about Dwyer?" would probably have been his next question, but for the discovery that the newspaper story merely dealt with the B.B.C. research laboratory at Clapham Park.

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The Work at Clapham.

Many of the public may not have been aware of the existence of this interesting little outpost, but readers of *The Wireless World* will remember that it received first exclusive mention in these columns in September last. Now, as then, the converted house at Clapham occupied by Capt. West and his staff is used solely for laboratory purposes, and not as an elaborate receiving station.

Experiments in studio acoustics have been conducted there, and I understand that a new microphone is now the subject of tests.

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Mr. Lloyd George to Broadcast.

Mr. Lloyd George's speech in responding to the toast of "Our Guests" at the Welsh National dinner of the Cardiff Cymrodorian Society will be relayed from Cardiff to 2LO and 5XX on March 1st (St. David's Day).

On the same day 5XX will broadcast a Welsh community singing festival from Liverpool.

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Lenten Services from 5GB.

Starting on February 23rd, and continuing throughout Lent, 5GB will broadcast each week a Thursday lunch-hour service relayed from St. Martin's, Birmingham.

The speakers on each succeeding Thursday will be Dr. Carnegie Simpson, Rev. Pat McCormick, Sir Harry Verney, Dr. Herbert Gray, Dr. Peake, the Rector of Birmingham, and Canon Rust.

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Peaches.

L. du Garde Peach has written a revue entitled "Peaches," with numbers by various composers. This will be broadcast from 2LO and 5XX on March 3rd.

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A Highland "Ceilidh."

Wherever Highlanders gather there "ceilidhs" are held. These are entertainments at which neighbours from croft and cottage meet to spend a cheerful evening in an exchange of old Highland stories, songs, and melodies.

Broadcasting is to try and capture that atmosphere on February 21st, when a "ceilidh," specially arranged by the well-known Highland writer, Donald A. Mackenzie, will be held in Edinburgh studio and broadcast from all Scottish stations. Highlanders and islanders from all parts of the north and west of Scotland will gather for this entertainment.

What Were the Wild Waves Saying?

A glaring instance of programme mistiming, a fault referred to in these columns a fortnight ago, occurred last week, when Temple Thurston's play, "The Burden of Women," was broadcast from 2LO. In this case the people at Savoy Hill were literally "caught out," and the poignant ending to a good play was rendered almost ridiculous.

Those who listened will remember that the poor woman around whose misfortunes the play centred was left sitting in grief-stricken silence broken only by the distant roar of the sea. The absurdity came in when the roar of the sea was over-prolonged. Minute after minute we waited, wondering whether the sea was really the sea, or whether our valves had gone soft. Finally, the tension was relieved by the scraping of the 2LO orchestra, tuning up for a few chunks of gap-filling music quite out of sympathy with the play that had just preceded it.

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"Caught Out."

I hear that the band was literally "caught out" on this occasion, having been dismissed at the beginning of the play with instructions to be "back in thirty-five minutes." But the play was so grossly mistimed (it was over ten minutes short) that the orchestra had to be dragged from its coffee while Temple Thurston's waves were doing overtime.

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Improved Variety.

On the subject of variety programmes opinion seems to be growing that the B.B.C. is making a genuine effort to cater to the needs of its public. Recent "turns" have been decidedly spicy and original, but I have heard one question asked. Is the band a real band, or a burlesque? As a burlesque of the village circus combination it could hardly be better, but there seems to be a growing suspicion that this is not its function.

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Have You Heard Them?

Most of the American broadcasting stations are anxious to be heard in this country, and WRNY, New York, is no exception. The station directors have just sent me the latest schedule of transmissions from their satellite station, 2XAL, which "puts it across" on 30.90 metres. The times given are G.M.T.:—

Wednesday ...	00.00 to 05.00
Thursday ...	00.00 to 02.00
Saturday ...	00.00 to 04.00
Sunday	00.00 to 03.00
"	21.00 to 23.00

Listeners are asked to report reception to Station WRNY, The Roosevelt, 45th Street and Madison Avenue, New York City.

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General Booth in the Studio.

General Booth will conduct a Salvation Army service from the studio at 2LO on February 19th.

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Oscillators in Glasgow.

Glasgow's guest of honour at the time of writing is a Post Office direction-finding van, on the hunt, not for "pirates," but for oscillators. The job of locating an oscillator by his howl must be unconscionably difficult, but the Post Office has been fairly successful in the Midlands, so no doubt they will use this experience to good effect in Scotland.

In most cases it is found that the oscillator is ignorant of the distress he is causing, and is quite anxious to learn wisdom.

FUTURE FEATURES.

London and Daventry (5XX).

FEB. 19TH.—"The Spectre's Bride," a dramatic cantata by K. J. Erben, with music by Antonin Dvorak (from Manchester).

FEB. 20TH.—A. J. Alan: "The B.B.I."

FEB. 21ST.—Variety Programme.

FEB. 23RD.—Speeches by the Prince of Wales and Sir William Seager, following the annual dinner of the Chamber of Shipping.

FEB. 22ND.—"Rodelinda," an opera by Handel.

FEB. 24TH.—National Symphony Concert, conducted by Albert Coates, relayed from the Queen's Hall.

FEB. 25TH.—Old Folks' Programme.

Daventry Experimental (5GB).

FEB. 19TH.—Military Band Concert.

FEB. 20TH.—"Rodelinda," an opera by Handel.

FEB. 21ST.—Liverpool Philharmonic Society's Tenth Concert, relayed from the Philharmonic Hall, Liverpool, conducted by Sir Henry J. Wood.

FEB. 22ND.—Orchestral Concert.

FEB. 23RD.—Symphony Concert, relayed from the Town Hall, Birmingham, conducted by Ernest Ansermet.

FEB. 24TH.—Orchestral and Vocal Concert.

FEB. 25TH.—Scottish Composers' Programme.

Cardiff.

FEB. 25TH.—"Lovers' Lyrics."

Manchester.

FEB. 19TH.—"The Spectre's Bride," a dramatic cantata by K. J. Erben, set to music by Antonin Dvorak.

Glasgow.

FEB. 21ST.—"A Wolf in Sheep's Clothing," or "The Country Cousin Visits a Cabaret," presented by the Radioptimists.

FEB. 25TH.—A Programme by Blind Artists.

Aberdeen.

FEB. 21ST.—Community Singing Concert, relayed from the Fishermen's Hall, Buckie.

Belfast.

FEB. 25TH.—"Shadows," a radio scene by Valerie Harwood. "Dropped from Heaven," a sketch by Dion Titheradge.

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.

STATION IDENTIFICATION.

Sir,—I have read with interest and a certain amount of amusement the arguments of Capt. Eckersley *re* above subject, and can only say that he is kicking against the pricks of massed public opinion.

The whole point appears to be simply this: Are listeners who have paid for their licence and spent anything from £15 to £50 or more for their sets to be restricted in their range of choice because of the limitations of outlook of one who appears to be the mouthpiece of a group of doctrinaires?

If I want to listen to Milan or Motala or Barcelona or Toulouse, and my set is capable of giving good results therefrom, I'm just going to do it, and so is everybody else who wants to. Any attempted dictation as to what one ought or ought not to do in this matter is bound to fail, and, in any case, what on earth does it matter to the B.B.C. as long as they get my licence money. If they think it does matter, then they are attempting to dictate on matters of personal taste and preference, which is nothing but unwarrantable interference.

Also, on points of fact, Capt. Eckersley is wrong because with good modern sets—particularly those embodying the screened valves—one is able to get, as I do, quite 6 or 7 Continental stations which are a joy to listen to, and I unhesitatingly say that if I want to hear, say, opera as it should be done, I'm going to do it and not wait for the millenium to occur in England when we can get opera as we do from the Continent. A little time ago I was enabled to hear the first act of Tannhäuser twice in one evening from two Continental stations splendidly done and received with a brilliancy and clearness of details that could not have been bettered by Daventry. Am I, then, going to shut off my set in a mood of pious patriotism and wait for the B.B.C. to give what I am already getting? Not likely, nor is anyone else.

I am not by any means deprecating the fine things that the B.B.C. are doing, far from it, and, in general, quite 50 per cent. of my listening is from that station, but when I want the Continent I get it.

There is also one other aspect, which is this: the more listeners of all countries hear foreign stations the better from the point of view of Brotherhood and Peace. Broadcasting should be the greatest ally that the League of Nations has. In listening to foreign stations no one who has an ounce of imagination can help visualising the millions of people of other nations who listen to the same sorts of things, who are moved by the same emotions, and who vibrate to the same type of thought and whose main difference is one of language only, without becoming influenced, if only subconsciously, by the idea that after all here are people like ourselves who are willing to give and receive ideas to the betterment of both. The linking up due to wireless is more powerful than that of commerce because it operates through similarity of tastes and not through self interest.

Jersey. H. E. DU PRÉ.
January 30th, 1928.

Sir,—The views of Capt. Eckersley and your numerous correspondents on the above subject are most interesting. It appears to me, however, that most of them have overlooked the keynote to the situation, viz., human nature.

I will cite a parallel case to emphasise my point. Motorists aim at:—

(i) Cheapness. (ii) Increased speed. (iii) More m.p.g., and so long as human nature is unchanged they will, presumably, continue on these lines.

The radio equivalents are:—

(i) Cheapness (within reason). (ii) Louder signals. (iii) More distant reception,

and I feel sure that a very large proportion of listeners will strive to obtain more distant reception as long as distant stations exist.

While human nature remains a factor in the problem I am afraid we must face the situation and let listeners have their distinctive signals.

I often think of the times when the reception of telephony and music was looked upon as an adventure—the early days of PCGG, Writtle, etc.—and if distinctive signs had not been given I wonder what we should have done? Human nature impelled us to "reach out" for more in those days, and if the present generation fails to follow suit I shall be very surprised. EDWARD J. HOBBS.

Luggershall.
February 1st, 1928.

Sir,—I have read with great interest the correspondence concerning "Identification of Stations" in your columns, and also the article by the Chief Engineer of the B.B.C. on the subject.

It appears to me that the only reasonable method of identification, under the present conditions of broadcasting, is by the frequency (or wave-length) of the transmitter concerned, i.e., by the method outlined by Alex. Sim, of Thornton Heath, in the January 25th issue of your paper.

Now consider the case of a person residing in the North of France. He is endeavouring to identify the various stations of the B.B.C. by call-sign or some other characteristic signal. How is he to do that when all our stations are taking the 2LO programme, and we hear: "This is London calling," not only from the London station, but also from Aberdeen, Cardiff, Belfast, etc. etc.?

Surely in this case identification by call-sign or other signal is impossible?

Similarly the various stations on the Continent relay programmes from other stations and again we get the same difficulty.

If it were possible to obtain the complete programmes of all the Continental stations—and in this respect "World Radio" is very, very inadequate, due, no doubt to the great difficulty in obtaining the detailed programmes—then station identification would become fairly easy by making use of these and noting also the approximate wave-length of the station received.

Finally, I must say I am very glad to see that somebody has made a note of the continual broadcast advertising of *The Radio Times* and its companion paper.

Wandsworth, S.W.18. A. D. USHER, B.Sc.
January 26th, 1928.

Sir,—May I add a few words to the discussion on station identification?

I cannot see how Capt. Eckersley can overlook your point regarding the trend of modern receiver design—it it not towards short range.

The only maker of repute that I have seen advertise a "local" set has recently added reaction, presumably for some degree of distance work.

Probably Capt. Eckersley is correct in his views, as an engineer it is his business to be interested in the quality of his goods, but *our* main interest is entertainment. To me listening continually to the nearby station is about as sensible

as going to hear a play, of any given type, simply because it is performed in a bigger theatre by a more famous company than the one I really want to see.

If my taste is for opera on a particular night of what consolation is the perfect rendering of chamber music by the B.B.C. I would sooner try Vienna or Milan, despite a slight reduction of quality.

In your correspondence columns Mr. Sim seems to prove the reverse of his views. His system of working round the dial is good but if it only leads to finding Berlin ten degrees above Radio Paris there is something lacking.

A signal *is* necessary. Hallo, followed by name of station slowly spoken is enough. The trouble is that announcers so rarely give anything except at long intervals. Toulouse, Frankfurt, Radio Wien, etc., are the marked exceptions.

Really the language presents little difficulty. "Wien" does just as well as Vienna, and other names are generally the same way.

A. W. FOSTER.

Newcastle-on-Tyne.
January 27th, 1928.

POWER OF CONTINENTAL STATIONS.

Sir,—One heard a good deal some time ago about some convention or other which was doubtless founded at terrific expense to control from Geneva (they always go to some beautiful and expensive place . . . never Wigan!) the wavelengths, etc., of the various broadcasting stations.

Is this still operative? If so, why is Germany allowed to have such tremendous power that we are practically *compelled* to listen to their excellent orchestral concerts?

A trip round one's dials, even on 2-v-2, is most disheartening. Germany, degrees of 5GB, groans and whistles, Germany again, more German stations, still more, Oslo, Glasgow blotted out by yet more German stations, heterodyne whistles, Manchester bleating through a terrific wind, more German stations, London distorting like anything every two minutes, Cardiff like a voice in the wilderness, groans, whistles, shrieks, heterodyning, Germany again, yet again. Darling, get the bally gramophone!!

Why, oh why, are we egged on to spend hard-earned pennies on such disappointing stuff? Years ago we *could* count on all the British stations . . . a log of mine for 1922 proves this . . . but now the safest course would be to listen to 5XX on a crystal. Even then 5GB is always in the background.

Oughtn't Geneva to see to it?

D. R. ROBERTS.

Wellesbourne, Warwick.
January 17th, 1928.

OPTIMISTIC PERFORMANCE CLAIMS.

Sir,—In reply to your correspondents who have answered my letter appearing in your issue of December 28th, I am afraid I must still stick to my guns!

I do not dispute that it is possible to obtain certain sounds from a loud-speaker at this distance from a main or high-power broadcasting station, and I have done so myself with such sets as 1-v-1, 0-v-2, and for many months I used a three-valve and crystal reflex, which certainly produced more sound than either of the other arrangements, but I still most emphatically deny that it is possible to obtain *adequate* loud-speaker reception with any arrangement of three valves as far away as we are. By "adequate" I mean a volume of undistorted sound which approximates very closely to the original in the studio.

I do not think even the most ardent 0-v-2 enthusiast would be happy here with his loud-speaker if his reaction were taken away, which brings me back to the point of my first letter—that most of these constructor sets are bought by beginners who, through lack of knowledge and an attempt to get the most possible noise, are bound, with such sets, to cause considerable interference and annoyance to others.

It is obvious that with certain valves and ample high tension it is possible to get a great deal of range from one of these sets *if it is in the hands of an expert*, but even then . . . let the expert go and hear such a set as the demonstration set at the South Kensington Museum, which uses more than a valve per mile of distance (I am not advocating this), and if he is still convinced that he has ample loud-speaker reception then I have no more to say.

S. G. BLACK.

Torquay.
January 25th, 1928.

MAN-MADE STATIC.

Sir,—I wonder if you know how much interference there is to broadcast reception from wireless machinery? A good many people in this town suffer from it. The cause in our case is sparking at the brushes of direct current commutators. This produces frying and crackling sounds like continuous atmospherics. A good many sufferers have no idea what causes this and simply take it as it comes. Of course, I have tried to overcome it, but it seems quite hopeless. I have cured a cinema near here, with a 50 h.p. D.C. generator, by the usual expedient of putting sufficient capacity across the brushes with the mid point earthed. But there are some who won't do this, and won't have it done either. So a remedy to be adopted at the receiving end is indicated. Well, I've tried—being well informed, as all readers of the *W. W.* should be—a good many things—counterpoise earth, shielded coils, loose coupling, frame aerials and wave-traps. I have had a little success, but on the whole, to reduce the interference means also reducing signal strength in proportion. Now, can you help me? You are the best judge as to whether well-informed articles on the subject would be interesting and desirable in your paper. I would suggest the following aspects of the matter: 1. What is the best remedy or cure at the source? 2. What is the best remedy at the receiver end? 3. Has an ordinary listener any legal remedy? 4. Has a dealer in wireless, whose business is interfered with, any legal remedy? 5. Could the manufacturers of D.C. and allied machinery be educated to the necessity, in these days, of making the necessary filtering condensers an integral part of their machinery? Most of them now also make and sell wireless apparatus of some sort. It would not add much to the cost of production. 6. Is there any particular kind of aerial or earth likely to minimise the trouble.

JOHN COLLEY.

Teignmouth.
January 27th, 1928.

ASSOCIATION OF BRITISH RADIO SOCIETIES.

Sir,—May I be permitted through your columns to appeal to all members of radio societies to help the above organisation?

We do not need money or even service, but just a few moments of each member's time and the expenditure of a 1d. on a stamp for a postcard. We are most anxious to compile a complete and comprehensive list of active radio societies in the United Kingdom before the end of February, and in order to do this we do require the assistance of radio society members. If, therefore, this notice should catch the eye of a member of a society will he please

Write on a postcard the name of his society,
Name and address of secretary,
The approximate number of members,

and post it to Mr. L. A. Gill, Hope House, South Reddish, Stockport, near Manchester.

By doing this the radio society members will be helping us and, incidentally, helping themselves.

J. E. KEMP, Chairman,
The Association of British Radio Societies.

February 6th, 1928.

GROUSES FOR 1928.

Sir,—In reply to your request for "1928 grouses": I have had five valves and associated eliminators on order since October last, and in spite of urgent and repeated enquiries, both personally and through my agent, no date for delivery is yet promised.

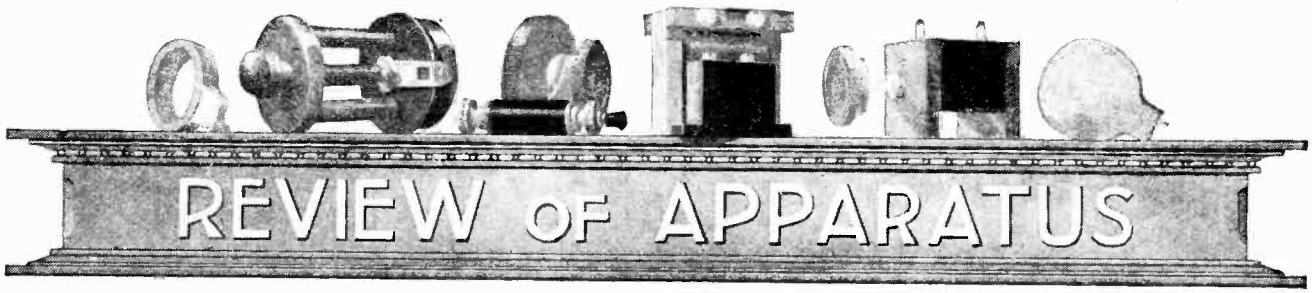
M. D.

London, N.W.3.
January 19th, 1928.

Sir,—This year a determined attempt should be made to have the morning weather forecasts issued at an earlier hour than 10.30. I am under the impression that the Air Force sends them out at 8 o'clock in code. If this is so, it is surely not beyond the wit of man to decode and issue them by 9 o'clock. The advantage to agriculturists, for whose welfare the Government professes itself to be solicitous, and to country dwellers generally would be immense. It is difficult to believe that something could not be done if the question were taken up strongly.

S. F. W.

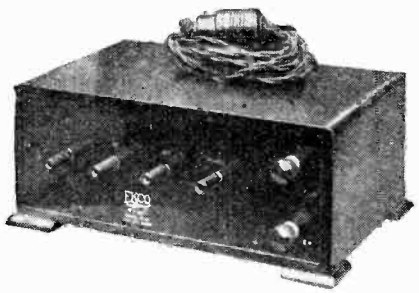
Berwickshire.
January 20th, 1928.



Latest Products of the Manufacturers.

"EKCO" D.C. ELIMINATOR.

The makers of this well-known unit, Messrs. E. K. Cole, Ltd., "Ekco" Works, London Road, Leigh-on-Sea, show themselves to be well acquainted with all the pitfalls of D.C. eliminator design.



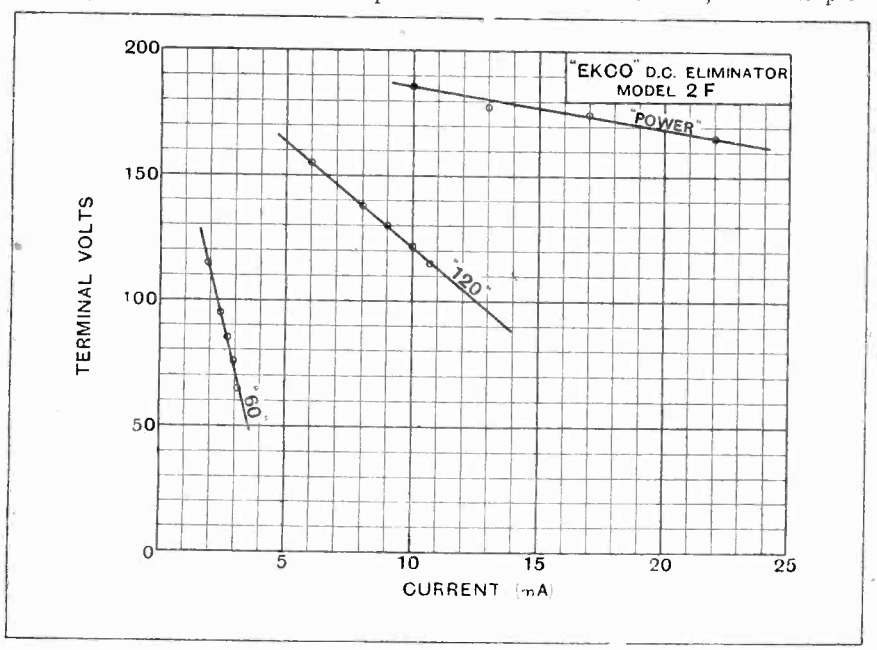
The "Ecko" D.C. eliminator for use with sets up to five valves.

The all-too-common fault of "motor boating" has been overcome by using the series method of connection for the voltage reducing resistances. There are three tappings on the 2F model: "Power," which is connected to the positive main and includes no reducing resistance other than the resistance of the smoothing chokes; "120" and "60," which both include series resistances and are by-passed by large smoothing condensers at each terminal.

Smoothing chokes are included in each lead from the mains, and a separate 2 mfd. condenser, with terminals for the set earth, make the unit equally suitable for negative—or positive—earthed mains.

On test mains hum was found to be negligible, and no trace of "motor boating" or oscillation from back coupling could be provoked. The fluctuation of terminal voltages with changes in the D.C. load is shown graphically, and will serve as a guide in fixing the grid bias of amplifying valves. This variation of terminal voltage is inseparable with series-connected eliminators as a class, but is far easier to cope with than "motor boating" or L.F. oscillation. In this particular case the resistance values have been well chosen. It will be seen from the curves that the "60" tapping gives 60 volts at 3.2 mA, an average anode current for leaky grid detectors; and the "120" terminal, which is presumably intended for first stage L.F. amplifiers, H.F. valves, etc., gives its rated voltage at 10 mA. The "power" terminal voltage is only slightly affected by the load, and gives 170 volts at 18 mA, so that it is quite suitable for output valves of the "super-power" type.

The price of the 2F model is £3 5s.



Variation of terminal volts with D.C. output in the "Ekco" Model 2F.

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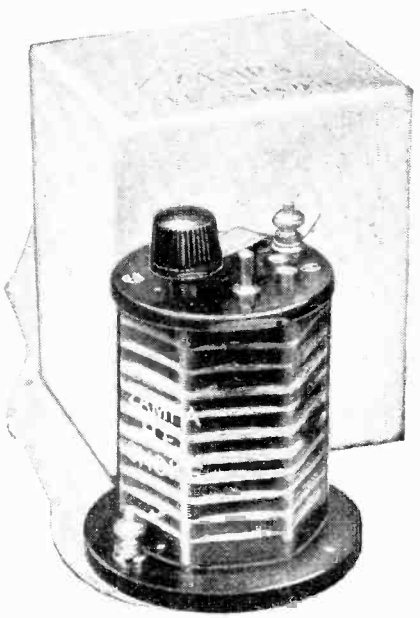
ZAMPA H.F. CHOKE.

It is well known that a high-frequency choke of fixed characteristics is suitable only for a limited band of wavelengths and that to cover all the broadcast wavelengths the use of more than one choke is desirable.



The Zampa tapped H.F. choke for all wavelengths.

In the Zampa H.F. choke (the Mic Wireless Co., White Horse Place, Market Street, Wellingborough) this end is achieved by tapping the choke winding so that its inductance can be varied to suit the circuit conditions. The choke is section wound on a ribbed ebonite former, and the tappings are brought out to a neat radial switch mounted on the top of the cylindrical former.

READERS' PROBLEMS

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department which are printed herewith: these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

Running Amok.

In the "Standard Four" receiver I notice that when changing from three valves to four it becomes necessary to break the grid circuit of the output power valve temporarily whilst effecting a change-over. Owing to the temporary removal of negative grid bias on the grid of this power valve will it not result in the plate current of the valve temporarily running amok, with consequent danger to the life of the valve? V. H. R.

Your fears are perfectly well grounded, but, of course, whenever a change of grid bias is made to any valve, the filaments should always be temporarily switched off; this applies to any set, and applies equally, of course, when it is desired to make a slight change in the grid bias value by moving the wander plug. Before any movement of the grid bias wander plugs in any set, therefore, the filaments must be switched off, or, at any rate, the filament of the particular valve in question.

o o o o

Safeguarding Loud-speaker Windings.

Recently I purchased a super-power valve for the output stage of my receiver, but, contrary to expectation, the quality of reception was not improved, and, in addition, I have experienced trouble with my loud-speaker windings breaking down on two occasions. I understand that if a filter output circuit is employed this trouble will be overcome, but as I am not conversant with the arrangement, I should be obliged if you would supply me with a circuit diagram. L. W. S.

The breakdown of your loud-speaker windings when connected in the anode circuit of the output valve is due to the surges of current which momentarily pass through them when the receiver is switched off. A super power valve with a reasonably high anode potential will pass an anode current in the order of 10-15 milliamps, and this heavy current will saturate the pole pieces of the loud-speaker, with the result that slight variations in current through the windings will not produce sympathetic variation in the magnetism of the pole pieces, and the diaphragm or reed will therefore not respond to all the variations in current. Unless the diaphragm faithfully follows the variations of the current in the loud-speaker windings, distortion will be inevitable. By the adoption of the choke capacity output circuit, as shown in Fig. 1 on this page, these disadvantages

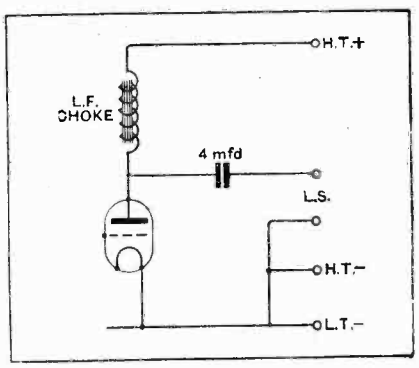


Fig. 1.—Choke-filter feed to loud-speaker. A method of preventing the heavy D.C. anode current from passing through the loud-speaker windings.

will be overcome, and, in addition, the tendency to low frequency oscillation will be minimised, since the speech frequencies do not pass through the H.T. battery.

o o o o

Some Operating Hints.

The operation of my "All-Wave Four" receiver is causing me some trouble. I find that the neutralising condenser tunes out the local station in two places. Again, the set seems to lack sensitivity unless the potentiometer is turned "full on," and movement of the aerial coil causes signals to increase to a certain strength, when further movement in the same direction causes a diminution. L. V. S.

We think that the majority of your troubles are associated with incorrect methods of operation. In the first place, you must not regard a neutralising condenser as a tuning control. When this has been set to prevent oscillation, it should not be touched again except to increase sensitivity by partial de-neutralisation; and even this aid should not be resorted to until you feel yourself quite at home with the receiver.

Regarding the potentiometer, it is not quite correct to speak of it as being "full on." We expect, however, that its slider is at the negative end, and this would make it appear likely that you require an additional bias cell in series. This point was dealt with in the article describing the receiver.

As with the neutralising condenser, you should not use the variable aerial coupling as a form of tuning, although it acts as one, due to the fact that movement of one coil with relation to the other varies their mutual inductance. We suggest that as a rule you should not alter the position of the aerial coil when once you have found a setting which seems to give a satisfactory coupling.

o o o o

A Cure for Overloading.

The last valve of my "Regional" receiver is inclined to be overloaded very easily, and I should appreciate your opinion as to which of the following alternatives you would recommend in order to enable me to get greater volume without distortion. I should naturally like to adopt the arrangement involving the least alteration and expenditure:—

(a) Raise H.T. voltage to some 160 volts. (b) push-pull amplification in the last stage, with two super-power valves, of the DE5.A. type, with my present H.T. voltage of 120. (c) Use two super-power valves in parallel in the last stage. L. G. R.

Of the alternatives you propose, we prefer the first. The extra H.T. voltage should be applied to both detector and output valves.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

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AND RADIO REVIEW

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CONTENTS OF THIS ISSUE.

CONTROVERSY.

JUST at the time we had understood that, for the present at any rate, the decision as to the inadvisability of broadcasting controversial matter had been generally accepted comes the surprising comment of Mr. Winston Churchill that, in his opinion, the ban on wireless controversy is "idiotic." The word is particularly ill-chosen for, whatever Mr. Churchill's private views may be, as a Cabinet Minister it is not a suitable word with which to express his contempt for the considered policy of his colleague, the Postmaster-General. There can be no doubt but that the Postmaster-General's decision to request the B.B.C. to refrain from broadcasting controversial topics was arrived at, not hastily, but after very careful consideration of the responsibilities involved. In this respect it differs very much from the obviously hasty expression of opinion of the Chancellor of the Exchequer, who, if his utterance had been preconsidered, would, we think, never have made it at all, or would certainly have avoided using the unfortunate word "idiotic."

The report of Mr. Churchill's remark has served to open up the subject afresh, and various comments have been made in the Press on the question. In discussing controversial broadcasting one newspaper states that "the nearest analogy to broadcasting is that of a newspaper, and we have only to figure to ourselves what sort of a newspaper it would be that endeavoured to please every single person in the country, and, not a more impossible task, but perhaps a more heart-breaking one, never to offend one of them." This, we consider, is a very fair statement of the case, but the analogy becomes more accurate if we can visualise one monopoly newspaper under Government control.

Broadcasting and the Press.

The great difference between broadcasting as it is to-day and the Press is that there are a sufficient number of newspapers with independent editors to ensure that no controversial topic is likely to be dealt with in a way which would give the public *collectively* a biased viewpoint. If we had a number of broadcasting stations under separate control then, and only then, would controversial matter be permissible.

A Possible Scheme.

Now, is such an arrangement wholly unworkable? Is it not possible that when the regional scheme comes into operation so that every area is served by at least two programmes that then we could introduce controversial broadcasts? To do so it seems that it would be necessary to appoint programme editors, one to each station, with autocratic powers which would not be interfered with provided the material that they broadcast conformed to the same principles which govern the production of a newspaper, that is to say, they would have to refrain from broadcasting controversial or other matter which was libellous or contrary to the public interest.

The Choice of Editors.

The editors could be chosen with very varying political opinions, and it would probably be well that their opinions on most matters of controversy should be at variance. The editors could be responsible for all matter broadcast except, perhaps, the musical section of the programme, and need not confine their attentions to a station in one locality but could rotate around all the stations of the regional scheme in turn, thus 2LO might have talks on controversial matters in great variety organised by a series of programme editors, this variety being shared by all the other stations. In our opinion, it is only by some such scheme that the objections to the broadcasting of controversial matter can be overcome. So long as the programmes were all compiled under one authority, so long should we be in danger of a very definite bias pervading the broadcasts, particularly in the case of topics political or religious.

The UNIVERSAL H.T. BATTERY ELIMINATOR

An Instrument Suitable for A.C. or D.C. Mains of All Standard Voltages.

By N P VINCER-MINTER.

SOME time ago, in an article[1] describing the construction of a simple and inexpensive instrument for charging H.T. accumulators from A.C. mains, the writer expressed the hope that at some future date he would have the opportunity of describing a battery eliminator which he himself would be content to use as a substitute for his large capacity H.T. accumulators, and the present article is the fulfilment of that hope.

Hitherto, the writer has confined himself to the use of H.T. accumulators for experimental work, and for testing sets generally; an eliminator was out of the question, because if trouble occurred he could never be sure whether it was the eliminator or the set which caused it. He determined, however, to conduct experiments in order to produce an eliminator which, without the necessity of making up special components, could be used in conjunction with more or less any set. In the course of his experiments, which included the testing of many commercial eliminators, he came quickly to the conclusion that the fact that H.T. battery eliminators had acquired such a bad reputation among a large number of the listening public, was due to three things. The first was the existence of a large number of eliminators of thoroughly bad design, the second was the existence of a large number of sets of equally bad design, and the third, and perhaps the most important, was the attempt by the average listener to use eliminators of inadequate output for the particular receiver they possessed. These conclusions apply equally to A.C. and D.C. eliminators.

[1] *The Wireless World*, August 3rd, 1927, page 147.

General Causes of Eliminator Troubles.

With regard to the first cause of trouble with eliminators, it must be realised that some sets which give good results on H.T. accumulators are in reality badly designed and constructed, the set being almost on the verge of L.F. oscillation, and only requiring the added complication of a mains unit, or even in some cases requiring only the slight extra back coupling provided by a dry cell H.T. supply, to cause it to give trouble. With regard to the second cause of trouble, the writer is referring to

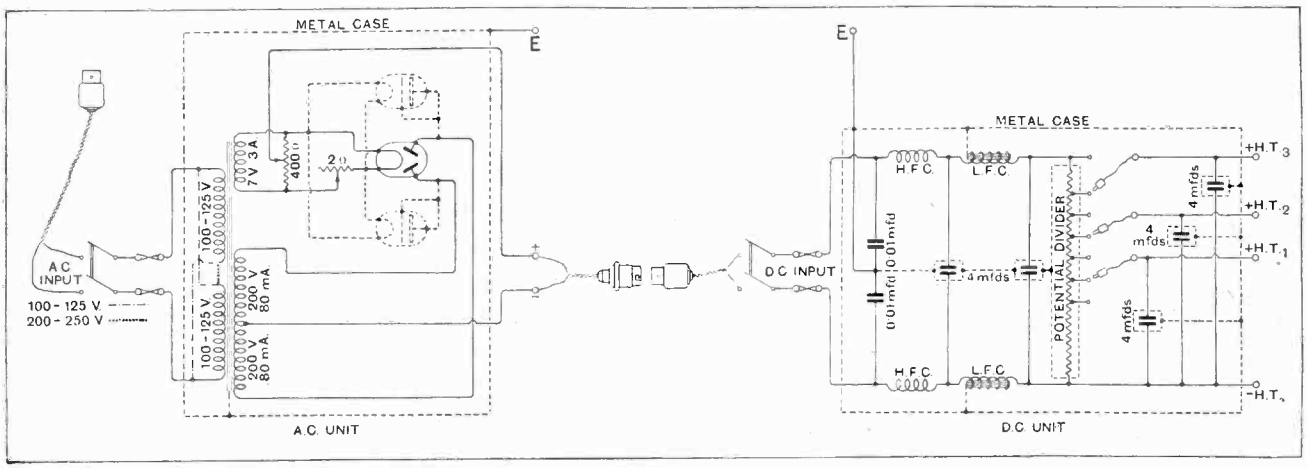


Fig. 1.—The theoretical circuit diagram of the whole eliminator. The dotted lines enclosing fixed condensers, etc., in the D.C. unit, represent their metal cases which should be "earthed" to the metal screens as explained in the text.

The Universal H.T. Battery Eliminator.—

cheap eliminators of thoroughly bad design or to home-made instruments using components showing an equal lack of technical knowledge on the part of their designer. This third cause is more common than many people suppose. A thoroughly well-designed eliminator may be purchased or constructed which will be perfectly capable of maintaining its rated output voltages on a moderate load, such as would be required by a two-valve set, but if used with a four- or five-valve set, the increased load causes the voltage to come down with a run, thus causing overload distortion in the receiver, and, at the same time, the smoothing chokes will be magnetically saturated and therefore severe "mains hum" will develop. In addition to this, if the eliminator is of the A.C. type, the small half-wave rectifying valve which will probably be used, will be ruined owing to the attempt to cause it to give more milliamperes than its designer intended. The power transformer will also probably become hot. Used on the load which the designer intended, the transformer, the rectifying valve, the smoothing chokes, etc., will behave in a manner which leaves nothing to be desired.

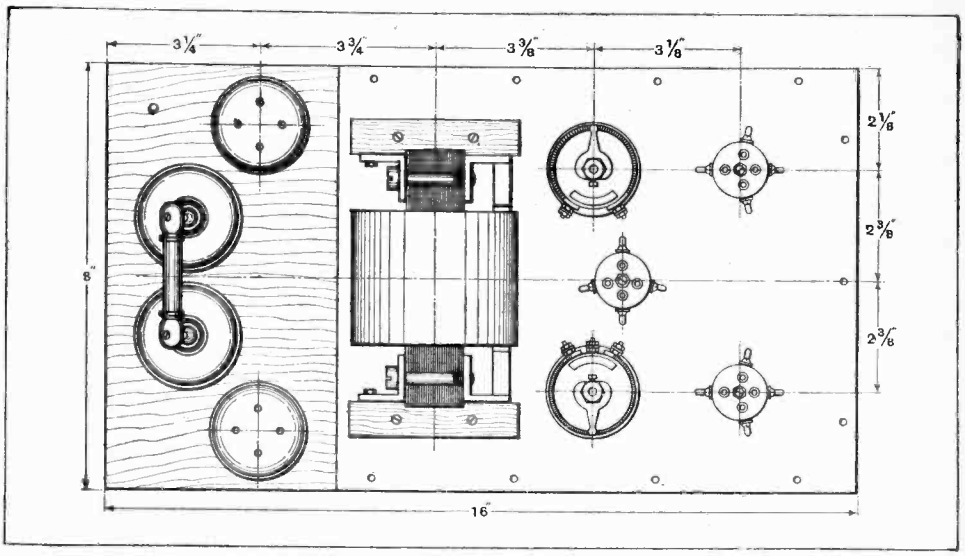
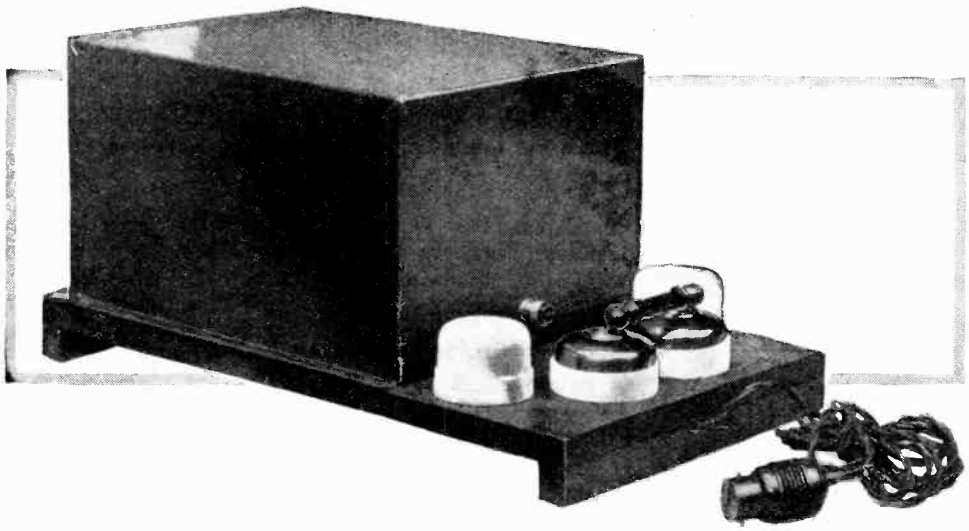


Fig. 2.—The layout of the A.C. unit. The white portion indicates the metal baseplate.



The A.C. unit with metal screen in position.

Ignoring both receivers and eliminators which are of thoroughly bad design, it will be seen, therefore, that the important rule in eliminator design is to see that it is capable of easily delivering the maximum output that the designer or user will at any time be likely to demand from it; moreover, a fair margin of safety should be allowed in order that the eliminator is not working at absolute maximum capacity, so that any slight unforeseen extra load will not upset everything. This means that we must build an eliminator according to the type of set which will be used with it, but does not mean, of course, that every set requires a special eliminator to be designed for it.

An attempt has been made to cater mainly for the average man, who uses something more ambitious than a "detector and L.F." set, but at the same time, limits his output to two super power valves in parallel. In brief, the eliminator will cater for a receiver employing two H.F. valves, a detector, and two L.F. stages with "paralleled valve" or "push-pull" output. The eliminator under discussion must thus cater with ease for six valves, including two "super-power" valves. In the matter of L.S.5A valves it is well to mention, for the benefit of those desiring a very large output, that this eliminator has actually been tested on an "Everyman Four" receiver, with two L.S.5 output valves arranged on the "push-pull" system. No hum was discernible in the loud-speaker, which was of the moving coil type, and therefore was more likely to reproduce it if present than would an "ordinary" loud-speaker, owing to the excellence with which the moving coil type reproduces the lower musical notes. Moreover, no "motor boating" occurred. To the man with a two-valve set only, the writer would say: Do not build this eliminator, but purchase a power trans-

The Universal H.T. Battery Eliminator.—

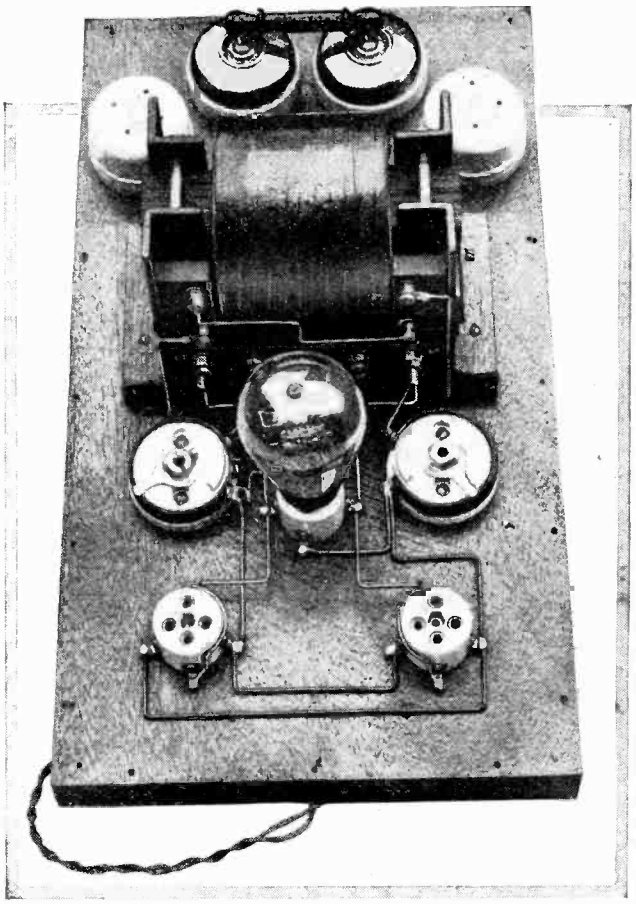
former, chokes, etc., of equal merit, but of less generous electrical characteristics, and follow the general design of this eliminator. If, however, it is intended later to purchase a more ambitious receiver, this eliminator will give you good results with your present receiver, and possess the advantage of not requiring to be rebuilt when the larger receiver is obtained.

The Question of Different Mains Voltages.

This instrument, in order to make its appeal as wide as possible, is so designed that it can be used equally well on either A.C. or D.C. mains, and upon any mains voltage—that is, upon any normal mains voltage found in this country, namely, 100 to 125 and 200 to 250. The apparently startling statement that the reason the instrument is equally useful, on either D.C. or A.C. mains, is simply explained by the fact that this whole eliminator is built in two units, for, of course, an A.C. battery eliminator is nothing more than a complete D.C. eliminator with certain extra apparatus added at the input end.

The reason why the complete eliminator is equally suitable for all normal voltages on its A.C. side is due to the use of a special power transformer with its primary wound in two sections, which are paralleled for 100- to 125-volt mains, and connected in series for 200- to 250-volt mains. This feature is clearly shown in both the theoretical and practical diagrams by the use of dotted lines, the significance of which everybody capable of constructing this or any other eliminator will have no difficulty in appreciating. Actually, the instrument shown is wired up with the two sections of the primaries in series, as it has been on 200-volt and 240-volt mains that the writer has actually conducted his experiments. It must be emphasised that this transformer is a standard commercial product obtainable through any wireless dealer, and is not specially made.

The maximum output of the transformer is 80 milliamps at 200 volts, the filament winding giving a maximum of 3 amps at 7 volts. This means that with a full-wave rectifying valve, which may be of the Marconi or Osram U.5 type, or any similar type by other manufacturers, we shall require a resistance in series with the filament, the value of this resistance depending upon the particular valve used. A so-called "fixed-variable" baseboard mounting rheostat can be used. Remember that the filament current of all these rectifying valves is well over an ampere, so that a rheostat designed to carry this current without overheating must be chosen. Actually, the Igranic "Pre-set" resistor of 2-ohms value was used by the writer. The correct setting of the resistor can either be made by means of an A.C. voltmeter, which is expensive, or by the equally accurate method with which all regular readers of this journal will be conversant;



Plan view of the A.C. unit.. Note the generous proportions of the power transformer.

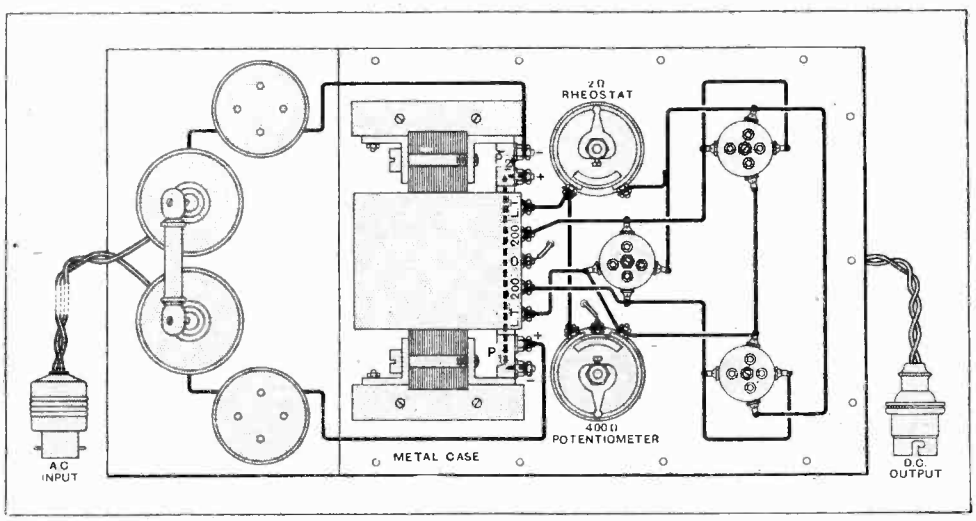


Fig. 3.—The A.C. unit practical wiring plan. For use on 100-to 125-volt mains the wire shown dotted should be removed and the two positive and the two negative terminals joined together respectively.

LIST OF PARTS.

A.C. UNIT.

1 Baseboard 16in. × 9in. × ⅝in.
1 No. 22 gauge black enamelled tinplate cover and baseplate (White Bros. & Jacobs, Ltd., 46, Chalk Farm Road, London, N.W.1).
1 Nickel-plated earth terminal (Belling & Lee).
2 Yards No. 52 nickel armoured "twin-flex" (C.A.V.).
1 D.P. switch.
2 Porcelain cut-outs.
1 Lampholder adaptor.
5ft. "Glazite" wire.
1 Lamp holder.
1 Power transformer, Type T.E.1 (W. Hamilton Wilson, 125 and 127, Red Lion Road, Tolworth, Surbiton, Surrey).
1 400 ohm potentiometer (Igranic).
1 2 ohm "Pre-set" fixed resistor (Igranic).
3 Porcelain valve holders (Athol).

D.C. UNIT.

1 Baseboard 23in. × 9in. × ⅝in.
1 No. 22 gauge black enamelled tinplate cover and baseplate (White Bros. & Jacobs, Ltd.).
1 Nickel-plated earth terminal (Belling & Lee).
2 Yards No. 52 nickel-armoured "twin-flex" (C.A.V.).
1 D.P. switch.
2 Porcelain cut-outs.
1 Lampholder adaptor.
5ft. "Glazite" wire.
5 4 mfd. condensers, 400 volts (T.C.C.).
2 0.01 mfd. mica condensers (T.C.C.).
2 Power chokes (Marconiphone).
2 H.F. chokes (Wearite).
4 Ebonite shrouded terminals, H.T.−, H.T.+1, H.T.+2, H.T.+3 (Belling & Lee).
1 15,000 ohm potential divider (Igranic).
3 Split-pin plugs (Lisenin).
1 Piece ebonite 7½in. × 1½in. × ¼in., for terminal strip.

Approximate total cost of both units, excluding metal covers, baseplates, armoured "flex," and rectifying valve, £9 : 15 : 0.
Approximate cost of D.C. unit only, £6 : 10 : 0.

In the "List of Parts" included in the descriptions of *THE WIRELESS WORLD* receivers are detailed the components actually used by the designer, and illustrated in the photographs of the instrument. Where the designer considers it necessary that particular components should be used in preference to others, these components are mentioned in the article itself. In all other cases the constructor can use his discretion as to the choice of components, provided they are of equal quality to those listed and that he takes into consideration in the dimensions and layout of the set any variations in the size of alternative components he may use.

this does not entail the expense of this instrument. This simple and well-known method has been checked by the writer against the precision A.C. voltmeter method, and it can be taken that it is perfecly accurate.

Briefly, the method is as follows :—The filament winding of the power transformer is temporarily disconnected, and a 6-volt accumulator put in its place; at the same time a voltmeter with a 0—6 scale is shunted across the rectifying valve filament; a cheap moving iron instrument will suffice. The eliminator and receiver are switched on, and the 2-ohm rheostat of the eliminator is adjusted until the normal working voltage is being applied across the rectifying valve filament, as indicated by the voltmeter. The reading of the normal "distortion indicating" milliammeter in the plate circuit of the last valve in the receiver is noted, and then the voltmeter, etc., is removed and normal connections resumed. It only remains to adjust the rheostat again until the same milliammeter reading is obtained.

No centre tapping is provided on the filament winding of the transformer, as the "electrical" centre will be displaced by the effect of the filament resistance. The electrical centre is, therefore, picked up by an ordinary three or four hundred ohm potentiometer, which must be adjusted *after* the filament resistance. A severe hum will be heard when the potentiometer is full over to either side, but this will disappear when the potentiometer is in the vicinity of the central position. The setting is quite flat and uncritical.

Modifications for Reduced Output.

With regard to the two valve holders on either side of the central one, into which the normal U5 type of full-wave rectifying valve is placed, these may normally be left vacant, and, in fact, since their insertion in the eliminator is optional, the connections to them are shown in the dotted lines in the theoretical diagram. The reason for their insertion is that many readers may not require so large an output as is given by a U5 valve. There are many half-wave valves upon the market, such as the U4, which will give an individual emission of 15 milliamps. Now if a half-wave valve of this type is thrust into each of the two "side" sockets, we shall be able to obtain full-wave rectification, even though the valves used are of the half-wave type. The output then will be 30 milliamperes, but nevertheless ample for a receiver of the "Everyman-Four" type, even though two parallel super-power valves of the D.E.5A class be used in the output. In the case of smaller sets, requiring much less than 30 milliamps., two ordinary D.E.5 type valves may be used in each side socket with perfectly good results. In fact, the writer has found that in the case of an ordinary detector and L.F. set there was no need to use anything more than two ordinary 5s. bright emitter valves. Two of these valves are capable of delivering a current in the neighbourhood of 10 milliamperes with less than 100 volts dropped across them, and therefore there is sufficient output to obtain good loud-speaker signals with a set of this class using, of course, a power valve in the last stage.

It must not be forgotten that all the above methods of valve arrangement have been fully tried out in the course of the experimental work connected with the design of the receiver. It might occur to some readers that since the U.5 type valve only gives a maximum output of 50 milliamperes, whereas the power transformer and smoothing chokes are designed to deal adequately with 80 milliamperes, it might be permissible to insert a rectifying valve into each side socket, and so increase the output in order to take full advantage of the current-carrying capacity of the transformer and chokes, thus enabling a large power amplifier to be operated from the eliminator. This could be done if two half- or full-wave valves having combined filament current requirements not exceeding 1.4 amperes, and an internal resistance approximately as low as the U.5 could be found.

(To be concluded.)

ANODE BEND OR GRID RECTIFICATION?

Some Practical Data on their Relative Merits.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

SO much has been said and written about both the anode bend and grid leak methods of rectification that a further article on the subject may seem at first sight to be rather superfluous. Of late there seems to have been a tendency to run down the leaky grid rectification in favour of the anode bend method, although the former method has enjoyed an almost clear field until recently. The present article is put forward with a view to showing, chiefly by the results of actual experiment, just how the two methods actually do compare under various conditions. Before proceeding to the discussion of the experimental results, it is desirable to see the main differences between the two methods.

Leaky Grid Rectification.

Fig 1 (a) shows the usual arrangement for this method. The input voltage (v) to the valve is passed first through a condenser C before being applied to grid and filament, and the latter are shunted by a high resistance R. Briefly, the operation is as follows: When there is no applied voltage between the input terminals X and Y, the current in the plate circuit of the valve, as indicated in the meter M, will have a certain definite value, depending on the characteristics of the valve, the H.T. voltage, the filament temperature, the value of the resistance R, and the position of the end (Q) of this resistance (*i.e.*, connected to minus or plus L.T. or to intermediate positions). When an alternating voltage v is applied between X and Y the effect is to make the *mean* potential of the grid more negative, the amount of the change of mean grid potential depending for a given circuit on the value of v.

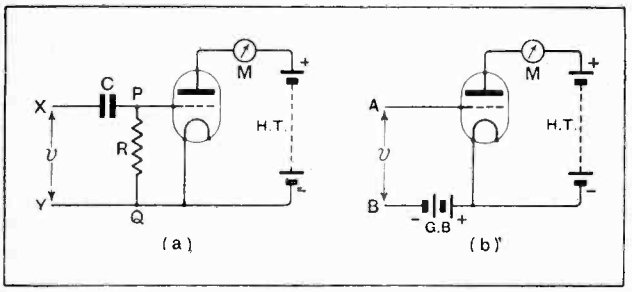


Fig. 1.—The circuit arrangements of (a) the grid leak rectifier and (b) the anode bend rectifier.

When the *mean* grid potential changes, the *mean* plate current will also change, and in this case will be reduced as the grid potential is more negative. Thus, for every value of v there is a corresponding value of mean plate current, and this method depends essentially on the flow of grid current to alter the mean grid potential and thus the plate current.

Anode Bend Rectification.

The circuit arrangement for this is shown in Fig. 1 (b). The input voltage v is applied to A and B, and the mean potential of the grid is kept fixed at some definite negative value by means of a battery G.B. (Note.—There will be a conducting circuit in practice between A and B.) With no input voltage the values of H.T. and G.B. are so chosen that the grid potential lies on the (lower) curved portion of the grid volt-plate current characteristic, as shown in Fig. 2. When an alternating voltage v is applied between A and B the grid becomes alternately more positive and more negative than it was before. When the grid is more positive the increase of plate current is much greater than the decrease corresponding to the grid being more negative, so that the final result is an *increase* of plate current, the amount of this increase for a given circuit depending on the value of v. This method depends essentially for its action on the curvature of the grid volt-plate current characteristic, and if the maximum or peak value of the input voltage v does not exceed the grid bias voltage, the grid will never be actually positive with respect to the filament, and thus grid current will not flow.

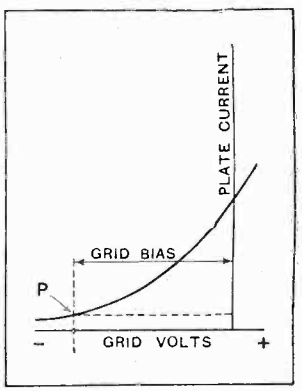


Fig. 2.—Showing the operating point P on the grid volts-plate current characteristic for an anode bend rectifier.

In the case of radio reception, where the power in the circuit across which the voltage v is developed is extremely minute, the necessity for grid current in the leaky grid method may involve a serious load on the circuit. Loading the input circuit is equivalent to increasing its H.F. resistance, thus reducing selectivity and lowering the voltage v available for a given input power.

The Effect of Loading.

In the case of the anode bend method, provided the grid bias is larger than the peak value of v, no loading due to grid current can occur. On the other hand, the leaky grid method is usually more sensitive than the anode bend, *i.e.*, the change of plate current for a given input voltage is larger for leaky grid than for anode bend.

From what has been said above, it will be seen that there is a possibility of obtaining the same *change* of plate current for a given input *power* by the two methods, since the greater sensitivity of the one method may be exactly offset by the reduction of available input voltage due to the loading. It will also be seen that without knowing the relative sensitivities of the two methods, and, as will be shown later, the "unloaded" input voltage, it is impossible to say which method will give the larger rectified current or will be the better to use.

Anode Bend or Grid Rectification?—

Experimental Results.

In order to compare the two methods, measurements of rectified current were made for similar voltages, the voltage in each case being developed across a circuit tuned to a wavelength of 500 metres. The voltage was measured by means of a dead beat reflecting type valve voltmeter (which is a specially constructed anode bend rectifier), and the power supply to the circuit was from a totally screened H.F. oscillator to which a very small coil, forming part of the tuned circuit, was loosely coupled. The arrangement is shown diagrammatically in Fig. 3. For the purposes of comparison, the resonant voltage across the circuit is taken, the main condenser C (Fig. 3) being adjusted in each case.

The curves of Fig. 4 show to the same scale the rectified currents for a grid leak rectifier with a 0.0003 mfd. condenser and a 2-megohm leak connected to the positive side of the filament, using a D.E.R (2-volt) valve, and for an anode bend rectifier with two separate grid bias values used under the same conditions as to valve and H.T. supply. These curves show that for this type of valve, at any rate, the grid leak method is vastly more *sensitive* than the anode bend method, but do not indicate the nature of the circuit loading introduced by the grid leak rectifier. A convenient way to represent the loading is to take the ratio of the resonant voltage with the rectifier disconnected to the resonant voltage obtained with the rectifier connected. If this be done, a very interesting state of affairs is seen to exist, namely, that this ratio is not constant, but depends on the input voltage, and actually *decreases* with increase of input voltage, thus indicating a lower percentage loading for large voltages.

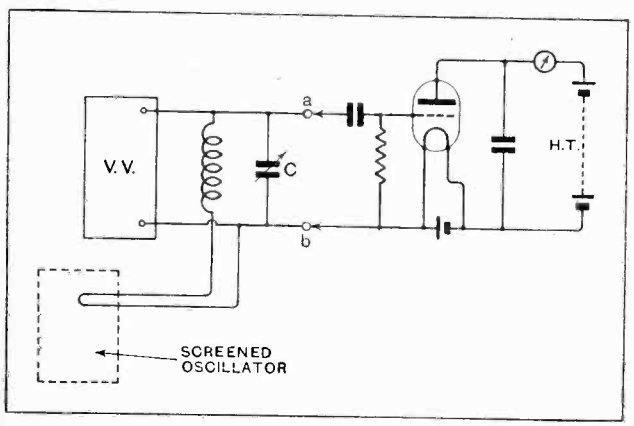


Fig. 3.—The circuit arrangement of the apparatus used for comparing the two methods of detection. The rectifier under test is connected to the points *a* and *b*, a grid leak rectifier being shown connected in the diagram.

Fig. 5 shows how the variation of the percentage loading due to the valve varies with the input voltage, and also how the actual grid current varies with the input voltage.

In the actual experiments the rectifiers under test used normal types of components, such as valve holder, grid leak holder, and grid leak, and a little load was introduced by these alone, as shown by the reduction of resonant voltage on connecting the rectifier complete, but with the valve filament not lighted. Part of this load, of course,

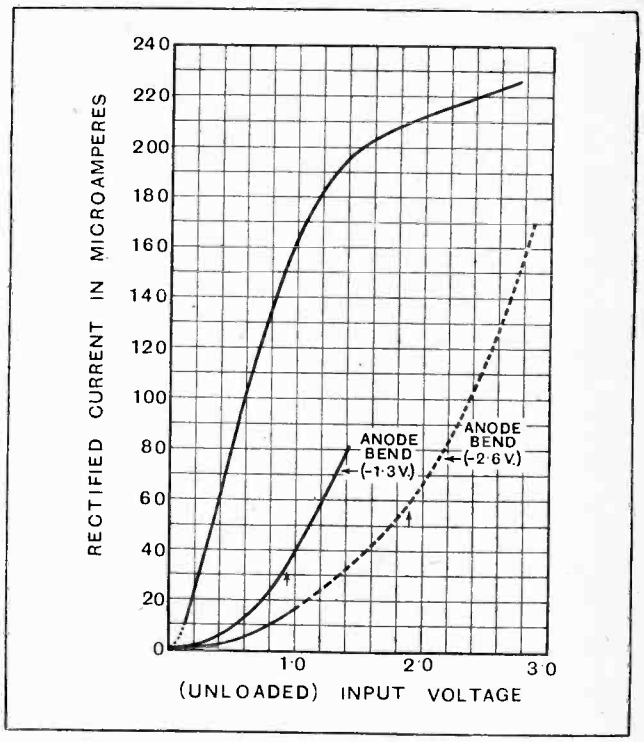


Fig. 4.—Input volts–rectified current curves for the two methods shown to the same scale. The arrows on the anode bend curves denote the point at which grid current commences.

is caused by the 2-megohm leak, and the rest by the solid insulating material of the various components.

Table I shows the relative loading due to the leak, the valve, and the rest of the components for the actual apparatus used.

TABLE I.

Remarks.	Resonant Voltage.	Ratio.
Filament side only connected (no valve, no leak)	2.63	—
Both input terminals connected (no valve, no leak)	2.53	1.04_0
Ditto, with 2-megohm leak	2.50	1.05_4
Ditto, with leak and valve (filament out)	2.50	1.05_4
Ditto, with leak and filament alight	2.41	1.09_3

It appears, then, that there is a constant load of approximately $5\frac{1}{2}$ per cent. due to the components, exclusive of the valve—and of course this load, less about 1 per cent. for the grid leak, will be present in the case of the anode bend rectifier. The writer does not wish to start any arguments as to the quality of the components used, and so refrains from naming them, but it is sufficient to say that some introduce less loading and some more than the particular ones chosen. The load due to the grid leak is, of course, unavoidable in the case of the leaky grid rectifier.

In Fig. 5 the percentage loading due to the valve is obtained by making due allowance for the constant load

Anode Bend or Grid Rectification?—

referred to above. In order to show more clearly why the percentage load decreases with increase of voltage for leaky grid rectification, it is instructive to find the mean grid potential by taking the product of the grid current (see Fig. 5) and the leak resistance, which gives the actual voltage drop across the leak and hence the potential of the grid with respect to the positive end of the filament, to which the leak is connected. The true value of the leak used was 2.14 megohms and the variation of voltage across the leak for various input voltages is shown in Fig. 6. The horizontal line at 2 volts represents the potential of the negative end of the filament to the positive end (*i.e.*, the end to which the leak is connected), and as this line crosses the mean voltage curve for an input voltage of about 0.5, it follows that the grid is actually positive (to the negative end of the filament) for even more than half a cycle below this voltage, so that grid current damping occurs for this period, while for larger input voltages the grid is only positive (*i.e.*, grid current only flows) during part of half a cycle. This shows why the percentage loading due to the valve might be expected to decrease as the input voltage increases. For moderate voltages of the order of 0.5 to 2 volts the extra sensitivity of the leaky grid method, using normal type valves, would appear to outweigh the extra loading introduced in a very large number of cases.

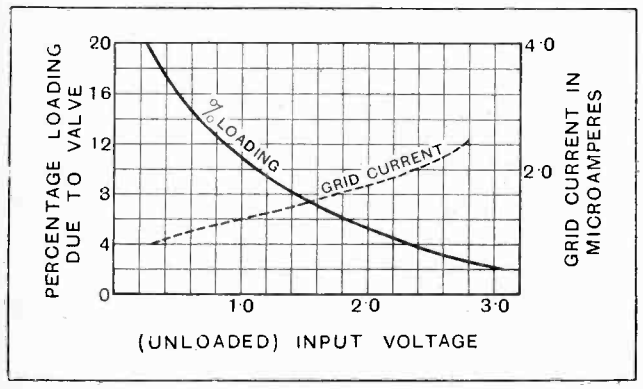


Fig. 5.—Showing the percentage loading due to a grid leak rectifier as the input volts are varied.

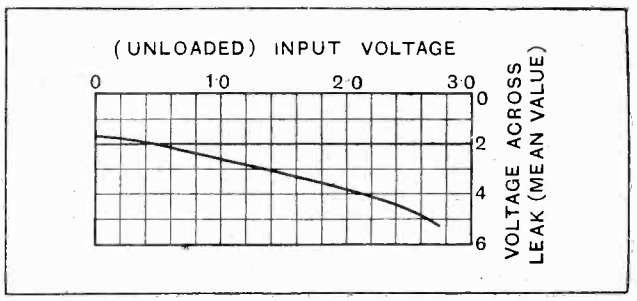


Fig. 6.—Showing the variation of mean grid potential with variation of input voltage.

Lest it should be objected that these voltages are on the high side in reception work, it may be remarked that voltages of this order are far from uncommon, especially nowadays, with the many powerful stations operating, when a reasonable amount of reaction is used.

Short-wave Stations.

Since the publication on February 8th of the list of short-wave transmissions, we have received particulars of a few additional stations and corrections of one or two errors. We cordially welcome all letters from correspondents which will enable us to revise and maintain up to date the record kept of stations throughout the world transmitting regularly on wavelengths below 100 metres. Alterations in these wavelengths are frequent, and it is obviously impracticable for one individual to keep accurate track of them all.

The following list supplements and corrects the information published on February 8th, and we hope, with the aid of our readers, to print further particulars from time to time :—

CJ	Drummondville, Montreal, 24.793 metres.
VIY	Ballan, Melbourne, 24.985 metres, working with CF and CJ.
GKT	Burnham Radio, 22 and 37 metres, working with ships.
WVA	Washington, 36 metres.
VIS	Sydney, 27.5 metres.
VIP	Perth, 28 metres.
AGJ	Nauen, 23 metres, in addition to the wavelengths already given.

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Corrections.

Hanoi HVA and Saigon HZA use the call-signs HVA1 and HZA1 when working on short-waves.

TRANSMITTERS' NOTES AND QUERIES.

PCG should read "Kootwijk Meijendel, Holland," and not "Malabar, Java."

PVC should read PJC as the call-sign for Curacao.

Abu Zabal (Cairo) is now using the call-sign SUW in place of SUC2.

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I.A.R.U. and R.S.G.B.

For some considerable time communications have been passing between the headquarters of the International Amateur Radio Union at Hartford, Connecticut, and the Incorporated Radio Society of Great Britain, with the object of a complete fusion between the British section of the I.A.R.U. and the R.S.G.B., and the removal of any possibility of friction which might weaken the unity of national effort. The matter was somewhat delayed while negotiations were being considered for the fusion of the R.S.G.B. and the T. and R. Section, and because the original constitution of the I.A.R.U. did not admit of direct amalgamation with any internal society such as the R.S.G.B.

The fusion of the R.S.G.B. and the T. and R. is now firmly consolidated, and the constitution of the I.A.R.U. has been amended so that membership of the Union may consist of the national amateurs' radio societies. It is therefore proposed to amalgamate the existing British section of the I.A.R.U. with the R.S.G.B., thus bringing the latter society into a position to become a full national section of the I.A.R.U. Membership of the R.S.G.B. will also carry full membership of the I.A.R.U., and the present anomaly of two societies with identical objects in the same country will cease.

The main objects of the International Amateur Radio Union are the promotion of two-way radio communication between amateurs of the various countries of the world; the effecting of co-operative agreements between National Amateur Radio Societies of the various countries of the world on matters of common welfare; the advancement of the radio art; the representation of two-way amateur radio communication interests in international communication conferences; the encouragement of international fraternity and the promotion of such additional activities as may be allied thereto.

The Manufacture of Single and Stranded Conductors.

TO dilate on the extreme importance of wires in wireless would seem somewhat of a paradox. It is nevertheless obvious from a cursory inspection of any receiving or transmitting plant that the wireless amateur must indeed possess a knowledge of the handling of instrument wires. When readers are occupied in the wiring of a set or the winding of a coil it is doubtful whether they have paused to consider the intricate processes and the magnitude of the plant involved in the drawing of wires from crude metal. It may therefore be of interest to give a general description of the works of Messrs. the London Electric Wire Company and Smiths at Leyton, to whom we are indebted for giving facilities for a visit by a member of our staff.

The Refining of Copper.

Any discussion on wire must necessarily involve a short description of the refining of copper, since this metal, due to its low resistance to the passage of electricity, is extensively used in all electrical industries. Silver has a lower resistance, but its cost precludes its general use in commercial apparatus. To obtain the necessary high conductivity of copper for industrial use it must be 99.96 per cent. pure, oxygen and sulphur being the chief impurities. The majority of copper is electrolytically refined, the metal in the crude state being cast into large plates which form the positive electrode in an electrolytic vat in which a copper sulphate electrolyte is used. The copper is deposited on the negative electrode and is termed "cathode copper." Among the impurities there are considerable quantities of silver and some gold and platinum which are left behind in the "mud" and are extracted.

Due to the inclusion of some of the sulphate from the electrolyte, the "cathode copper" contains a certain amount of sulphur, and is not in a suitable condition to be worked. The removal of this sulphur is accomplished by scarifying the molten metal by blowing air through it, the sulphur being oxidised and passing off as sulphur dioxide gas. The copper, however, becomes oxidised during the process, and is subjected to "poling," which is an ingenious means of reducing the copper oxide to copper by the action of carbon; birch poles about 10in. in diameter are thrust into the molten metal and provide the carbon, while acceleration of the action results from the evaporation of the sap of the tree, which also causes a vigorous stirring action. "Poling" is continued until there is about 0.03 per cent. oxygen left, and the molten copper is then cast into wire bars of approximately 4 sq. in. cross section. It should be pointed out that the small percentage of oxygen is purposely left in the copper, otherwise, should a greater degree of purity be attempted, the copper may be of the wrong "pitch" and be incapable of being worked satisfactorily. The wire bars are heated to bright red heat and passed through grooved rolls, each pass reducing the size of the bar until it becomes a rod about $\frac{1}{4}$in. diameter. The action of the air on the hot metal covers it with a thin layer of black copper oxide. Pickling in hot sulphuric acid cleans the rods, which are now ready for drawing to any size wire of lesser diameter. Fig. 1 shows diagrammatically the successive manufacturing processes involved in the manufacture of copper wire from the natural ore.

Wire-drawing is extremely interesting, and consists essentially of pulling wire through successively smaller holes until the desired diameter is obtained; the holes in

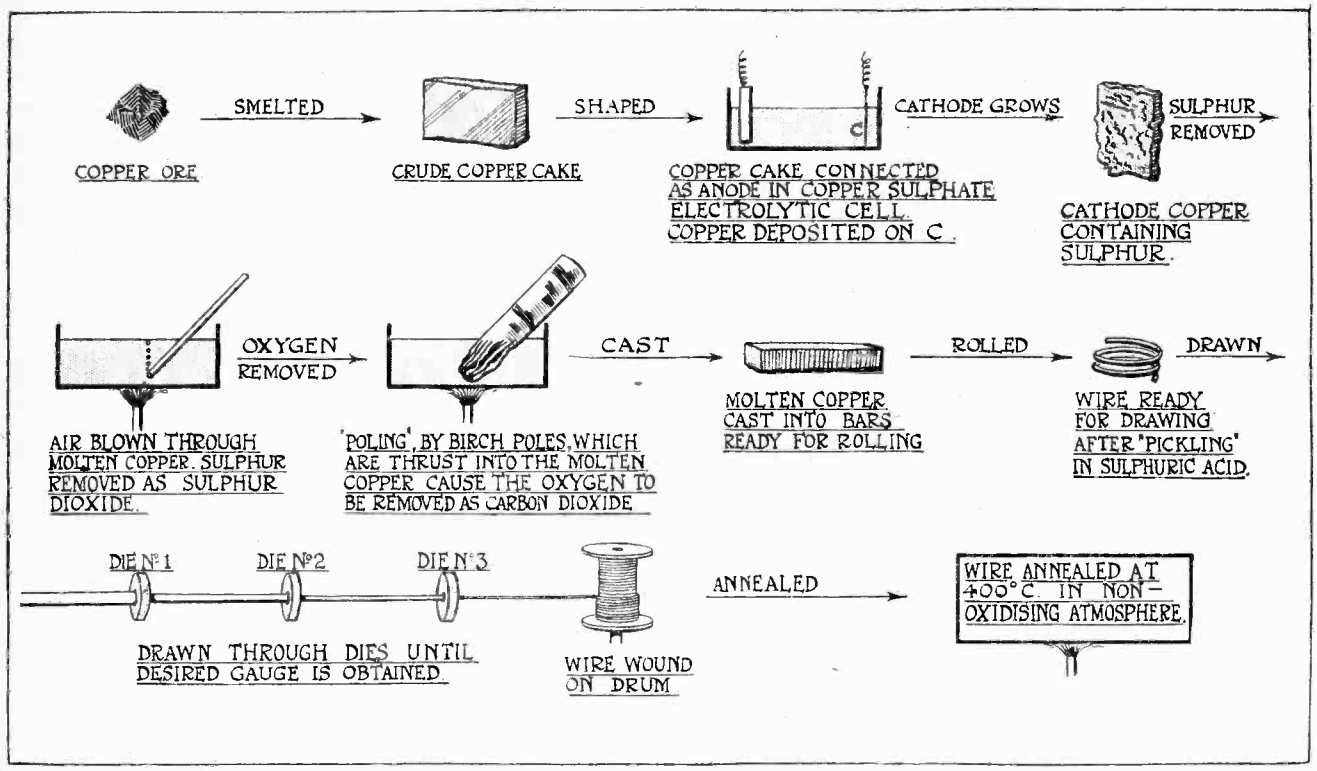

Fig. 1.—Schematic diagram showing successive processes involved in the manufacture of copper wire from crude copper ore.

practice for wires smaller than No. 16 gauge are highly accurately ground diamond dies set in steel housings, and their action is of a wedging or squeezing nature, whereby the wire of larger diameter is drawn through a well-polished aperture which gradually converges to the required size. No cutting of the wire occurs, and no particles nor shavings of metal are thrown out. A sectional drawing of a typical die is shown in Fig. 4, the wire enters at A and emerges at B with a smaller diameter. It is most important to see that the strain imposed on the wire by the drawing motor is less than the tensile strength of the wire concerned, and it is therefore necessary to arrange that each die only reduces the diameter by a small amount, otherwise continual fracture of the wire will take

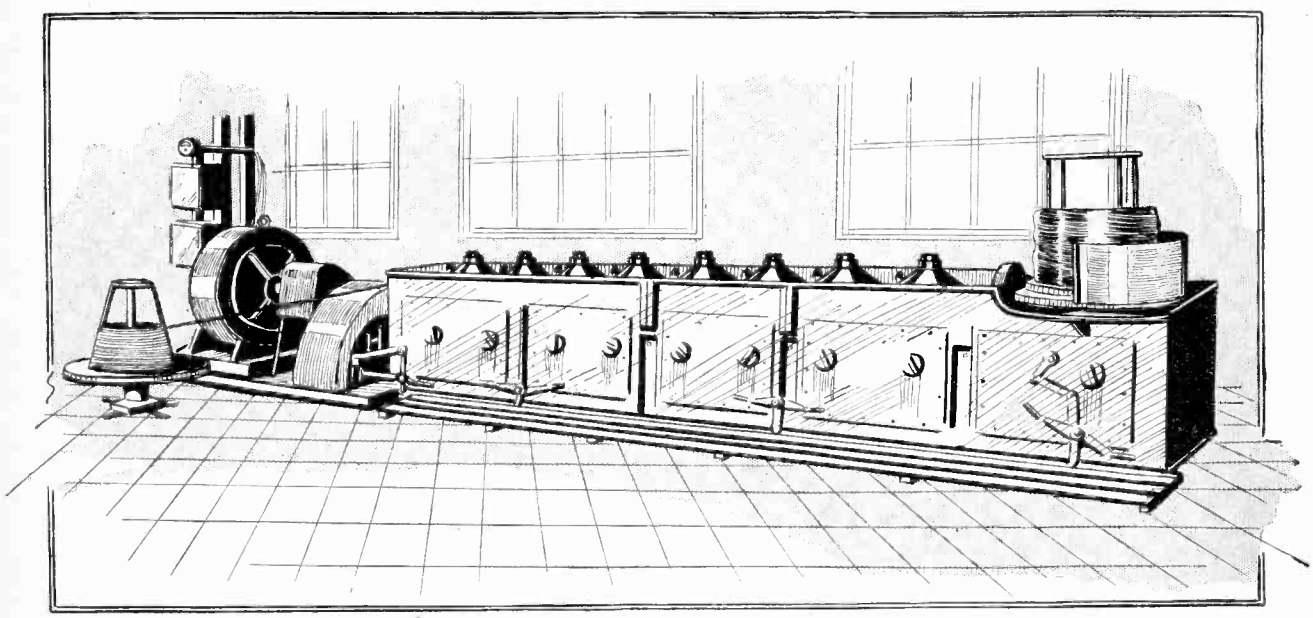

Fig. 2.—A typical wire-drawing plant. A 1/4in. rod shown on the left is being drawn round 8 rollers and through 8 dies to effect a reduction to No. 16 gauge.

Instrument Wires.—

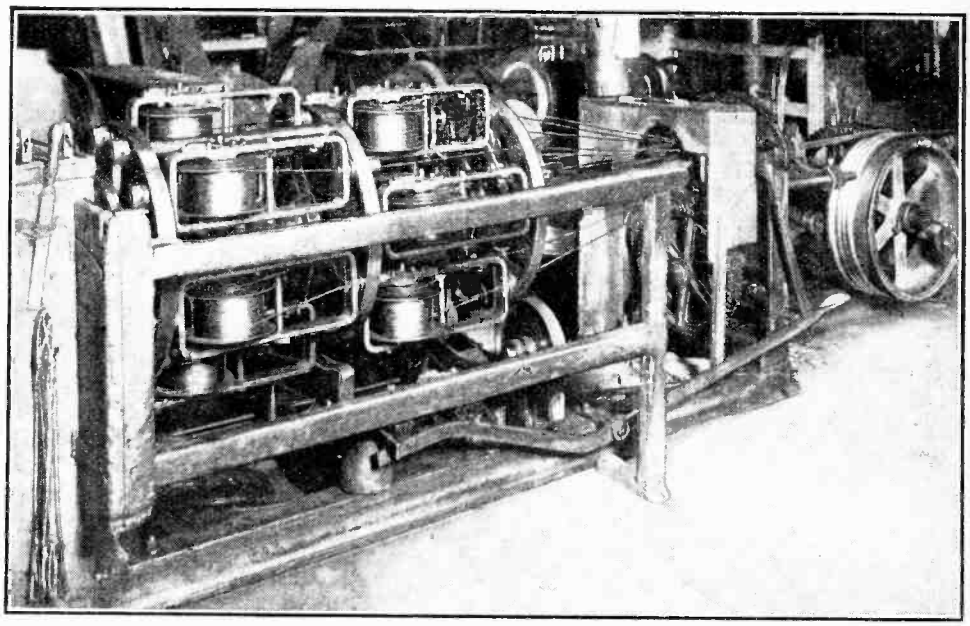

Fig. 3.—A stranding machine. The cage containing the spools of wire rotates as a whole but the axes of the spools remain vertical.

place. A wire-drawing plant is shown in Fig. 2, and to avoid straining the wire unduly it will be seen that there are eight rollers in conjunction with eight dies to reduce the $\frac{1}{4}$in. rod to 16 gauge wire of approximately $\frac{1}{16}$in. diameter. The drum on the right, which is drawing the wire of required final gauge through the machine, is driven by a shaft from the 60 h.p. motor seen on the left; the wire and dies are immersed in a lubricant of soap and water. The drawing of finer wires up to 50 gauge is carried out on the same principle, but with relatively smaller apparatus. The action of drawing copper wire is to harden the metal and incidentally to increase its electrical resistance by 2 per cent. over that of the soft wire. It is therefore necessary to anneal the wire by heating it for a considerable period to about 400° C. in a furnace containing a non-oxidising atmosphere.

A brief reference to the properties of the more generally known resistance wires, which are drawn in much the same way as copper, should not be omitted, as a number of radio components in everyday use contain them. The most commonly used alloy is Eureka, which consists of copper and nickel, has a resistance about twenty-eight times that of copper, and is consistent and permanent in its properties. Nichrome, consisting of nickel, chromium, and iron, has a higher specific resistance than Eureka, and is fifty-eight times that of copper; it can be worked at a higher temperature, but, being hard, is somewhat difficult to handle. Manganin, an alloy with a resistance twenty-four times that of copper, is especially valuable for use in precision instruments, but, since it is liable to oxidise, a protective layer of varnish is necessary.

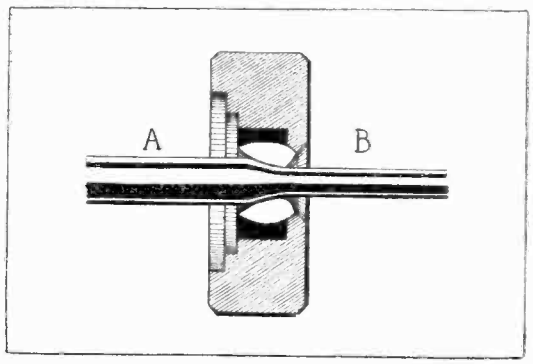

Fig. 4.—A diamond die. The wire enters at A and by a wedging or squeezing action emerges at B at a smaller diameter.

A great deal of interest at the present time is centred around the use of multiple conductors for winding coils; a description, therefore, of the various methods of stranding will be given. Whenever wires are twisted together, it is essential that no single conductor be twisted about its own axis. Therefore, any spool or bobbin, containing a single wire destined to form part of a multiple cable, is arranged to rotate in a cage, at the same time unwind and yet retain a vertical axis throughout. Fig. 3 shows a machine stranding no fewer than 501 members of 20 gauge wire, the resulting flexible cable being about 2in. in diameter. A conductor, which is the product of helically winding any number of strands, is said to be "bunched," and is exemplified by ordinary flexible twin lighting wire (see Fig. 5A). If a number of wires be wound round a central conductor, the resulting cable is known as "concentric" (see Fig. 5B), and the stranding

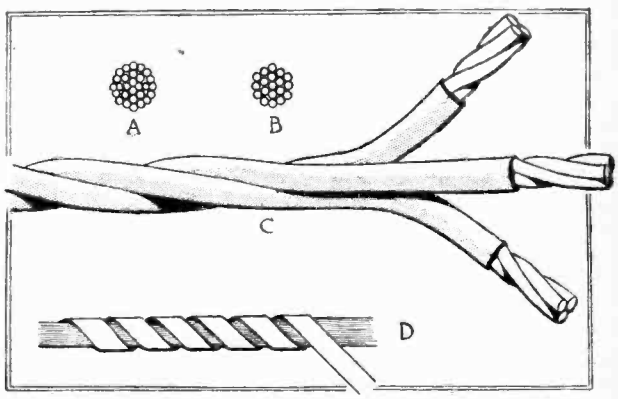

Fig. 5.—Various stranded cables. A is a bunched conductor. B is a concentric conductor of regular formation with adjacent helices wound in opposite senses. C is a nine-member Litz wire with each group of three shown covered to make the illustration clearer. D is a single telephone tinsel.

Instrument Wires.—

of a series of this type produces a "roped" conductor. Adjacent helices in a "concentric" conductor are usually wound in opposite senses, so that, should a twist be given to the cable, no lengthening takes place. Fig. 5D shows a single member of a telephone tinsel in which copper strip is wound round a central cotton strand: the flexibility of loud-speaker cords is due to the use of multiple tinsel.

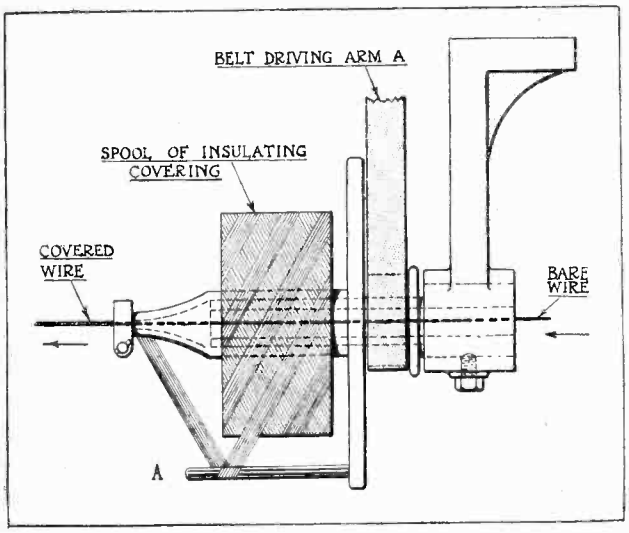

Fig. 6.—An insulating machine in which a tape of cotton strands is rotated round the wire by arm A.

Due to the tendency of high-frequency currents to run on the exterior of a conductor rather than in its centre, it is found advantageous to wind H.F. inductances of stranded wire, so that maximum surface per given over-all diameter of cable is obtained. It is, further, of importance that each strand should take up all possible positions in the cable in order to pass through every field intensity. To conform to these desiderata it is found necessary to take a cable of three twisted wires and strand it with two other such cables, and again to take the cable of nine wires resulting from the last operation and strand with it two other such cables of nine wires until the desired number of strands (a power of three) is obtained. The cable under discussion is known as Litz, and, although it can be constructed of a number of wires which is a power of two, the separate operations entailed in manufacturing a large cable are too numerous to be a satisfactory commercial proposition; by using a four-wire unit in a power-of-four conductor there is always the chance of one wire becoming "concentric" due to uneven tensioning in the stranding machine, and causing the other three wires to wind round it. The potentialities of plaiting the component members of Litz wire forms a subject which often comes up for discussion. It is probably somewhat easier to plait a cable in which each member passes through every field intensity the maximum number of times per given length of conductor, but this efficiency can so nearly be attained by small-pitch stranding that, together with the danger of chafing of insulation during winding, it must be admitted that the production of plaited Litz is hazardous and costly from a commercial standpoint.

The cotton and silk insulation of wires is a laborious process, and occupies comparatively a very large floor space; one room, in which fine wire is being silk-covered, is shown in the title illustration to this article. Fig. 6 is a sectional drawing of a typical cotton or silk-covering machine in which a tape of about ten threads is held in tension and rotated by the arm A at high speed around the wire, which is drawn slowly through the centre of the spool of insulating material. Enamel insulation of wire is carried out in long ovens wherein it is arranged that the distance a wire has to travel after it has been dipped into the enamel bath, and before it touches the first pulley, is sufficiently great to ensure its drying; the rate of progression of the wire and the temperature of the oven are of paramount importance in producing a uniform insulation which is sufficiently flexible when dry to allow the wire to be bent round an acute angle without cracking the enamel.

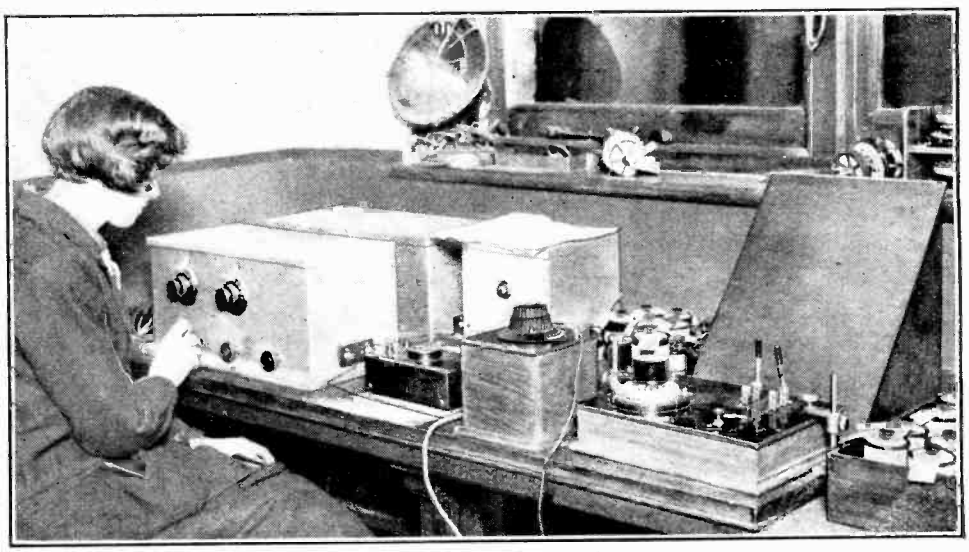

Fig. 7.—Corner of a coil-testing room. To ensure uniformity in inductance, sense of winding and insulation resistance the valve voltmeter is extensively employed.

The London Electric Wire Company and Smiths, Ltd., have designed and are exploiting a series of finished coils, the majority of which are wound with Litz wire; Fig. 7 shows a corner of the coil-testing room, where the valve voltmeter is extensively used to obtain accurate calibration of inductance values so that the purchaser may be assured of uniformity of design.

W. I. G. P.

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Another Suggestion.

By DALLAS BOWER.

DESPITE the suggestions from the many distinguished persons in the world of radio, the problem of station identification remains little advanced. The B.B.C., as usual, is intolerant of the subject, so the solution must be left to those who desire to see it on a satisfactory basis. Sir John Reith has said it is all wrong to give the public what it wants; so, having grasped the full meaning of such an attitude, Mr. P. P. Eckersley's views on the particular subject of station identification are not surprising.

Mr. Léon Deloy's article in the issue of February 1st puts forth an interesting suggestion, but one which the average individual would not tolerate. Prosaic man is insufferably lazy if he can be, and one cannot see him going to the trouble of identifying a station by copying down its Morse signal on a piece of paper and then deciphering it into letters. What is wanted is a system which will immediately identify a station with the assistance of its published programme. Morse signalling does not fulfil this end; it only complicates the situation. Numerous suggestions have been made for the utilisation of various peculiar sounds, and in some stations those suggestions have actually materialised; but it seems to be an exceedingly crude and generally unsatisfactory way of solving the problem.

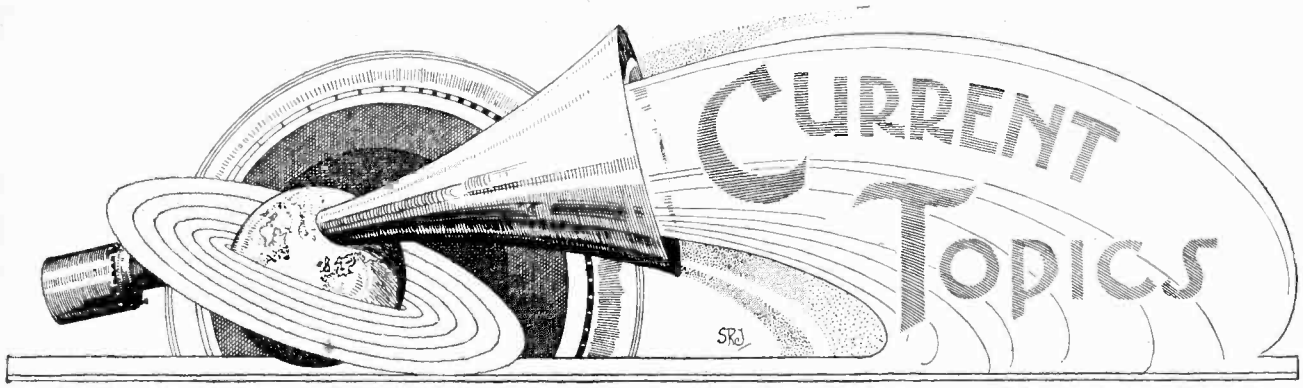
Greek Letters as Call Signs.

Practically everyone with any education at all has a rudimentary idea of the Greek alphabet, and one suggests that its application would be something near a solution to station identification, at any rate, in so far as the continent of Europe is concerned. We have twenty-four letters with which to juggle, and the sound produced by speaking those letters is the same in all languages. Suppose, now, we allot one letter to each country, viz., Spain might be given *beta*, Germany *omega*, and so forth. Every station in any particular country would transmit after each item, through the medium of the announcer's voice, the national letter followed by a definite number of long dashes on a buzzer, the number being determined by the station's seniority according to power rating. To make the suggestion more concrete, take a definite case. Assume for the sake of argument that the letter allotted to Holland is *gamma*. Hilversum, therefore, after each item on its programme would give the call *gamma*, followed by two long dashes on a buzzer in the studio (the instrument being operated by the announcer), indicating he is the second most powerful station in Holland. On referring to his published list, the listener would see against Hilversum—*gamma*, two dashes. Hilversum may not necessarily be the second most powerful station in Holland, but it is cited here purely for example. The scheme is practical up to the tenth station in a country, according to power rating. After that, the time taken to transmit the buzzer dashes would be too long and would become tiresome and annoying.

Power Indicated by Call Sign.

It will be argued immediately by the technicians that so many stations use the same power and that dash identification, according to power rating, would not be satisfactory on that count. Although two stations may use the same power input, it is only by fluke if they both put exactly the same power into their respective aerials, due to obvious technical differences which need not be gone into here. Every station engineer should know, and no doubt does, the power his transmitter is putting into the aerial, so the solution to the problem is to reckon on a basis of power output. As far as one can see at present, the suggestion only represents the allocation of a Greek letter to each European country within the administration of the Union Internationale de Radiophonie, and the grouping of stations in proper order according to output power rating, together with the supply of a powerful standard buzzer giving, say, a thousand cycle note. The scheme would only apply to the more powerful stations of a country, as after ten it becomes impractical, as mentioned above; but if a country possesses a large number of stations the great majority of very low-powered stations need no consideration because they feed a very limited area which is purely of a national character.

This ingenious suggestion of making use of the Greek alphabet as an international language, so as to permit of a combination of letters and figures, introduces the need for the production of both speech and buzzer signals. If only buzzer signals are used as outlined in a recent Editorial then the station identity signals can be automatically interposed in intervals in the programmes. Readers' suggestions would be appreciated on this subject.—EDITOR.



Events of the Week in Brief Review.

WIRELESS WEEK IN ESTHONIA.

The present week is being observed in Esthonia as "Wireless Propaganda Week," and the first National Wireless Exhibition is proceeding at Reval.

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PCJJ: AN EXCLUSIVE PHOTOGRAPH.

PCJJ, the famous Dutch short-wave station, now transmits regularly three times a week, on Tuesdays, Thursdays, and Saturdays. The times of transmission are as follows: Tuesdays and Thursdays, 15.00-19.00 G.M.T.; Saturdays, 14.00-17.00 G.M.T. The wavelength is 30.2 metres. The first published photograph of the transmitting plant, hitherto veiled in the closest secrecy, appears on p. 202 of this issue of *The Wireless World*.

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TELEPHONES ON NORWEGIAN TRAINS.

A regular train telephone service is to be instituted on the new railway between Krageroe and Oslo. At a recent demonstration officials of the Norwegian Broadcasting Company equipped two compartments of a coach with transmitting and receiving equipment, and during the journey telephone conversations were conducted between train and termini on a wavelength of 84 metres.

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TELL-TALE AERIAL.

The sudden appearance of a new wireless aerial on a bungalow at Biggin Hill, Kent, led to the arrest last week of an alleged housebreaker. At the Bromley Police Court, Mark Eastwood, the owner of the bungalow, was charged with breaking into another bungalow and stealing a wireless set. Eastwood was remanded.

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INTERFERENCE BY TRAMS.

The Postmaster-General has written to Mr. Walter J. Baker, M.P. for East Bristol, in reply to complaints made by Bristol residents of interference with broadcast reception by tramcars.

The letter states that experiments to overcome this kind of trouble have been undertaken on the Continent and in this country in co-operation with the tramway and broadcasting authorities, and that the results have been encouraging.

THE NEW STATIC.

A householder at Towcester, Northants, recently complained to the Rural Council that his neighbour was pumping smoke through the party wall by means of his wireless set.

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EDISON ON TELEVISION.

"Television is remarkable, but hardly applicable, in my opinion, for general use."—Mr. T. A. Edison, at a Press interview on February 11th, on the occasion of his 81st birthday.

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WIRELESS ON RE-DISCOVERED ISLAND.

An interesting sequel to the recent "dispute" between the British and Norwegian Governments concerning the ownership of Bouvet Island in the South Atlantic, is provided by the news that Lars Christensen, the explorer who rediscovered the island a few weeks ago, has taken steps to erect a meteorological wireless station there. The station should be able to supply valuable weather forecasts to all shipping in the South Seas. It is understood that Mr. Christensen proposes to finance the enterprise.

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PARIS WIRELESS SHOW.

A wireless section is to be an important feature of the Foire de Paris, to be held from May 12th to 28th, 1928.

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ELECTRICAL TREK TO THE NORTH.

The Institution of Electrical Engineers proposes to hold this year's summer meeting in Norway, with a visit to Tröllhätten, in Sweden, on the return journey.

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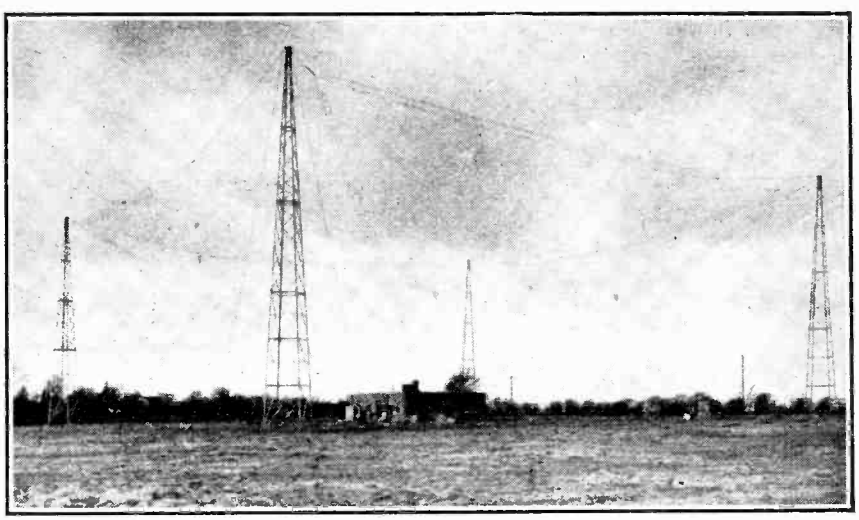
A PIRATE'S ENTHUSIASM.

An unlicensed transmitter was fined £10 and five guineas costs at the Rochdale Police Court on February 9th. The accused, John Butterworth (21), of Castleton, Rochdale, pleaded guilty to the two charges of installing and operating a transmitting set without a licence.

For the Postmaster-General, Mr. Frank



AIR PORT WIRELESS. A general view of the Air Ministry transmitting station at Mitcham, constructed by the Marconi Company. This station, which is operated from the Croydon Aerodrome, was fully described in our last issue.

Elliott said that Butterworth was refused a licence in 1925. Early in 1927 it was discovered that a number of people were transmitting wireless messages to each other with call signs to which they were not entitled, viz., 6JF, 2LC, 2AUC, 2EBU, and 2RL. After investigations suspicion fell on Butterworth, who was thereupon detected in the act of transmission. He was given a caution and promised to dismantle the set, so no action was taken. Four months later, however, further unauthorised transmissions were detected, and soon afterwards a particular message was traced to Butterworth's house.

In pleading guilty, Butterworth said, "I have been overcome by my enthusiasm for wireless telegraphy."

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FRENCH GOVERNMENT BROADCASTING SCHEME.

The future of broadcasting in France is still undecided pending a full official enquiry. In the meantime the broadcasting interests are being permitted to continue their activities, though this concession has only been granted after strong protests against the earlier edict that all private broadcasting must cease on February 1st.

A Paris correspondent states that official plans provide for the division of the country into eighteen "transmission districts," each served by its own Government station. In Paris, Bordeaux, Grenoble, Lille, Limoges, Lyons, Marseilles, and Toulouse official stations are already in operation. It is expected that each station will eventually have a power of 3 kilowatts.

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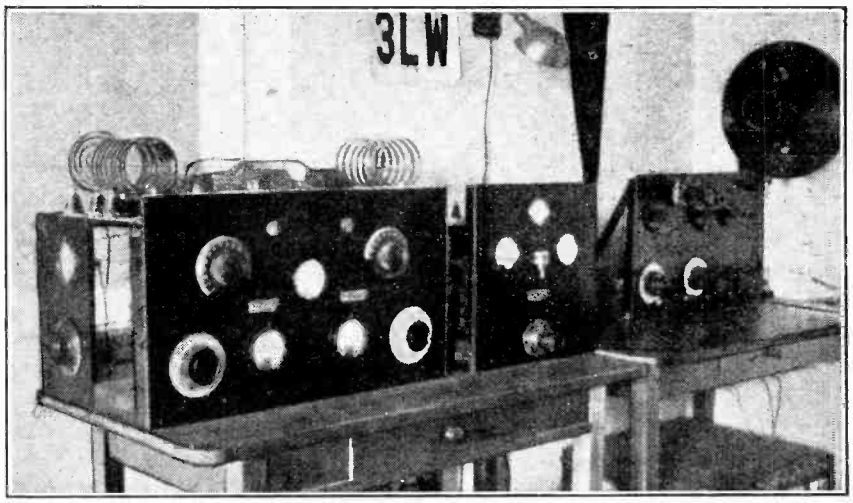
GERMANY 'PHONES TO AMERICA.

A notable extension of the Transatlantic telephone service took place on February 10th, when service was opened between the United States and Berlin, Frankfurt, and Hamburg.

Conversation to America from Germany passes over the Anglo-Continental cables to the London Trunk Exchange and thence by land line to the Rugby wireless station. Speech from America is received at Cupar, in Scotland, passing from there through the London Trunk Exchange to the sea cables. During the past month the service has been made available to towns in Belgium and Holland, and we understand that further European extensions are contemplated.

BRISTOL WIRELESS TRADE.

A Radio Traders' Association has been formed in Bristol.



AMATEUR TRANSMISSION IN THE UNITED STATES. A typical American short-wave transmitter, NU 3LW, owned by Mr. H. A. Robinson, of Willow Grove, Pennsylvania. Power up to 1 kilowatt is used, American amateurs not being under the same power restrictions as the majority of their British cousins.

FRENCH ARMY AND GERMAN BROADCASTING.

A reminder of the influence still exerted by the French Army of Occupation in Germany comes with the news that the new broadcasting station at Kaiserslautern is limited to a power of two kilowatts by order of the French military authorities. If it is found that no interference is caused with French military communications permission will be granted to increase the power to four kilowatts. The Kaiserslautern station, which opened on February 20th, works on a wavelength of 204.1 metres, relaying programmes from Stuttgart, Mannheim, and other stations in the neighbourhood.

ARE THERE "PIRATES" IN CANADA ?

Statistics prepared at Ottawa go to show that there are approximately 208,000 licensed receiving sets throughout the Dominion, but it is strongly hinted that the actual number of receivers in use is far in excess of this figure. A motor car "round up" has been quietly proceeding for a number of months, and in some cases the Royal Canadian Mounted Police have proved helpful in tracking offenders.

BOOKS RECEIVED.

Wireless Principles and Practice. By L. S. Palmer, M.Sc., Ph.D., A.M.I.E.E. Pp. 504+xi., with 307 illustrations. London: Longmans, Green and Co., Ltd., 1928. Price 18s. net.

This book adequately fulfils its intended object of supplying the electrical engineer with a complete course on the fundamental principles of wireless communication. It deals in a very thorough manner with the production and properties of high-frequency alternating currents, with their generation in oscillatory circuits and aerials for the transmission and reception of electromagnetic waves. A chapter is devoted to the electromagnetic theory and the propagation of waves, including atmospherics, while later chapters deal with the radio-telephony and directional wireless aspects of the subject. The theory and uses of the thermionic valve are naturally discussed at some length, but, without unduly overloading the book with historical matter, some space is devoted to the spark arc and alternator methods for generating high-frequency oscillations. Throughout the book the theoretical work is illustrated by many practical descriptions and the results of various experimental investigations. A fair proportion of mathematics is used, but much of this can be omitted, if necessary, by the reader without loss of interest or instruction. The book is very well produced, and altogether should form a valuable text-book suitable for the serious-minded student who is anxious to understand the principles of the subject, in which he may be engaged either professionally or as an interested experimenter.

R. L. Smith Rose.

The Practical Electrician's Pocket Book, 1928. Edited by H. T. Crewe, M.I.M.E. The usual comprehensive subject matter has been revised and enlarged with additional sections. Pp. 609+Diary for 1928 and numerous illustrations and diagrams. Published by S. Rentell and Co., Ltd., London. Price 2s. 6d. net.

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Report of the Committee of the Privy Council for Scientific and Industrial Research for 1926-1927, including the work undertaken by the Radio Research Board. Pp. 157. Published by H.M. Stationery Office. Price 3s net.

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The Electrical Conductivity of the Atmosphere and its Causes. By Victor F. Hess, Ph.D., of the University of Graz. Translated from the German by L. W. Codd, M.A. Pp. 204, with 15 illustrations and diagrams. Published by Constable, London. Price 12s. net.

LOW-FREQUENCY TRANSFORMERS.

Some Theoretical Considerations in the Design of Intervalve Transformers.

By "EMPIRICIST."

(*Concluded from page 64, January 18th issue.*)

THE essential difference between an intervalve transformer and one for the purpose of supplying power to a loud-speaker is that the former is not concerned, in the first place at any rate, with any question of the consumption of power, but merely with the production of a high, uniform output voltage in response to a given uniform input voltage. The "stage of amplification" consists, as shown in Fig. 8, of a valve A_1 followed by a transformer T_1, the secondary winding of which is followed by a valve A_2. If v_1 be the voltage across grid and filament of the valve A_1, and v_2 that across the secondary of the transformer, then the criterion of successful design is the ratio $\frac{v_2}{v_1}$, which must be made high and uniform over the range of audible frequencies.

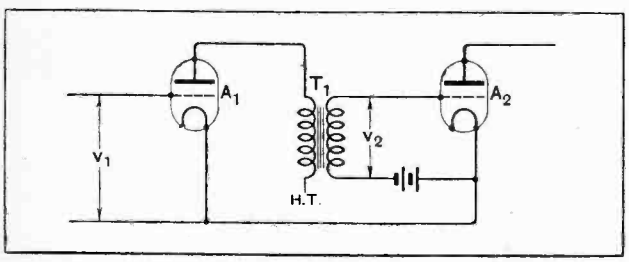

Fig. 8.—A stage of low-frequency amplification in which the criterion of successful design is that the ratio V_2/V_1 should be high and uniform throughout audible frequencies.

From the designs standpoint the problem is essentially less straightforward than that previously considered. In the first place, the effective capacity, both of the transformer itself and of the associated apparatus, comes more markedly into play; secondly, there is some indefiniteness in the nature of the problem itself, since the transformer may be used under a variety of conditions which are difficult to lay down exactly. Further, since "high value" and "uniformity" of amplification are questions of degree, there is no possibility of reaching real finality of design, though, of course, there are practical limitations of cost which must be borne in mind. The present article does not purport to go into structural details, but only to consider the principles involved.

The Capacitative Load.

For the present purposes we will assume that the transformer we are considering has no losses. This assumption is justified because any losses that exist are masked almost entirely by the damping effect of the input valve (A_1 in Fig. 8). The only load is, therefore, capacitative, and we may study the properties of the transformer by assuming this load to be transferred to the primary winding. As before, the leakage inductance will be external to this transferred load, and the resulting equivalent network will be as shown in Fig. 9.

It will be noted in this figure that the voltage across C is $\frac{v_2}{\sigma}$, so that we merely have to multiply it by the step-up ratio in order to arrive at the true output voltage. The input voltage will be μv_1, where μ is the magnification factor of the valve.

Considering first the operation at the frequency where L and C resonate, it is clear that the circuit LC will have such a high impedance at this frequency that all the volt-drop will take place across its terminals and none across R_A or l. In this case $\frac{v_2}{\sigma} = \mu v_1$, *i.e.*, $\frac{v_2}{v_1}$ = the step-up ratio multiplied by the valve magnification.

At lower frequencies the impedance of the LC circuit will fall, and, since the impedance of the leakage inductance l is proportional to the frequency, it will fall also and become negligibly small. The amplification is proportional to

$$\frac{\text{impedance of LC}}{\text{impedance of } R_A,\ l, \text{ and LC in series}}$$

and this clearly diminishes as the impedance of LC diminishes.

The extent of the falling-off is governed by the value of the impedance of L in comparison with R_A, and we may say that when $2\pi fL$ is equal to R_A, then about 70 per cent. of the amplification at resonance is obtained. Thus, if we are considering a cut-off of this nature as permissible at 50 cycles, then, to find a suitable value for L in the case of a valve having a resistance of 22,000 ohms, we have approximately:

$$314\ L = 22{,}000$$

or

$$L = 70 \text{ henries.}$$

At higher frequencies than that corresponding to the resonance of L and C, a more complicated state of affairs prevails, inasmuch as the impedance of l increases, whereas that of LC decreases and becomes capacitative in nature. In order to simplify the consideration of the problem at high frequencies, we may consider the inductance L to be omitted. This is permissible, since its impedance becomes very great, compared with that of C at frequencies above about three times the resonant frequency. We then have an arrangement consisting of R_A, l, and C, in series, and it is clear that, as l and C come into resonance with each other, the impedance of the circuit will drop, and more current will flow. On the other hand, the voltage across C for a given current is inversely proportional to the frequency, therefore, on this account there will be a tendency to a reduction of the higher frequencies. Either effect may predominate

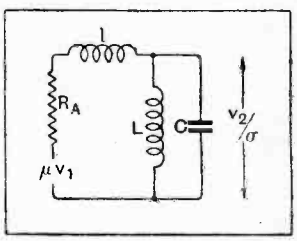

Fig. 9.—Equivalent transformer network where the load is capacitative.

Low-frequency Transformers.—

according to circumstances, and it is possible to obtain a rising amplification characteristic giving a sharp resonance peak.

From the standpoint of design it is desirable to push up the resonant frequency of l and C to a value about 50 per cent. higher than the highest frequency which it is desired to reproduce faithfully. This will be appreciated when it is considered that at this so-called "second resonance" the current has ceased to grow as the frequency is increased and has attained a more or less stationary value, whereas the voltage across C is still dropping as the frequency rises. At still higher frequencies the impedance of l will predominate and the current will fall, and from this point onward the combination of l and C will act as a filter to choke back high frequencies. For this reason a transformer amplifier has an advantage over a resistance or choke amplifier in eliminating unwanted frequencies, and in consequence transformers aid in ensuring smooth working in a receiver.

Linear Characteristic Considerations.

It may readily be shown that the amplification of the transformer and valve is very approximately equal to

$$\frac{\mu\sigma}{\sqrt{\left((1-lC\omega^2)^2+R_A^2\left(\omega C-\frac{1}{\omega L}\right)^2\right)}}$$

where $\omega = 2\pi f$.

This may be rewritten in the form:

$$\frac{\mu\sigma}{\sqrt{\left(\frac{R_A^2}{\omega^2L^2}+1-2R_A^2\frac{C}{L}+\omega^2C^2\left(R_A^2-2\frac{l}{C}\right)+l^2C^2\omega^4\right)}}.$$

From this we see that if $2\frac{l}{C}$ is greater than R_A^2 there will be a tendency for the amplification to rise at moderately high frequencies, though as the frequency rises still further the last term will curb this tendency and produce a decrease in amplification. If, on the other hand, $2\frac{l}{C}$ is less than R_A^2 there will be no effect of this kind, though a slightly higher value of amplification than $\mu\sigma$ may be obtained in a loss-free transformer. The optimum value for $\frac{l}{C}$ is *slightly* greater than $\frac{1}{2}R_A^2$, so that a curve is obtained which rises slightly throughout the greater part of its length, but, in spite of this, deviates very little from its mean value. The last term which contains the product lC determines the upper frequency limit of effective amplification obtainable, so, in order that this shall be high, it is necessary that lC should be small.

It will thus be seen that the problem of designing an intervalve transformer resolves itself into two parts; first, we must choose the inductance of the primary winding so as to give the required response at low frequencies, and, secondly, we must adjust the leakage inductance and effective capacity so as to give adequate reproduction of the upper frequencies.

The former problem is a matter of straightforward design, though, in view of the high value of inductance required, particular attention must be given to the iron circuit in order that an economical design may be achieved. In respect of the latter, we have to effect a compromise, bearing in mind that the necessity for intermingling the primary and secondary windings, for the purpose of reducing the leakage, also implies an increase in the mutual capacity. It is necessary that the effect of the latter on the performance of the transformer should be small in comparison with that of the probable load on the secondary, and the latter is unlikely to be less than 30 micromicrofarads, and may be as high as 150 micromicrofarads. It is, therefore, not practical to save, say, 10 micromicrofarads by reducing the mutual capacity if this is going to result in an increase of 50 per cent. in the leakage inductance. It is impossible to predict with any safety on

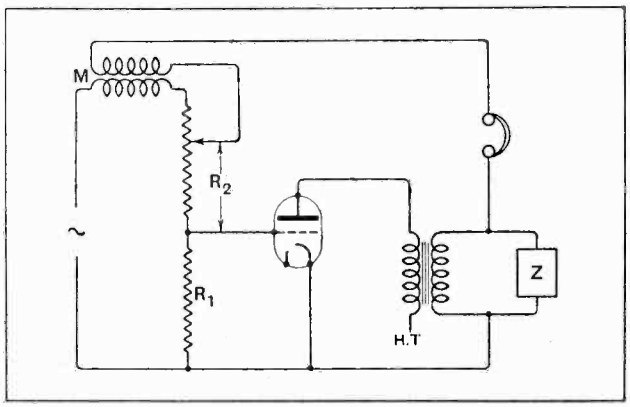

Fig. 10.—Circuit arrangement for measuring stage amplification in which practical conditions are closely followed.

theoretical grounds what the best arrangements of windings may be, and it would seem as if the only safe method of working is on the basis of an actual measurement of amplification. In this connection it is absolutely essential that practical conditions should be taken into account, and the most common failure in this respect, in the case of published curves, is the taking of measurements by a method where the primary and secondary windings of the transformer are not connected together. The safest methods are those in which a comparison is made between the input and output voltages of an amplifier without the absolute values being known.

Measurement of Amplification.

A typical circuit for this purpose is shown in Fig. 10, in which the input voltage is equal to the volt drop along the resistance R_1, due to the current supplied from an A.C. source, and the output voltage is measured in relation to the input by balancing it against the voltage set up in a resistance R_2 and a mutual inductance M by the same current, the point of balance being indicated by silence in the telephones. It can easily be seen that the amplification ratio is equal to $\frac{\sqrt{(R_2^2+4\pi^2f^2M^2)}}{R_1}$. Any desired load Z may, of course, be connected in shunt across the transformer secondary.

The advantage of such a method is, first, that it closely corresponds with practical conditions, and, secondly, that it is extremely easy to isolate a single frequency, even though the wave-form of the supply is

Low-frequency Transformers.—

not pure, since the act of balancing distinguishes between the fundamental frequency and its harmonics.

It has been stated that the capacitative load on an intervalve transformer will be at least 30 micromicrofarads, and may be as high as 150 micromicrofarads. Inasmuch as both of these values are considerably higher than the normal electrode capacities, it should be understood that they are due to the reaction effect from the plate to the grid of the valve which follows the transformer. If this valve be of low magnification, feeding a loud-speaker, the reaction effect will correspond to the lower limit above specified, but if a high magnification valve be used as a second amplifying stage a very high effective capacity may be thrown across the transformer secondary. The use of a screened valve will, of course, reduce this load to the value corresponding to the geometrical capacities of the electrodes.

Other Types of Transformers.

Two other main classes of transformer are worthy of mention, namely, microphone transformers (including those attached to gramophone "pick-ups") and line transformers, used for transforming down the output of a telephonic circuit for transmission over a telephone line. The former class corresponds fairly closely to intervalve transformers, inasmuch as it is required to produce from them a high uniform voltage at different frequencies, but very often they have a considerable inductance value which very much modifies the design and makes it impossible to employ as high a ratio as would be possible for a non-inductive input device. Line transformers are frequently required to operate between resistances of comparatively low value, and here the magnetic leakage is of far greater importance than the self-capacity, which is negligible in comparison with the resistance loads. The leakage inductance, however, acts as a choke, which tends to suppress the high frequencies at the expense of the low, and it is therefore necessary to pay particular attention to it in the course of design. The performance of these transformers corresponds very closely with theory, and if the coefficient of coupling for a particular arrangement of primary and secondary turns be known, it is readily possible to specify the number of turns and the ratio to give the required performance, or the closest possible approximation to it.

Distortion: Its Cause and Cure.

The subject of "Distortion" was thoroughly ventilated by Mr. G. E. B. Burgess at the last meeting of the South Croydon Radio Society. The lecturer, in tracing the origin of distortion, dealt first with the valve, explaining the many causes of poor reproduction from this source. He emphasised the need of studying the characteristic curves of valves before deciding to what particular use each type should be put.

Hon. Secretary: Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

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Transformers.

At a recent meeting of the Holloway Literary Institute Radio Society, a representative of Messrs. Ferranti, Ltd., gave a talk on the construction and use of transformers, following this with a demonstration with various types of valve and loud-speaker.

Meetings are held weekly on Monday evenings at 7.30 p.m. at Holloway School, Hilldrop Road, Camden Road, N.7.

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Mains-driven Five-Valve Set.

A demonstration dealing with the Met-Vick mains-driven five-valve receiver was given before the Stretford and District Radio Society on February 8th by Mr. Daynes, 5YD, a well-known local transmitter. Mr. Daynes carefully explained the advantages of the Astatic Non-Parasitic coils, and demonstrated the benefits of using valves with indirectly heated cathodes.

Hon. Secretary: Mr. W. Hardingham, 6XA, 21, Burleigh Road, Stretford.

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Association of British Radio Societies.

Under the auspices of the Association of British Radio Societies a lantern lecture on "Radio Valves" was given by Mr. John Ree, of the Mullard Wireless Service Co., Ltd., on Thursday last, February 16th, in the Albert Hall, Peter Street, Manchester. A series of interesting features of this type is being arranged.

Hon. Secretary: Mr. L. A. Gill, Hope House, South Reddish, Stockport.

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Moving Coil Loud-speakers Compared.

The Rice-Kellogg and other moving coil loud-speakers were demonstrated by Mr. Smith, of the Broadmead Wireless Co., at the last meeting of the Bristol and District Radio Society. Owing to the difficulty of obtaining good broadcast reception at club headquarters due to the close proximity of electrical apparatus, the demonstration was confined to the reproduction of gramophone records. These, used in conjunction with electrical pick-ups, provided ample means of testing the various instruments.

Hon. Secretary: Mr. S. J. Hurley, Arno's Vale, Bristol.

CLUB NEWS.

An Interesting Revival.

An old society which is taking on a new lease of life in a very determined fashion is the Hornsey and District Wireless Society, with headquarters at Priory College, Priory Road, N.8. On February 6th, Mr. R. F. White lectured on the origin and characteristics of crystal used in wireless, exhibiting specimens and showing the construction of many types of detectors. Of particular interest was the lecturer's own device—a "never fail" crystal receiver for 2LO and 5GB. This consisted of four separate detectors joined up to a five-point switch by means of which it was possible to make instantaneous change from one crystal to another without readjusting a refractory crystal. 2LO was heard on the loud-speaker direct, and the separation of the London station and 5GB proved a simple matter.

Particulars of the society's meetings may be obtained from the Hon. Secretary at the above address.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 22nd.

Stretford and District Radio Society.—At 8 p.m. At 6a, Derbyshire Lane. "6IIS Calling." by Mr. Saville.

South Croydon and District Radio Society.—Lantern Lecture and Demonstration: "Valve Manufacture," by Mr. Clarke, of the Edison Swan Electric Co., Ltd.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove. Demonstration of Gramophone Pick-up Devices, by Mr. F. E. R. Neale.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown. Lecture and demonstration by Mr. R. Garside (of Messrs. Ferranti, Ltd.).

THURSDAY, FEBRUARY 23rd.

Golders Green and Hendon Radio Society.—Club Dance at Headquarters.

Leyton and Leytonstone Radio Society.—The R.C.C. Threesome.

FRIDAY, FEBRUARY 24th.

Leeds Radio Society.—At the University. Exchange and Mart.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Demonstration.

Wigan and District Technical College Radio Society.—Lecture: "Beam Radio," by Prof. E. W. Marchant, O.Sc., M.I.E.E.

SATURDAY, FEBRUARY 25th.

Stretford and District Radio Society.—Select Dance.

MONDAY, FEBRUARY 27th.

Hackney and District Radio Society.—At 8 p.m. At the Electricity Halls, Lower Clapton Rd., E.5. Discussion on "Distortion."

Holloway School Wireless Society.—At 7.30 p.m. At Holloway School, Hilldrop Road, Camden Road, N.7. Demonstration by Messrs. Gambrell.

Particulars of the society's meetings may be obtained from the Hon. Secretary at the above address.

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A Musical Evening.

The organisation of a social evening presents no difficulties to the Tottenham Wireless Society, which held a highly successful event of this kind on Wednesday, February 8th. During the progress of a whist drive music was provided by a dance band and by broadcast music reproduced by a moving coil loud-speaker. At intervals during the programme music was also obtained from gramophone records in conjunction with an amplifier and loud-speaker. Thus music was the order of the evening.

Hon. Secretary: Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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Why the Moving Coil Excels.

Popular enthusiasm for the coil-driven loud-speaker was shown by the keen debate on this topic carried out by the Manchester Radio Scientific Society on February 1st. The member introducing the discussion traced the development of the coil drive and the principle of inertia control, and gave the main reasons why this type of instrument gave such relatively superior reproduction. At the following meeting the manufacturers of the Rice-Kellogg moving coil loud-speaker lent an instrument, and members were able to test its powers on a programme S.B. from London.

Hon. Secretary: Mr. G. C. Murphy, 335b, The Cliff, Higher Broughton.

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Maintaining Enthusiasm.

How to maintain interest in amateur radio in Bradford during the coming year was the basis of a discussion at the annual meeting of the Bradford Radio Society on February 7th. The possibility of holding field days in the summer was discussed, and it was suggested that local traders be approached with a view to the holding of a wireless exhibition towards the close of the present year.

Hon. Secretary: Mr. E. A. Cowling, 1145, Leeds Road, Thornbury, Bradford.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

Post Office and Potters Bar.—Is the B.B.C. Sensitive ?—Continental Relays.—Rugger Items.—Trouble in India.—Friday's National Concert.—Applause.

Potters Bar.

Although, at the time of writing, the B.B.C. refuses to make a definite statement, it is an open secret that the London regional station is planned to occupy a site near Potters Bar, as originally forecast in *The Wireless World* of December 7th, 1927. The reticence at Savoy Hill is due to the fact that the Postmaster-General, ever omniscent in wireless matters, has not yet sanctioned the regional scheme.

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B.B.C. and the Post Office.

This reflection is a little disquieting. It was common knowledge, of course, that the Post Office gave away no blank cheque when permission was granted to experiment with 5GB; but at this time of day, when the regional scheme with all its promised benefits has been talked about for months and months, the thought that the Post Office can end the whole matter with a peremptory "No" is not at all stimulating.

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What Does the P.M.G. Think ?

The silence of the Sphinx is nothing to what a Government department can accomplish, and so far the Post Office has been true to type on the question of a redistribution of broadcasting stations.

Nothing has leaked out from St. Martin's-le-Grand to show whether the authorities rejoice in the idea, despise it, or are merely prepared to tolerate it; and until this important question is answered, all proposals must be accepted with reserve.

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A Plea for Light.

Very possibly the Post Office would decline its blessing on the regional scheme as a whole, preferring to grant licences to individual stations as and when they are ready for use. But whatever course is pursued, it seems desirable that the official view should be known.

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Controversy.

This hidden hand policy has made itself felt in the matter of controversial broadcasting. Mr. Winston Churchill's spirited observations at the Civil Service dinner have been described by headlines such as "Chancellor's Tilt at the B.B.C.," many newspapers imagining that the Corporation is directly responsible for the veto on controversy. Actually, all that the B.B.C. can possibly be accused of in this regard is a certain evasiveness when the question came into the limelight.

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Is Savoy Hill Thick-skinned ?

The danger of blaming the B.B.C for every misfortune under the sun (including the weather) is that, in time, it may develop a thick skin. Even now there is a pachydermatous tendency; if it were not so, the staff would long ago have found its way over the conveniently near parapet of Waterloo Bridge. We do not want this toughening process to continue. The sensitive artist must be guarded, otherwise he will lose his sensitiveness and cease to be an artist.

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Relays from Belgium and Germany.

An important step towards the eventual inter-linking of British and Continental cities for broadcasting purposes will be made on Sunday, March 11th, when the singing of the Legia choir of 225 voices, under the direction of M. Ernest Jerome, will be relayed from Liége to London and S.B. to other stations. This interesting experiment will be made between 10.5 and 10.35 p.m. On the following evening a relay will be made of a concert from Cologne, and the experiment will be completed on the Tuesday evening by a relay in the reverse direction, listeners to Langenberg being enabled to take 5GB's programme.

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B.B.C. Repeaters.

It is interesting to note that these relays will be made possible by the use of land line repeaters under the control of B.B.C. engineers stationed at various points in Belgium. I understand that these repeaters, or thermionic relays, will be spaced at intervals of about fifty miles. The cross-Channel link will be provided by the new submarine cable between Ostend and Dumpton Gap, Isle of Thanet, which was first used for broadcasting purposes when the Menin Gate ceremony was relayed to British listeners.

FUTURE FEATURES.

London and Daventry (5XX).

FEB. 26TH.—Albert Sandler and the Grand Hotel, Eastbourne, Orchestra.

FEB. 27TH.—Ellen Terry Programme.

FEB. 28TH.—Military Band Concert and Vocalists.

FEB. 29TH.—Leap Year Programme.

MARCH 1ST.—Speech by the Rt. Hon. David Lloyd George, M.P., responding to the toast of "Our Guests" at the Welsh National Dinner of the Cardiff Cymrodorion Society (from Cardiff).

MARCH 3RD.—"Peaches," a revue by L. du Garde Peach.

Daventry Experimental (5GB).

FEB. 26TH.—Orchestral and Vocal Concert.

FEB. 27TH.—Light Music and Songs.

FEB. 29TH.—Orchestral Concert and Vocalists.

MARCH 1ST.—Hallé Concert relayed from the Free Trade Hall, Manchester.

MARCH 2ND.—Light Music and Songs.

MARCH 3RD.—Orchestral and Vocal Programme.

Cardiff.

FEB. 27TH. — Reminiscences of Famous Operas by Cardiff Grand Opera Society.

Manchester.

FEB. 27TH.—"The Laughter of Fools," a comedy by H. F. Maltby.

Newcastle.

FEB. 28TH.—Glimpses of the Past—a series of dramatic episodes dealing with the history of Newcastle and district.

Glasgow.

MARCH 1ST. — A Scandinavian Programme.

Aberdeen.

MARCH 2ND.—Songs and Stories of the Gael.

Belfast.

FEB. 28TH. — Reminiscences of Musical Comedy.

Footballers in Church.

The Rugby Footballers Service at Bristol Cathedral on March 4th will be relayed by Cardiff station.

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More International Rugger.

The international Rugby match between Wales and Ireland on March 10th will be the subject of an eye-witness account relayed to 2LO from Cardiff.

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This Year's Boat Race.

The Boat Race this year is on the last day of March. A running commentary will again be broadcast from a launch following the Oxford and Cambridge crews.

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An Instructive Title.

From *Wireless Weekly* (Australia):—"Why Some Receivers Turn Tenors into Basso-Profundos."

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Oscillators in India.

History is repeating itself very savagely in India. A few weeks ago the Indian Broadcasting Co. was deploring the advent of the "pirate"; the newest trouble is oscillation! According to the *Indian Radio Times* the nuisance is growing apace. Eloquent appeals are being addressed to the public with lucid explanations of the evils of misused reaction, and the hope is expressed that oscillators, conscious or unconscious, will take the advice to heart. If history continues to repeat itself, I am afraid the I.B.C. are only at the beginning of the trouble.

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The Government and the Pirate.

On the financial side the company's prospects seems no brighter. *The Indian Radio Times*, which recently expressed the view that "piracy" was rampant, now declares that the Government refuses to recognise the fact, and that therefore the situation is extremely serious.

The company deserves all sympathy, for it has reached a period when the results of many months of hard work are beginning to show themselves in the growing volume of appreciative correspondence.

If the I.B.C. can keep the flag flying for a little longer conditions may improve, but some definite official action seems necessary to enforce the law of licences. I understand that the hours of broadcasting are to be reduced as from March 1st.

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An Orchestra for Wales.

The Welsh National Council of Music, the National Museum of Wales, and the City Corporation of Cardiff, co-operating with the B.B.C., have evolved a scheme for a "National Orchestra of Wales" to perform in public and to broadcast nationally. If this scheme survives the experimental stage, it may serve as the model for other similar schemes which may perhaps stimulate a great popular revival of active interest in music.

The B.B.C. undertakes to support the scheme financially. The Cardiff City Corporation provides the Assembly Rooms at the City Hall on two nights a week with permission to charge for admission at popular prices. These concerts will be given in three seasons—twelve weeks before and twelve weeks after Christmas—with six weeks in the early summer.

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A Good Programme.

There is a striking bill of fare for the B.B.C. National Concert at the Queen's Hall on Friday next, February 24th. Geoffrey Toye will be the conductor, and the solo artists will be the well-known violinist sisters, Jelly d'Aranyi and Adila Fachiri, who will be heard in Bach's D minor Concerto for two violins and orchestra.

The orchestra will also give Mottle's collection of Ballet Suites from Gluck's operas, "In a Summer Garden," by Delius, and the beautiful "Siegfrid Idyll," which is often regarded as Wagner's masterpiece. A "Tzigane" for violin and orchestra by Ravel and Stanford's unfamiliar Symphony in D will complete the programme.

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The Microphone Manner.

As one of the audience in the 5GB studio last week when Viola Tree and Robert Boothby, M.P., debated on the question "Should Bachelors be Taxed?" I was particularly interested to note how the protagonists revealed their respective professions by the manner of their approach to the microphone. Miss Tree, tall and regal, exhibited all the gesticular graces of the Shakespearian stage, and it was impossible to overlook what was being lost by listeners who could hear only the spoken word. Mr. Boothby attacked the microphone with all the ardour which a clenched fist can testify, and any listener who remained unconvinced by the force of his arguments would have been helped to a decision if the speaker had been assisted by television.

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"Rampa."

Cecil Lewis has translated into English and adapted for radio the four-act play, "Rampa," by Max Mohr. It will be transmitted from 2LO and other stations on March 7th.

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A Scots Legend.

An all-Scots programme is Belfast station's tribute to its Northern neighbour on March 6th. The chief feature will be a one-act play, "The Lost Piper," which deals with an old Scots legend of the eighteenth century. Tradition tells that a subterranean passage extends from Musselburgh Sands to Edinburgh. A piper once took a wager that he would pipe from one end of that eerie vault to the other. The incident forms the foundation of the play.

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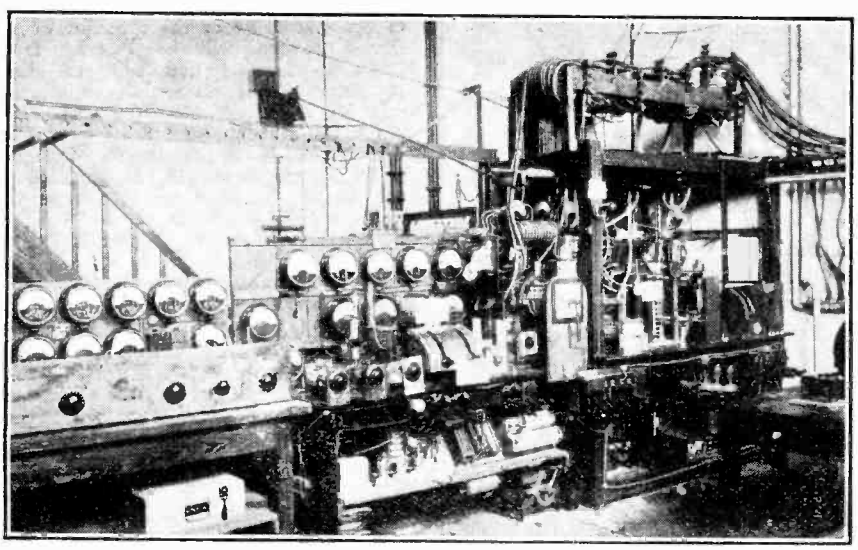
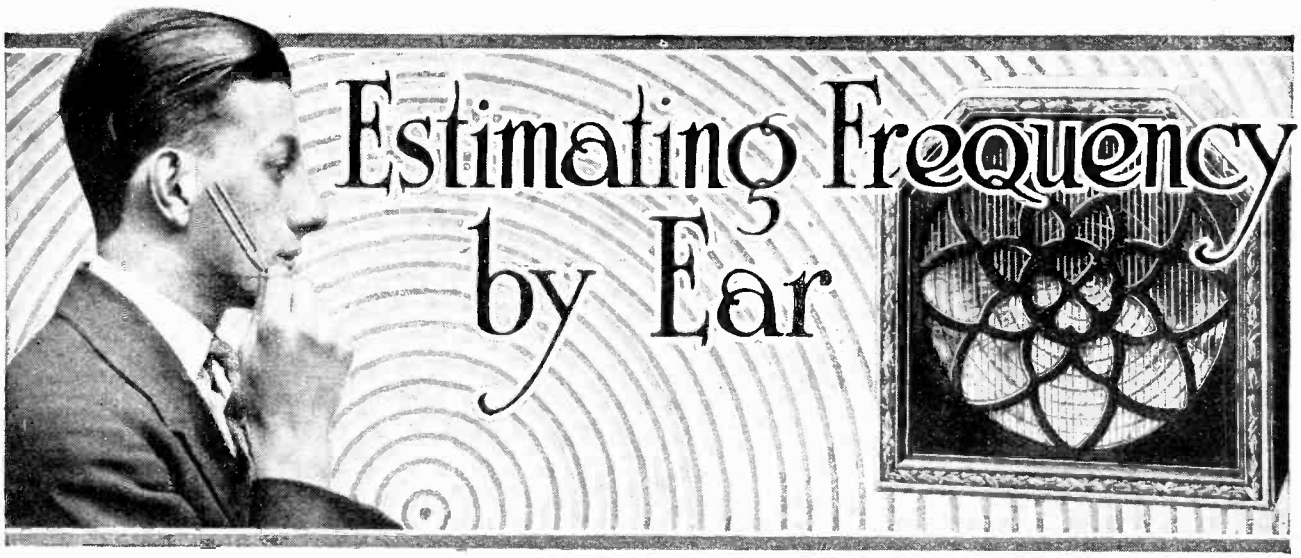
Applauding the Broadcast Singer.

Somebody has been asking whether listeners join in the songs they hear broadcast. Very probably there are listeners who do, just as there are listeners who clap the items that please them. Several folk I have met are quite unable to restrain this inclination to applaud, especially when among a company of other listeners.

There is nothing criminal in this, and the idea seems no more absurd than that of clapping at a cinema. There are few of us, probably, who have not occasionally wished that some form of short-wave oscillator could be set into operation by the pressing of a button to register approval that could be heard in the studio. The danger, of course, would lie in the opportunities for its misuse!



BEHIND THE SCENES AT PCJJ. A glimpse of the apparatus at the famous Hilversum experimental broadcasting station, showing the short-wave plant and power control equipment.



Estimating Frequency by Ear

A Useful Aid in Judging L.F. Amplifier and Loud-speaker Performance.

By F. L. DEVEREUX, B.Sc.

Some method of arriving at the frequency of musical sounds is essential when experimenting with low-frequency amplifiers and loud-speakers. The standard methods of measuring frequency are too complicated for the amateur and give an unnecessarily high degree of accuracy for his needs.

In this article it is shown how to estimate the frequency of a note with an accuracy of 5 per cent., using no other apparatus than a simple tuning fork.

THE pitch of a note depends on its frequency, and in music (excepting always certain "modern" compositions) a definite relationship exists between the frequencies utilised for the production of harmony and melody. This relationship is quite independent of the absolute frequency, since a tune or chord can be transposed from one key to another without changing its musical significance. Superficially, one would imagine that the "interval" between two notes depended on the difference in their frequencies, but a closer examination reveals that the relationship which gives the interval its characteristic quality is the *ratio* of the two frequencies. Thus the interval between two notes played simultaneously as a chord will be instantly recognised whether it be high or low in the musical scale, and if the frequencies were measured and each pair expressed as a ratio they would cancel out to the same fraction.

The Choice of a Tuning Fork.

Given a tuning fork of known frequency, and making use of this relationship, it should be possible to estimate the frequency of any other note by observing the interval it forms with the tuning fork. The difficulty is to recognise the interval by ear, but this, as it is hoped the latter part of the article will show, is not so formidable as it seems and is one of the first things a student learns in the elementary class of a school of music.

First, a word about the choice of a suitable standard fork. An ordinary piano tuner's fork will be quite accurate enough for most purposes, but one must be chosen which has the frequency marked on it *in figures*; forks marked "C continental," etc., without the frequency are hardly suitable as they may be tuned to some obsolete pitch which may have been recently revised.[1] More heavily constructed forks mounted on sounding boxes are obtainable from all the leading makers of scientific apparatus. A suitable pitch to choose is middle C with a frequency of 256 cycles (512 vibrations) per second.

The simplest interval is the octave in which the ratio of frequencies is 2; that is to say, if the note is an octave above the standard its frequency is twice that of the standard fork, or, if an octave below, the standard frequency must be halved. The octave is easily recognised and may be described as "the same note one stage higher or lower in pitch." Some people have difficulty in deciding whether two notes are in unison or separated by one, two or more octaves, particularly when the notes are situated in the bass. A little practice soon overcomes this difficulty, and it is most important for the present purpose that the octave should be immediately recognised, since it is convenient to visualise the whole range of musical frequencies as divided up into "territories" by the octaves of the standard fork thus:—

C_{III}	C_{II}	C_{I}	C	C^{I}	C^{II}	C^{III}
32	64	128	256	512	1024	2048

The first step, then, is to find in which octave "territory" the unknown frequency is situated, and to use the

[1] Many forks are marked in "vibrations per second," a vibration being one half-cycle or movement of the fork blade out from its mean position in one direction only. A complete cycle consists of two vibrations, so that the figures on the fork must be divided by 2 to obtain the frequency.

Estimating Frequency by Ear.—

lower C of that octave as a new standard when estimating the small interval inside the octave. The writer has found it helpful, when trying to decide whether notes are in unison or an octave apart, to whistle the note in several octaves above and below, varying the pitch out of tune slightly in each case; unison is then indicated by "beating," which does not occur when the octaves are sounded.

Having approximately located the unknown frequency, the next step is to find its relation to the lower note of the octave in which it is situated. The octave is divided by musicians into seven simple intervals, which are easily recognisable whatever their absolute pitch, and are each

TABLE I.

Interval.	Notes.	Ratio of frequencies. (Equally tempered Scale.)
Unison	C and C	1.000
Second or Tone	C ,, D	1.122
Third	C ,, E	1.260
Fourth	C ,, F	1.325
Fifth	C ,, G	1.498
Sixth	C ,, A	1.682
Seventh	C ,, B	1.888
Octave	C ,, C^1	2.000
Semitone	Half tone between any of above.	1.059

characterised by a definite ratio of frequencies. Keeping to the scale of C the intervals are set out in Table I with their frequency ratios. The frequency of a note halfway between any of the simple intervals can be obtained by multiplying the nearest lower simple interval by 1.059. Since it is difficult to judge by ear differences of frequency less than a semitone, this gives us the accuracy of the method which turns out to be 5.9 per cent.

We now come to the most difficult part of the process, viz., the identification of the intervals within the octave. The writer's own method, which he commends to readers, is to memorise a few well-known tunes, starting with the simple intervals. The tunes he uses personally are given in Fig. 1, but the reader will no doubt select his own favourites. The only intervals which do not appear are the semitone and the seventh. The semitone hardly needs separate identification, as it will be at once recognised if the note of unknown frequency should happen to fall between any of the simple intervals, and it is to be hoped

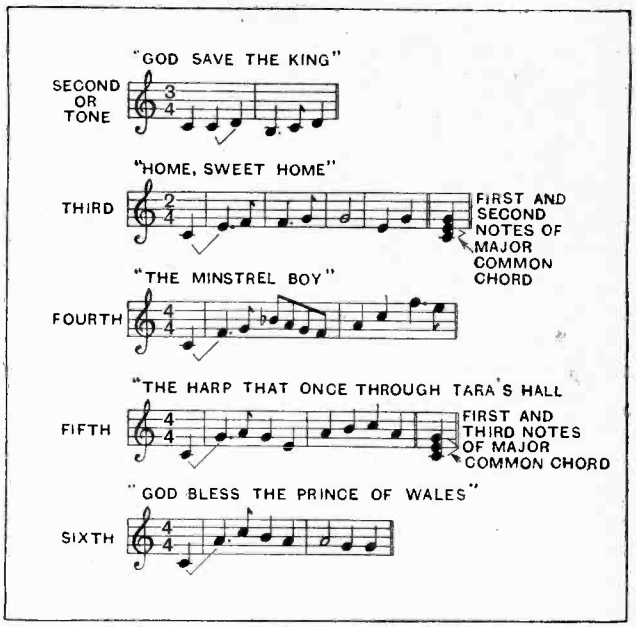


Fig. 1.—Well-known tunes which start with simple intervals from the tone or second to the sixth.

that no well-known tune will ever start with the seventh. We will leave it for the exclusive use of the aforementioned school of modern composers and approach it ourselves by reducing the octave by a tone.

To show the working of the method let us consider the imaginary case of a note of fairly high pitch. We find that it is an octave, "The Minstrel Boy," and a semitone above our standard fork (middle C). Looking up the ratios of the various intervals from Table I we find the frequency works out as follows:—

Middle C. Octave. Fourth. Semitone.

$256 \times 2 \times 1.325 \times 1.059 = 933$ cycles.

This is, of course, child's play to anyone with a knowledge of the rudiments of music, and the non-musical experimenter should have little trouble in mastering the process. If he finds his first attempts a little discouraging let him persevere in the knowledge that the method is far more accurate than trying to find the unknown note on a piano, since pianos are tuned to so many different pitches and middle C may be far from 256 cycles. Further, a tuning fork is easier to transport than a grand piano!

CATALOGUES RECEIVED.

Harlie Brothers, Balham Road, Lower Edmonton, London, N.9. The Harlie Log Chart of Broadcasting Stations, with particulars of Harlie condenser dials, valve holders, etc.

○○○○

C. A. Vandervell and Co., Ltd., Acton, London, W.3. "The Modern Battery," showing in an ingenious manner the anatomy of the C.A.V. all-moulded battery.

○○○○

Ever-Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7. Leaflet showing reductions in price of "Popular Power" batteries.

○○○○

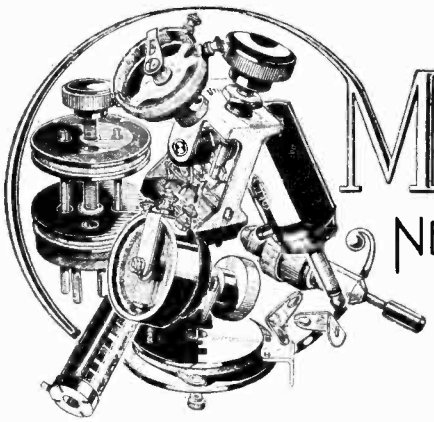
Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C.4. "The Accumulator Catalogue," a 24-page booklet dealing with Ediswan accumulators of the portable and wireless types.

○○○○

Metro-Vick Supplies, Ltd., Trafford Park, Manchester. Special Publication No. 7117/10, describing the Met-Vick 3-valve sets, A.C. mains, or battery models.

○○○○

Carrington Manufacturing Co., Ltd., Camco Works, Sanderstead Road, S. Croydon. Camco catalogue of cabinets for the latest types of wireless receiver.



MANUFACTURERS' NEW APPARATUS

"Wireless World" Laboratory Tests.

AN ATTRACTIVE PEDESTAL CABINET.

Messrs. G. E. Ambatielo and Co., Ltd., Ambatielo House, Farringdon Road, London, E.C.1, have produced a most imposing wireless cabinet in the Jacobean style which costs only £5. It is 2ft. 10in. in height and 14½in. deep, and is designed to take a panel 26in. × 8in., and is thus suitable for the "Everyman Four" and "*Wireless World* Five" receivers.

Ambatielo wireless cabinet in Jacobean oak finish.

Accessibility has been carefully studied; the interior of the receiver can be inspected *via* the top lid or hinged back, and the battery compartment by a hinged front below the doors which protect the receiver panel. The strength and rigidity of the structure as a whole is more than sufficient to stand the weight of the heaviest H.T. and L.T. batteries or eliminator chokes and transformers.

A baseboard and panel end facings are included, and a lower shelf can be supplied ready to drop into position at an extra cost of 5s.

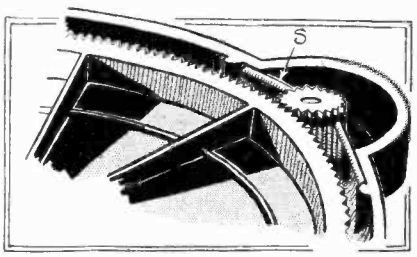
o o o o

THREE NEW HARLIE PRODUCTS.

All experimenters who are acquainted with the Harlie crystal detector will be interested in three new components which Messrs. Harlie Bros., Balham Road, Lower Edmonton, London, N.9, are now putting on the market.

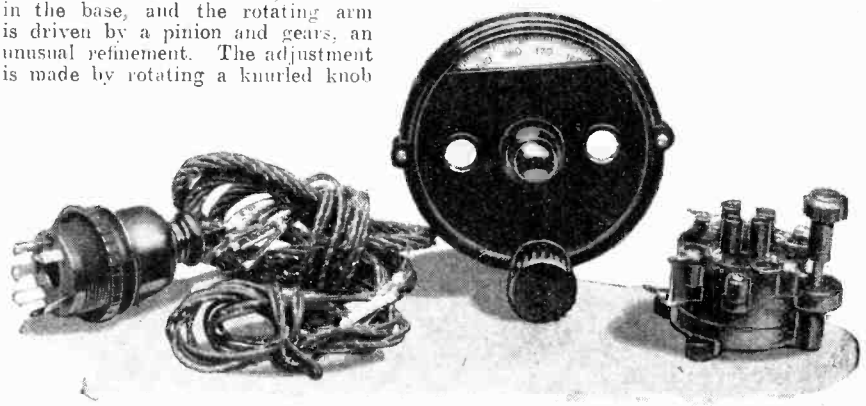
Slow Motion Dial and Indicator.—This is of very sound design and it is difficult to find a point for adverse criticism. The drive is positive, not friction, and consists of a large toothed wheel of moulded material driven by a small brass pinion. The gears are kept firmly in mesh by the pressure from the bow springs, and the reduction ratio is 12 : 1. The dial reading is indicated by a hair line on a celluloid window, and station indications may be made through circular holes on each side of the dial. The price is 3s. 9d., and the dial is made to fit ¼in. spindles, which are now almost universal.

Combined Anti-microphonic Valve-Holder and Variable Resistance.—This component is well thought out and is extremely reasonable at 3s. 6d., having regard to the amount of detail work. The filament resistance available in three values, 6, 15 and 30 ohms, is contained in the base, and the rotating arm is driven by a pinion and gears, an unusual refinement. The adjustment is made by rotating a knurled knob at the side of the valve-holder, and as evidence of careful design we note that this knob has been slotted so that the adjustment can be made with a screwdriver. This makes the unit ideal for baseboard mounting and relieves the front panel of subsidiary controls.



The geared drive of the Harlie slow-motion dial.

Seven-way Battery Connector.—Although no bigger than a standard electric lamp adaptor this connector contains seven contacts which are arranged to keep surface leakage low and to give a firm, independent electrical connection for each of the seven leads. The quality of the mouldings is exceptionally high and the leads are identified by tags which are numbered to correspond with the contacts in the socket.



The Harlie battery connector, slow motion dial, and combined valve-holder and variable resistance.

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.

FOREIGN PROGRAMMES.

Sir,—I am, alas, a very untechnical devotee of wireless and am quite unable to grasp even the most elementary of the principles of the science. I have a two-valve set which gives me the London programme quite satisfactorily from the "hearing" point of view, and 5GB *not* too well on the loud-speaker, except when my next-door neighbour (who has a much more powerful set than I have) gets through to that station, when I get very excellent reception—due, I am told, to re-radiation, whatever that may mean!

Now, in common with untold others, I get very fed up with 2LO programmes. Instead of coming home after a hard day's work to some light jolly music, the odds are that I arrive just in time for a "talk" on some terribly dry subject, of interest to only an infinitesimal number of listeners, to be followed probably by a "symphony concert," consisting of some interminable concerto or some compositions by some new or old composers only understandable (if at all) by "highbrows."

Under these conditions, is it any wonder that, although I only possess a two-valve set, I "search" the ether for something more lively? I confess that I *do* do that and that I frequently oscillate, though when I get to that point I always "get down." Often, however, I am able to get Langenberg and Hilversum on the 'phones, and although there is frequently a "background" of 2LO or some other station, I put up with that because there is generally some lively music being played at one or other of these two stations. Last night, for instance, I had a jolly hour or so at Hilversum, where a "Viennese" programme was being played. I turn to to-night's programme at 2LO and find, when I reach home, at about 7.45 or 8 p.m., I must listen to a Trio in F Minor, Op. 65, etc. Heaven knows what all that means, but I have no doubt it will be pretty dreary! If my neighbour is through to Daventry Experimental I shall be able, if I like (but which I shall *not* like) to listen to "Dainty Diana!" What I shall no doubt do will be to try to get Langenberg or Hilversum again, and probably oscillate a bit doing it! CEEGEE.

Surrey.
February 1st, 1928.

PERFORMANCE CLAIMS.

Sir,—Your editorial article and the correspondence which you have received regarding the popularity of certain circuits is very interesting, and it brings forward another point on which, in my opinion, you could with advantage spare some space in an early issue to render a service to large numbers of people who have recently built or contemplate building similar sets.

The sets in question are, when used close to a broadcasting station, doubtless very efficient and give excellent results, but under these circumstances the use of a low-impedance power valve is essential to prevent over-loading and distortion, and it is here where from practical experience I know that large numbers of customers are being misled.

They buy a kit of component parts to make up the set and at the same time purchase a high-tension battery, and generally their local dealer does not tell them, and the purchasers do not know, that when these low-impedance power valves are used it is *essential to employ large capacity H.T.* batteries. Usually a small battery is purchased, and the result is that within a week or two the purchaser is in trouble because the battery which has been subjected to grossly unfair treatment is rapidly discharging, and the battery maker is blamed for supplying faulty goods.

Large numbers of the public and, indeed, a considerable section of the trade seem to be unaware, or at least do not give sufficient attention to this aspect of the matter, and I therefore feel that an authoritative article from you would do much to prevent the employment of small capacity batteries under incorrect conditions and the disappointment arising therefrom.

Croydon. FIVE VALVES.
February 1st, 1928.

TUNING NOTE.

Sir,—May I suggest that the present form of tuning note be replaced by something less ear-splitting?

Some time ago the B.B.C. substituted piano scales, but apparently the change did not meet with approval. It would be useful to know if there is a general desire for a tuning note at all, coming as it does in the middle of the day's broadcast or thereabouts; and if there is good reason for retaining it in any form.

Should this be found to be the case perhaps some of your readers will come forward with constructive criticism; as a modest contribution thereto, may I suggest a chord on an organ? I believe a studio contains this instrument.

Golders Green, N.W.11. G. CHEERS CHALONER.

OUTSIDE BROADCASTS.

Sir,—People complain to you about so many things that I am surprised that more is not said on the subject of purity, particularly with regard to outside broadcasts.

It is 4 p.m. on January 26th, 1928, and I have been trying for the last half-hour to listen to a symphony concert relayed by 5GB from the Winter Gardens, Bournemouth.

The noise reminds me of the first gramophone records ever made, only it is worse.

I have never heard such startling impurity, and, to make matters worse (if possible), there are constant doublings and halvings of volume and other interruptions.

I have listened often to these Winter Garden programmes, and they are always hopelessly impure, and, in my opinion, not at all worth while. No music at all would be better than this contorted version.

There is nothing wrong with my set, which is designed very carefully for purity. I am using three LS5A valves in parallel in the last stage and listening to a well-designed moving coil loud-speaker; further, on switching over to 2LO and 5XX, reception is satisfactory.

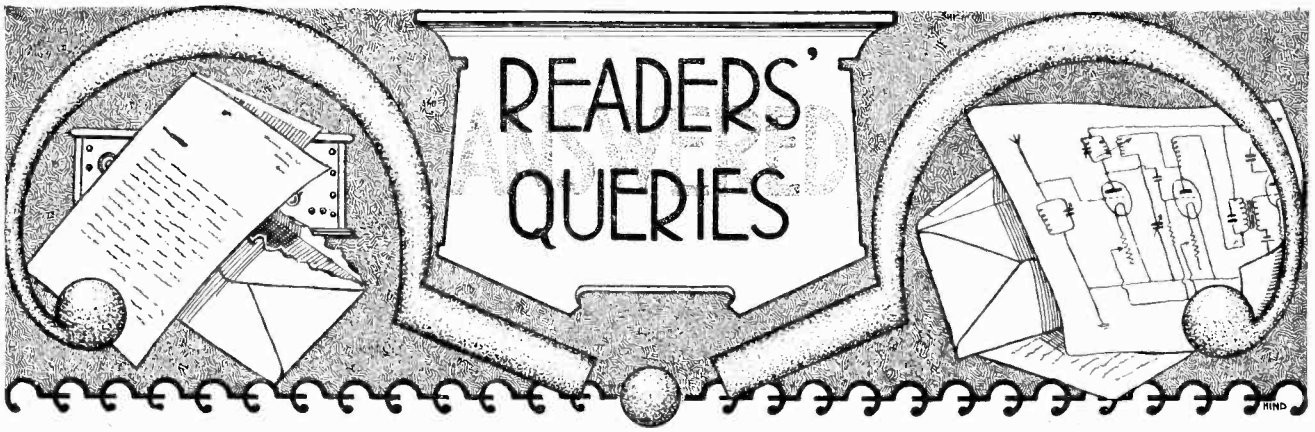
There are obviously a great many people whose sets distort so vilely to begin with that the difference between a pure and an impure broadcast is not noticeable, but surely the B.B.C. must know.

London has been distorting horribly lately and piano music is often excruciating.

There seems to be a sort of general pretence that nearly all programmes are quite free from distortion when broadcast—alas, this is far from the case, I should say rather that about 50 per cent. are fairly and satisfactorily free from it, and of these very very few are outside broadcasts—as for the rest, some are poor, some bad, and some, like this afternoon's, an insult to music, wireless and the listener.

Reading. KYRLE LENG.
January 26th, 1928.

P.S.—The programme from Lozells Picture House is now being broadcast and reception is quite satisfactory.



"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department, which are printed below; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

The "Everyman Four," on the Gramophone.

My gramophone pick-up seems to be quite sensitive, and to require no more than two L.F. stages for full volume, or at any rate as much as the output valve is capable of handling. I now intend to convert my "Everyman Four" for alternative gramophone reproduction, and propose to use the last two valves, instead of connecting the pick-up in the grid circuit of the detector, as is usually recommended. If you think that this is sound, will you please give me a few suggestions as to switching arrangements?

D. B. L.

With the average pick-up, it is often quite possible to load the ordinary output

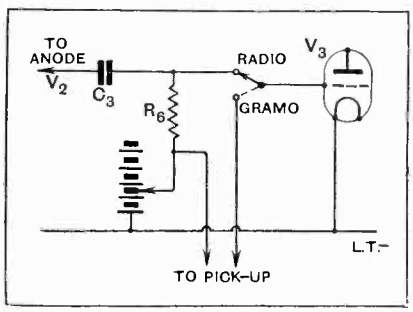


Fig. 1.—How to use the L.F. amplifier of the "Everyman Four" for gramophone reproduction.

valve to its capacity with two L.F. stages. A simple method of switching, applicable to the "Everyman Four," is shown in Fig. 1. The only addition is a single-pole two-way switch, arranged to change over the first L.F. grid either to the detector valve plate or to the pick-up (or its transformer, if one is used). Of course, provision must be made for switching off the filaments of the first two valves.

A plug-and-socket device may be used instead of the switch. Needless to say, whichever arrangement be used, insulation should be of a high order, and stray capacities should be reduced as much as possible.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.

L.T. Charging from A.C. Mains.

I have read that an ordinary receiving valve with plate and grid connected together may be used as a rectifier in a battery eliminator. Would it be possible to use it for charging an L.T. accumulator from D.C. mains?

A. N. W.

Practically speaking, an ordinary valve would be useless for this purpose, as the rectified current passed would be quite insufficient for charging even the smallest type of L.T. battery. Special rectifying valves are necessary for this purpose.

Mutual Interference.

My next-door neighbour recently installed a single-valve receiver, with the result that my own reception, which was previously all that could be desired, has suffered very considerably. Tuning is erratic, and the volume obtained is generally less than normal, although on occasions it is greater than I have been accustomed to obtain. The aerials are parallel, and about 9 feet apart, while the earth connections are close together. Can anything be done to overcome the difficulty?

B. H. P.

It is obvious that your troubles are due to interaction between the neighbouring aerials, and we fear that the only way of minimising it is to separate them as much as possible. If it can be arranged, the horizontal portions should be more or less at right angles, and at the same time efforts should be made to avoid parallel down leads. Possibly you will be able to remove the receiver to another room, which should help you to obtain better separation. The earth connections should also be spaced as much as possible, and it would be as well to use different kinds of "earths": for instance, if your neighbour's is connected to a water pipe, we suggest that you yourself should join your set to a buried metal plate, or *vice versa*.

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By-pass Condensers in the "Selection Four."

There seems to be some divergence in the values of the condensers given in the "List of Parts" relating to the "Selection Four" receiver and those appearing in the inscription under Fig 1. Which is correct?

T. P.

We suggest that you should be guided by the values given under Fig. 1. Actually, however, it is immaterial whether capacities of 0.5 mfd. or 1 mfd. are used at C_1 and C_{10}, but there is no point in using the more expensive condensers, unless you happen to have them already in your possession.

Where a Crystal Rectifier is Out of Place.

Please tell me how a crystal detector can be used for local station reception in my "Everyman Four" in place of the valve. P. T.

We think it would be a great mistake to attempt the modification you propose, as the circuit of the receiver in question does not lend itself to crystal detection without considerable alterations, the introduction of which might easily result in serious loss of efficiency, which would make itself felt when the set is being used for distant reception. In any case, the economy resulting from crystal rectification would be almost negligible, as the detector valve in this particular set consumes very little current from the H.T. battery, and, moreover, its filament may be run at a low temperature.

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The Parallel Push-Pul lSystem.

For some time I had in use a receiver using two D.E.5A valves in the output stage. Later on I changed over to the push-pull system, using the same two valves. I now wish to obtain a still greater output, and a friend has told me that this can be done by the parallel push-pull system. Can you explain what this means? D. R. A.

The parallel push-pull system consists merely of adding another valve of the same type in parallel with each of the existing push-pull valves. The diagram in Figure 2 will probably make the matter clearer. It will be seen that filament grid and also plate of the extra valves are in parallel with each existing valve. The valves should be of the same type as the other valves. This arrangement gives the advantages of both the ordinary push-pull and the ordinary parallel valve output systems.

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The Advantage of Measuring Instruments.

I am using an "Everyman Four" receiver fitted throughout with 2-volt valves. A high-impedance valve is used in the detector position, and the low potential end of the H.F. transformer secondary is connected to L.T.—, as the long-wave arrangement has not been included. With a sensitive milliammeter connected in the anode circuit of the detector valve it is noticed that maximum signal strength is possible only with the filament below normal brilliancy. That is to say, maximum signal strength does not coincide with maximum plate current. Can you please explain this effect? A. L. B.

The effect noticed is due, probably, to the detector valve not being correctly adjusted for maximum sensitivity. This requires a negative grid bias of from 0.75 volts to 1.5 volts, according to the specimen used, and it is recommended, therefore, that you fit a biassing battery and a potentiometer. This matter was dealt with at some length in an article entitled "Notes on the Everyman Four," which appeared in *The Wireless World* for December 28th last, and you could not do better than refer to this issue for particulars as to the method of incorporating the biassing arrangement. Fig 1 (C) on page 844 would be the most suitable for your purpose, but in the first instance one grid cell only should be fitted, and if it is found that more bias is required then a further cell can be added without any difficulty.

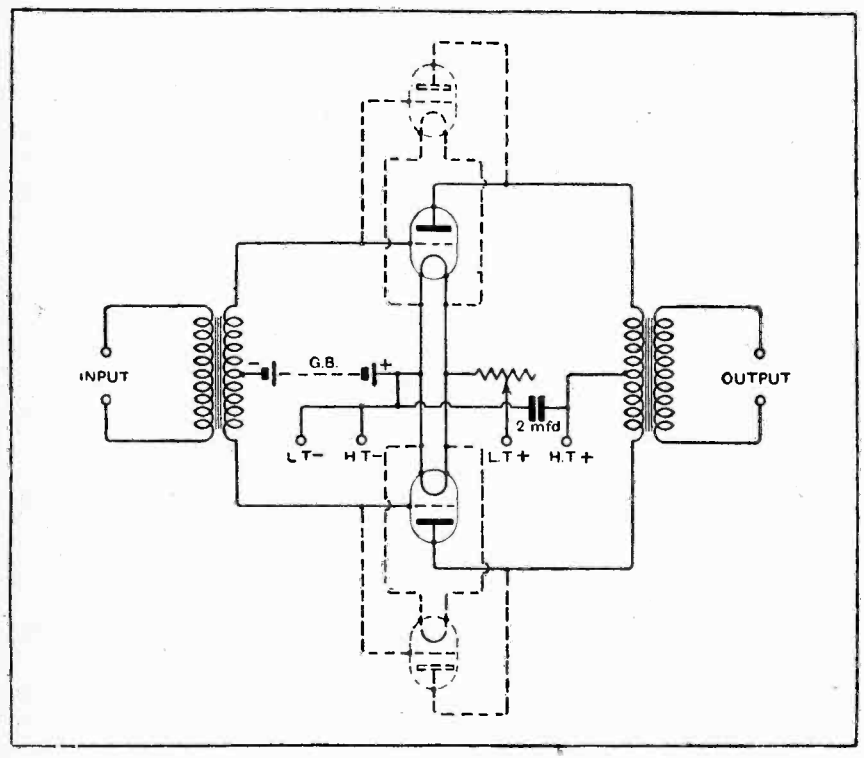

Fig. 2.—The push-pull system with valves in parallel.

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A Biassing Pitfall.

While experimenting recently with an 0-v-2 receiver I found that a noticeable increase in volume on very weak signals could be obtained by reversing the connections of the L.T. battery. The circuit used is an orthodox anode bend detector and two resistance-coupled amplifiers. Varying the grid bias to the valves will not achieve the same results, neither will different values of H.T. within reasonable limits give an increase in signals. Can you explain this, please? F. N.

On reversing the connections of the L.T. battery the grid bias applied to the grids of all valves will be reduced by the value of this battery. If we assume that a 4-volt accumulator is used and the detector valve is biassed normally to 1½ volts negative, then on reversing the filament battery the grid of this valve will become 2½ volts positive. Under these conditions the detector will function as a leaky grid rectifier and not as an anode bend detector. Generally speaking, leaky grid rectification will be more sensitive to weak signals, but the detector valve will overload much sooner on a strong signal than would be the case with anode bend. If certain precautions are taken in the design of the circuit associated with the grid of the detector valve, the anode bend method of rectification can be made nearly as sensitive to weak signals as the other method, but this question would be too lengthy for adequate treatment here.

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Rheostats for the "Standard Four."

In the description of the "Standard Four" published in your issue of November 30th, 1927, I notice that you do not specify values for the filament rheostats. Will you please give me some information on this subject, as I am about to construct this set? K. S. M.

The value of filament rheostats will always depend on the type of valves which are used, and also on the battery voltage. You do not give us any information on this subject, but assuming that any of the specified combinations of valves of standard types are used, it will be quite safe to choose as R_3 and R_4 rheostats of 5 ohms maximum. As the detector valve has a comparatively high resistance in its anode circuit, full emission will not as a rule be required, and we suggest that R_3, which controls this valve, may have a value of at least 20 ohms. R_4 may be regarded as a volume control. With 2-volt valves of any type its resistance need not exceed some 15 or 20 ohms. Quarter ampere 6-volt valves would necessitate the employment of a resistance of about 30 ohms, while as much as 50 ohms would be required for 0.1-ampere 6-volt valves.

The Wireless World AND RADIO REVIEW

(15th Year of Publication)

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TELEVISION: WHERE WE STAND TO-DAY.

"SOUND broadcasting has now developed to an art and industry of world-wide scope and significance. The television receiver, as at present developed, will supplement and not replace the modern radio receiving set in the home. Broadcasting of television, it seems clear, will develop along parallel lines with broadcasting of sound, so that eventually not only 'sound' but also 'sight' through radio broadcasting will be available to every home."

A Fair Statement.

This comment on the future development of television was made recently by Mr. David Sarnoff, President of the Radio Corporation of America, after a demonstration of television had been carried out jointly by the Radio Corporation of America and the General Electric Company. This is probably a satisfactory and adequate statement of the position of television to-day. There seems to be nothing to stand in the way of the ultimate achievement of television as a practical service to mankind within a reasonable space of time by one or other of the several systems of television which are at present being developed.

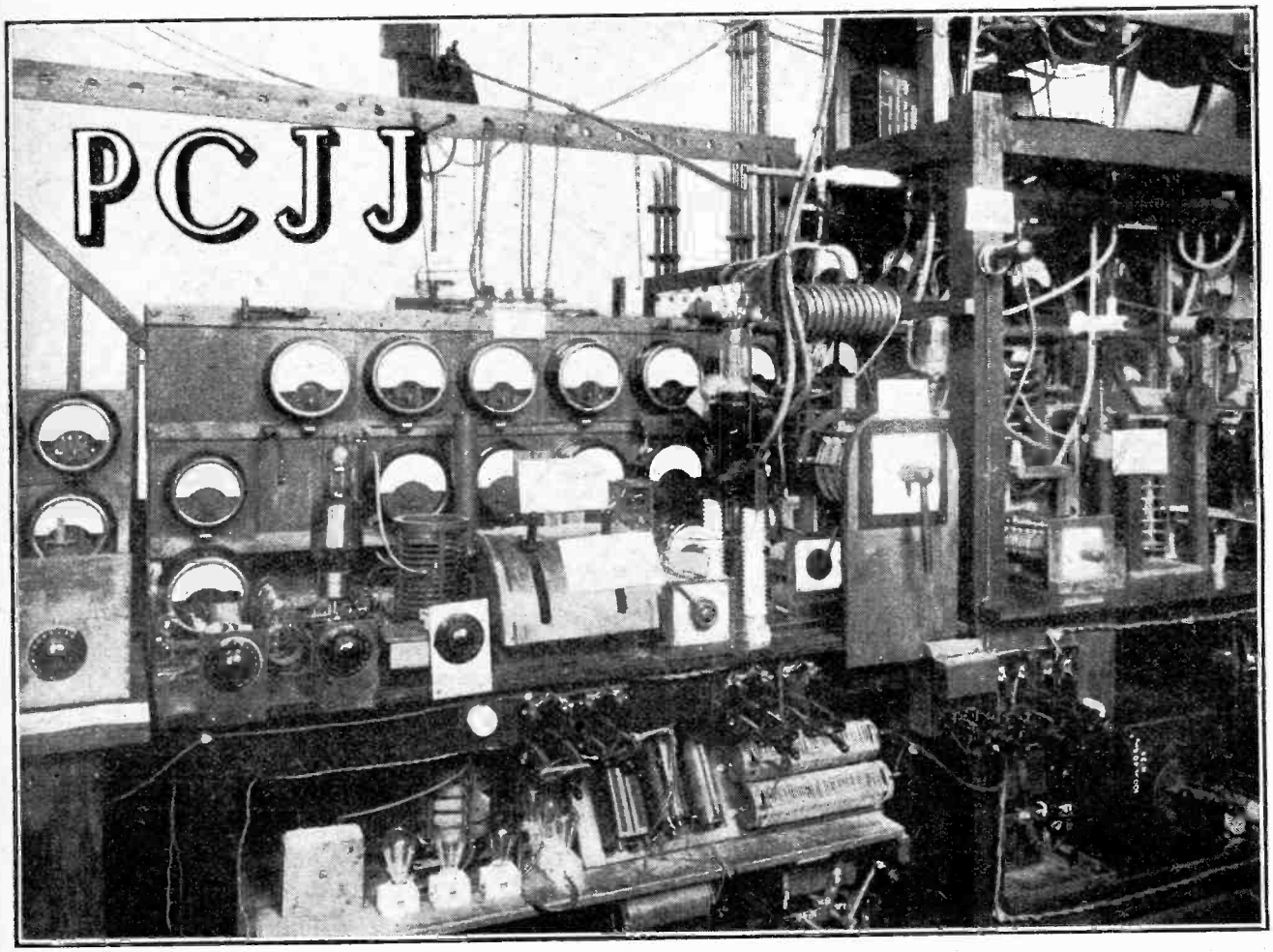
The Need for Caution.

We must, however, guard against permitting ourselves to be influenced unduly by the optimistic statements and claims of those who, in their enthusiasm for the system in which they are themselves interested, see the ultimate goal of their experimental efforts long before it has become visible on the horizon. What most we deprecate is the licence which those who are working on television development permit to Press reporters to exaggerate and enlarge upon remarks made in the course of interviews, until the public is misled into the belief that television has reached a stage of development vastly in excess of what actually is the case. Every scientist who respects his reputation should take steps to ensure that what he puts on record regarding his scientific achievements shall not be distorted and exaggerated by others who may quote him. In the newspaper reports of the success which attended the experiments referred to above it was, in our opinion, unfortunate that reference should have been made to "home television sets," implying that the receivers had reached a stage where they could be available to the public. The same complaint we make against Mr. Baird, who in 1926 made a statement to the Press that he anticipated that his Television receivers would be available to the public before the end of 1927, and at the Radio Exhibition in 1926 went so far as to exhibit a number of dummy boxes labelled "Baird Televisor" with a ground glass screen and loud-speaker trumpet.

The Effect.

Now, although this kind of thing may have publicity value, it is calculated to undermine the confidence of those who are looking for evidence of definite scientific achievement, and when the complaint is made, as we have recently seen it in print, that Mr. Baird's work is criticised "in certain quarters," we feel that Mr. Baird has only himself and his associates to thank for having acted in a manner which provokes distrust.

We do not think that commonplace home television reception can be expected for some considerable time to come. The systems of which we have knowledge at the moment appear to us to be either too crude to be of more than experimental interest, or else, where some higher degree of success has been attained by way of results, the cost is at present prohibitive as far as the general public is concerned.



The Dutch Short-wave Station.

Some Notes on the Future of the Station and the Example which it Sets.

THE Dutch short-wave station PCJJ scarcely requires any introduction to our readers, who, through the pages of *The Wireless World*, have been kept informed of the activities of this transmitter, which has done so much to assist us by example in our demand for a British Empire broadcasting station.

It will be remembered that last year the station commenced experimental transmissions from Eindhoven, in Holland, the home of the Philips lamp and valve business, which has grown to be one of the most important individual industries in Holland. The wavelength which has been used throughout these experiments is 30.2 metres, and, although in the early stages the station was designed and erected purely for experimental purposes, yet it seems likely that it is now destined to play an important commercial *rôle*. Recently the station was transferred from Eindhoven to a new site at Hilversum, a distance of about 90 miles.

First Photographs.

The photographs accompanying this article, which are the first to receive publication in this country, with the exception of that which appeared in our issue of last week, show the station after re-erection at Hilversum, but still not in permanent form, for a building is being specially built to accommodate it in the small village of Huizen, which is located not far from Hilversum and is also near Amsterdam. On its present site experimental transmissions are now being conducted every week-day from 6 to 10.30 p.m. G.M.T., and apparently the same success is being achieved from the new site as was experienced when it was located at Eindhoven.

An Interesting Map.

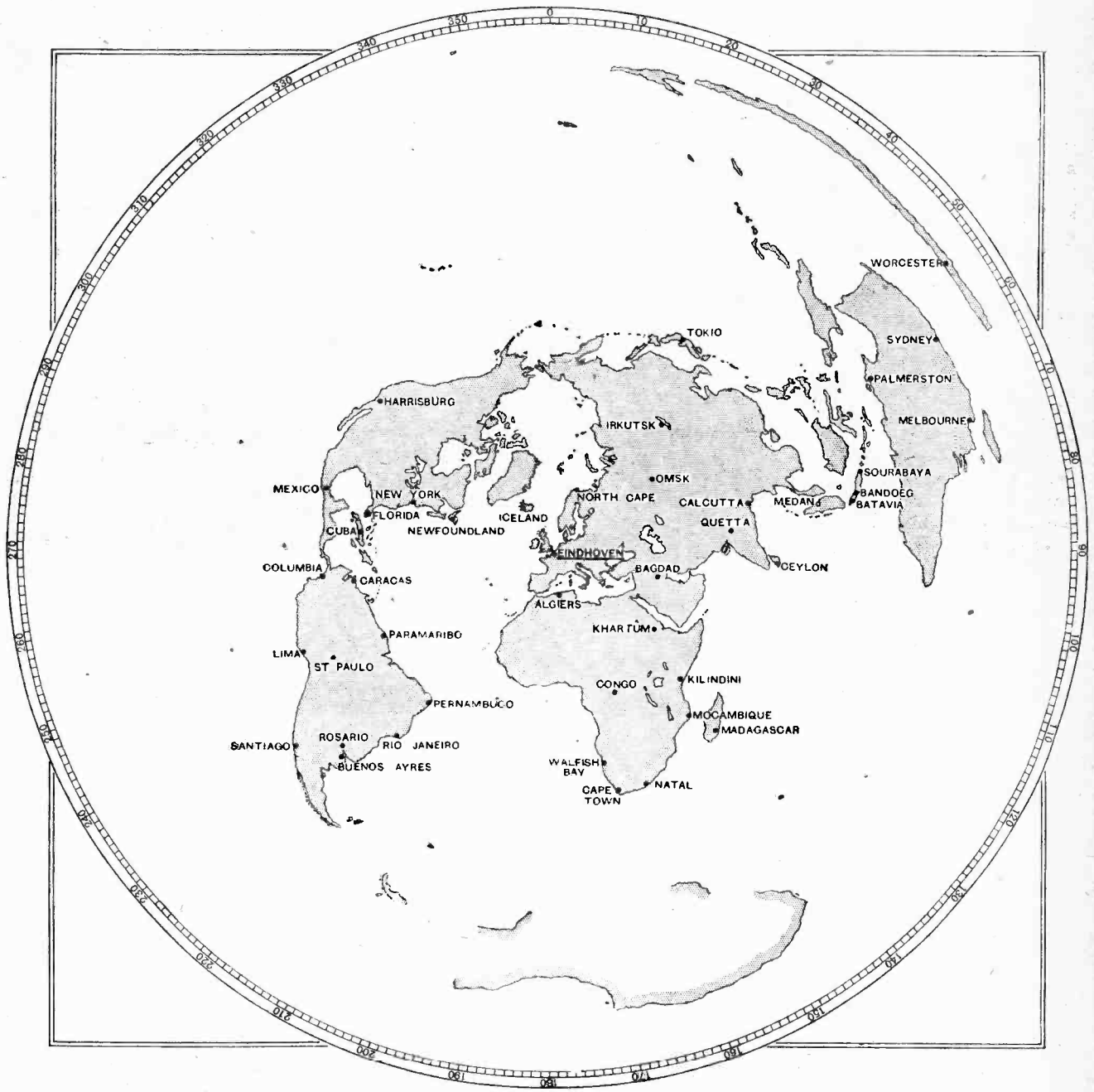
The map which we reproduce is interesting as showing locations where the station was satisfactorily received in June and July last, soon after it had commenced transmissions. The map is *The Wireless World* Great Circle Projection Map, which indicates the correct distance and direction of any part of the world from Eindhoven, and the points recorded indicate how world-wide was the range achieved by PCJJ.

Until the station is permanently installed in the building now being prepared for it, the transmissions will con-

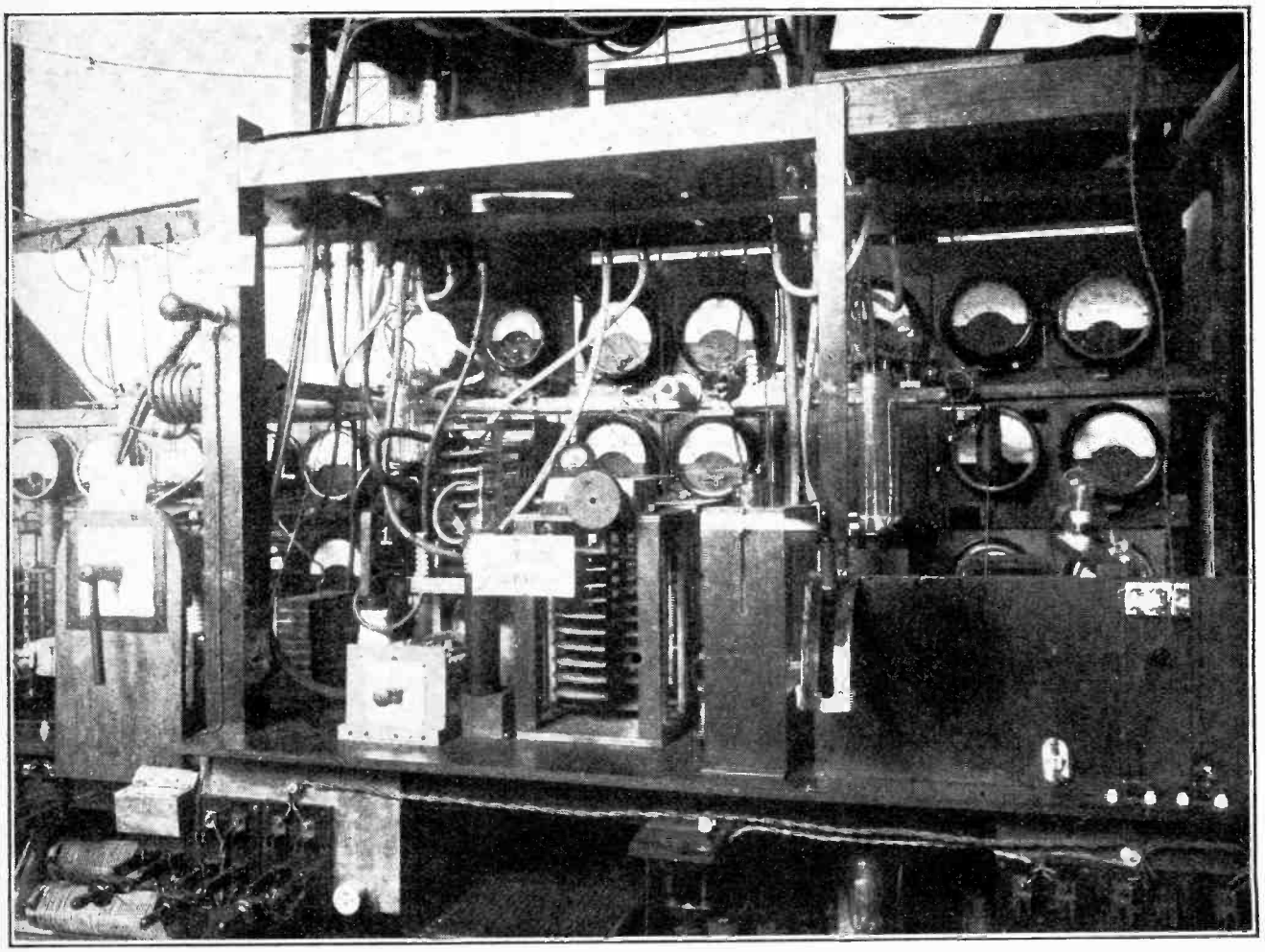
PCJJ.—

sist in the main of gramophone records and piano music, though if the opportunity presents itself a few special transmissions of concerts or other features will be conducted. Officially, transmissions will not commence until the station is permanently installed, but then the programmes will be compiled and organised by a company recently formed at Amsterdam, known as the Holland-India Broadcasting Corporation, which has a capital of £100,000. The object of this Corporation is to transmit concerts, lectures, and interesting events, apparently the principal intention being that these transmissions should be received in the Dutch Indies, where the station is very regularly heard.

It is expected that it will be May or June of this year before these official transmissions commence, and it seems likely that after the station is permanently installed the Philips Company will turn its attention to transmitting on a wavelength of 17 metres, which is a project they have been considering for some time. An interesting point in connection with the design of the station is that Dr. Balth. van der Pol and Mr. J. J. Newmans designed



A map of the world centered on Eindhoven showing where the station was successfully received shortly after transmissions were commenced last year.



A close-up view of part of the transmitting equipment.

the station to have an aerial output of 25 kW., carrying out all their measurements and calculations for the design using small transmitting valves with a miniature station as their basis. The wavelength is crystal controlled.

The station engineer uses a simple, though very convenient, method of checking the performance of the station. A receiver with a loud-speaker is used to pick up the transmissions, and this is brought in to a check room, where there is also a loud-speaker working direct through a microphone and amplifier from the studio, where the gramophone or other source of transmission is being operated. In this way it is comparatively easy to turn from one speaker to another and check any difference arising from incorrect adjustment of the transmitter.

What of the British Empire Station?

Now that PCJJ is well on the way to being installed as a permanent station operating regularly, it is time for us to ask when our British Empire broadcasting station is to follow this example? In July last Capt. Ian Fraser, M.P., in the House of Commons, asked the Colonial Secretary if any views had been expressed by the representatives of the Colonies at the recent Colonial Conference as to the desirability of establishing a Dominions broadcasting station. The reply was that the representatives at the Conference expressed the view that such a service, if found to be practicable, would be very widely appreciated overseas, and whilst it was considered premature to ask for an undertaking to contribute until the necessary experimental work in this country was further advanced, the Colonial Secretary did not for a moment anticipate that the Dependencies would show reluctance when the time came to share the expense involved. The degree of success attending the efforts made up to the present by the British experimental short-wave station at Chelmsford is probably better known to the B.B.C. than to anyone else, and we regret that so far we have had no official information as to what real success has been attained.[1] It is high time that the B.B.C. published a report on the results of their experimental work up to the present, indicating how far afield the station had been satisfactorily heard, the material from which to compile such a report is undoubtedly now available at the offices of the Corporation.

[1] Letters published under Correspondence in this issue indicate, however, that progress is being made.

HIGH-NOTE LOSS IN RESISTANCE AMPLIFIERS.

Part I.—The Important Effect of Incidental Capacities.

By A. L. M. SOWERBY, M.Sc.

Resistance-capacity coupling and distortion-free L.F. amplification are often considered by amateurs as synonymous. A perusal of Part I. of this article will reveal the dangers of neglecting the many capacities incidental to this method of amplification which may cause a serious suppression of high notes.

THE old and time-worn superstition that the removal of all iron-cored apparatus from a low-frequency amplifier necessarily results in the elimination of all distortion seems to die very hard, for in many quarters one still hears the remark, "Oh, no! There is no distortion whatever in my set; it is resistance-coupled." Now, though it is perfectly true that a well-designed resistance amplifier, supplied with anode current from a source free from internal resistance, need not introduce any falsity that is not insignificant compared with the shortcomings of the best loud-speaker yet made, still the fact remains that a resistance amplifier requires just as much care in design as any other type.

It is easy, of course, to get perfect quality if the number of valves employed is of no account, just as it is easy to obtain high amplification if one aims blindly at doing so without considering quality at all, but to obtain the highest amplification compatible with a predetermined standard of quality is a problem in design that calls for a good deal of careful consideration.

What are the causes of poor quality in the type of amplifier under discussion? Setting aside the question of distortion caused by the internal resistance of the anode current supply, which can, after all, be mitigated by the use of high-tension accumulators, there are two faults that can mar the performance of a resistance amplifier.

The first of these is low-note loss, which cannot be completely avoided, but can, by suitable choice of coupling condenser and leak, be reduced to any desired extent. The present writer, among others, has written on this point, and the necessary data for design work will be found in a previous article.[1]

The second loss that is likely to arise is that of high notes. The present craze for high amplification per stage, brought about by competition from the transformer makers, has led to the design and manufacture, both commercially and in the home, of a very large number of resistance amplifiers in which the highest notes are almost entirely lacking. There must be tens of thousands of listeners, each piously convinced that his receiver, being resistance coupled, can give rise to no distortion, who are putting up with reproduction in which the highest audible notes are reduced to less than one quarter of their proper strength.

Nor is this all; in the majority of such cases the bass register is also deliberately attenuated in an attempt to disguise the lack of high notes, and to bring the general tone of the music to the correct level. This, however, is not a cure for the loss of high notes; carried to its logical conclusion, this method would eventually land us with an amplifier that reproduced nothing but one octave somewhere in the middle of the musical scale. It is necessary, therefore, to find the magnitude of the high-note loss, and the factors contributing to it, so that we may be in a position to design an amplifier in which the loss is reduced to negligible proportions.

It is the purpose of the present article to do this, going rather fully into the loss of high notes, and not only showing how the loss arises, and upon what it depends, but indicating methods and giving data by which an approximate estimate of the magnitude of the loss in any particular case may be made by a comparatively simple calculation.

First, let us see through what channels these elusive high notes slip away.

Fig. 1 shows, in solid lines, the connections of a single stage of resistance coupling, drawn in the conventional way. There is nothing present that can cause a loss of high notes, though if care be not taken in the proportioning of the coupling condenser C_1, some loss of low notes may arise. But if we remember that in an actual

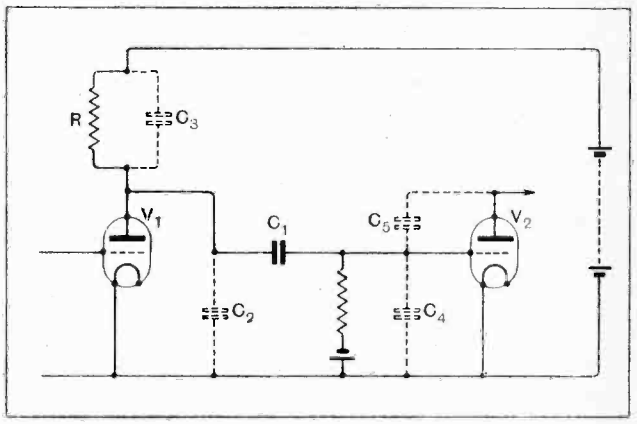


Fig. 1.—The connections of a conventional resistance-coupled stage in which the incidental capacities are shown in dotted lines.

amplifier all the components, not excepting the valves themselves, have incidental capacities, we begin to see where our high notes can get lost. The extra condensers, shown in Fig. 1 in dotted lines, are intended to represent these stray capacities.

There are at least four of them in this one inter-valve coupling:—

C_2, the capacity between the plate and filament of valve V_1;

[1] "Coupling Condensers and Leaks," *The Wireless World*, April 20th, 1927.

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C_3, the stray capacity across the anode resistance and its holder;

C_4, the sum of the grid-filament capacity of valve V_2, and stray capacity across grid-leak and holder;

And C_5, the grid-anode capacity of V_2.

Although this circuit, with all its incidental capacities, looks—and is—extremely complicated, yet we can grasp

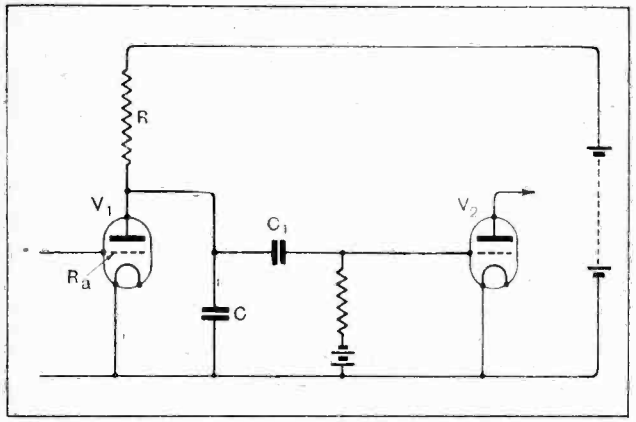


Fig. 2.—The incidental capacities shown in Fig. 1, being in parallel, can be represented as a single condenser C connected as above.

fairly easily its general behaviour if we once seize upon the fact that, in essence, *all* the stray capacities are in parallel. C_2, C_3, and C_4 run direct from a point at high signal potential (the plate of V_1 and the grid of V_2) to earth, so that we can lump them all together into one big condenser C. C_5 can also be treated in this way, because it can be shown, either by a piece of mathematical jugglery or by experiment, that its effect on high notes is that of a much larger condenser in parallel with C_4.

Let us, then, consider the behaviour of the circuit of Fig. 2, in which this process of amalgamation has been carried out.

The Network of Impedances.

It will be seen from this diagram that, in effect, the plate circuit of the valve V_1 is made up of two parts: the one the pure resistance R, the other the condenser C. In addition, it must not be forgotten, there is the internal resistance of the valve itself, which we will call R_a. There flow in this circuit two currents; the steady plate current of the valve which would be registered by a meter placed in series with R, and, superposed on this, the current due to the signals. This current, being alternating, does not actuate an ordinary meter, but its presence can be detected if the meter be replaced by a pair of telephones. The signal current alone interests us for our present purposes.

It is generated within the valve itself, in response to the signal voltages applied to the grid, and flows first through R_a, the internal resistance of the valve. After that it divides, part going through the resistance R and part through the condenser C. The path of this current, and the various impedances it meets with en route, are so important that a special diagram, Fig. 3, is drawn to show them. The quantities marked in this figure are exactly the same as those shown on Fig. 2, the generator serving simply to indicate the point, actually within the valve, at which the voltage that drives the signal current originates. The high-tension battery is only inserted to preserve the likeness between Figs. 2 and 3, so as to make reasoning based on the one as easily transferred to the other as possible.

In passing round the circuit, the signal current we are considering develops voltages across the various impedances through which it flows, and of these voltages the one that interests us is that across R (or, what is the same thing, since C and R are in parallel, that across C), since this voltage is applied through the coupling condenser to the grid of the second valve, and so passes on through the amplifier. We must, therefore, see how this voltage varies with the frequency of the signal (*i.e.*, the pitch of the note), the resistance of R and R_a, and the capacity of C. In doing this we must bear in mind the fact that C offers a very much greater impedance to the lower notes or frequencies than to the higher.

Effects of Capacity.

For the lowest notes of all we may regard C as offering an infinite impedance, so that the voltage in the circuit is divided between R_a and R in the ratio of their resistances. We therefore incline to make R large compared with R_a, so that as large a proportion as possible of the available voltage shall be transferred to the succeeding valve, thus giving us high amplification per stage.

As the frequency of the note being amplified rises, the stray capacity C offers less and less impedance to the passage of the signal current, while R_a and R, being pure resistances, continue to offer the same resistance as to the lowest note. The voltage across R, owing to the partial short-circuiting effect of C, becomes therefore a smaller and smaller proportion of the total voltage as the frequency rises, so that the high notes are not amplified to so great an extent as the low.

In consequence, an amplifier in which the effects of stray capacity are marked will tend to cut off the highest notes to some extent, and the reproduction that it gives

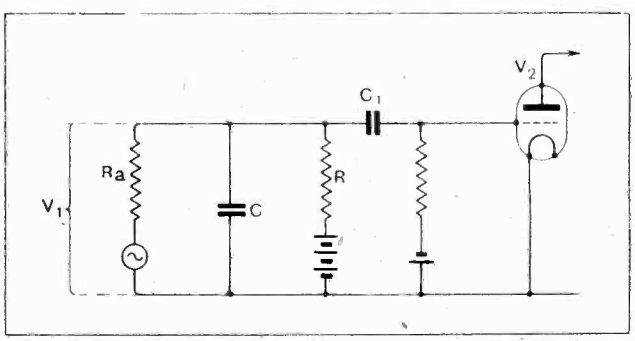


Fig. 3.—The equivalent network of impedances in the output circuit of valve V_1.

will consequently be too rich by comparison in middle and low notes, so that the general effect will be "woolly" and low-toned. This will not, usually, be very noticeable in music, for a "mellow" tone is often preferred, especially by those who never check the fidelity of their loud-speaker by listening occasionally to a real orchestra. When speech is being received, however, the lack of high

High-note Loss in Resistance Amplifiers.—

notes is usually very evident; the consonants are slurred and not easily distinguished, and an "s" in particular in very "shushy," degenerating sometimes even to the level of the noise that does duty for that consonant on the Post Office telephones.

It is not difficult to see that this loss of high notes will occur to a greater extent when the stray capacity is large than when it is small; it may be less obvious that the loss depends also upon the values of the internal resistance R_a of the valve and on the anode resistance R. If we suppose that at some high note frequency C offers five times the impedance of R, then the loss of high notes will not be very great; but if, keeping C unchanged, R and R_a are both increased ten times, C will now only offer half the impedance of R, and the high notes will suffer badly.

This can be made clearer, perhaps, by taking a pair of examples. Suppose that in one case R_a = 10,000 ohms, R = 60,000 ohms, and C = 150 micro-microfarads. Then for the lowest notes the condenser offers an almost infinite impedance, and the voltage developed across R is 6/7 of the total voltage produced by the valve in Fig. 2, or by the generator in Fig. 3. For high notes of a frequency of 5,000 per second the condenser offers an impedance that it is no longer safe to regard as infinitely high. The actual impedance is about 210,000 ohms, so that the impedance of R and C in parallel is reduced to about 58,000 ohms. This is not very different from the original 60,000 ohms, of the anode resistance alone; the loss of high notes will therefore be but small.

If we now increase R and R_a ten times, making them 600,000 and 100,000 ohms respectively, and still keep C at 150 micromicrofarads, the same conditions hold, for low notes, as before, and still 6/7 of the voltage developed within the valve V_1 will be passed on to the grid of V_2. On high notes, however, the impedance of C and R in parallel, made up of 600,000 ohms for R and 210,000 ohms for C, will only be about 190,000 ohms. This is a sad falling off from the resistance offered to the low notes, and results in a transference to the grid of V_2, not of 6/7 of the voltage produced within V_1, but of some smaller fraction. Thus the increase of the resistances in this circuit, with no increase in the value of the stray capacities, leads to a greater loss of the high notes.

High Anode Resistances Produce Distortion.

This shows that the loss of high notes will be much greater if we adopt the modern method of using anode resistances of the order of a megohm, together with high-impedance valves, than if we use the older method of keeping both these resistances fairly low.

We see, then, that for the least high-note loss it is necessary to keep all three values reasonably low, and to balance any unavoidable increase in C by a corresponding diminution in R and R_a. These conclusions, so far as they go, are helpful, but we need something more; a definite formula is required, from which the loss can be calculated, if only approximately, in order that we may know how far we can safely increase R and R_a (and with them the degree of amplification per stage) before our high notes begin seriously to be cut off.

We will simplify our task by not making any attempt to determine the high-note loss for all frequencies, but will fix our attention on the highest note that we wish to retain. This may, in most cases, be taken to be 5,000

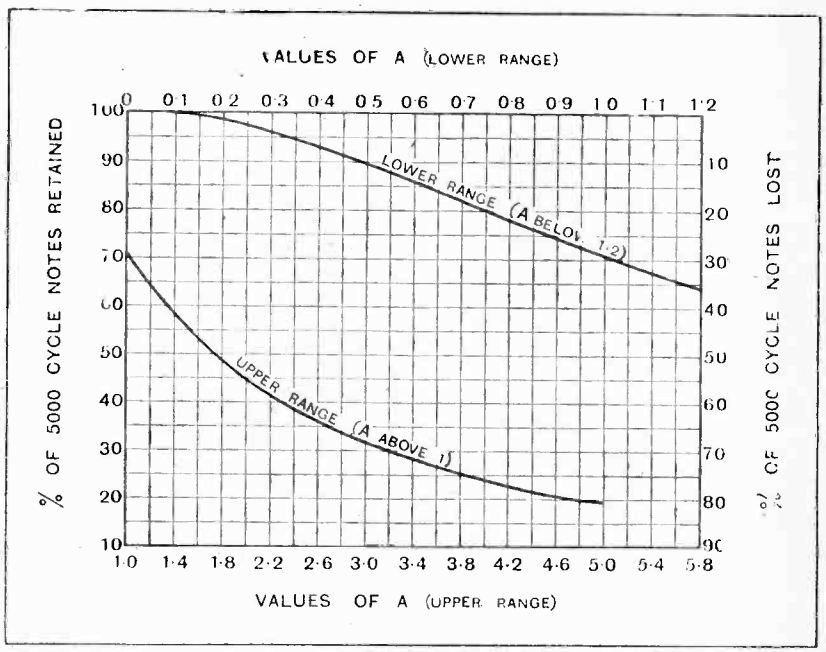


Fig. 4.—Graphs to be used in conjunction with equation (1.) to give percentage loss of high notes.

cycles (about half an octave above the highest note of the piano), since this is the highest note that can be transmitted by any station that keeps within the ten kilocycle band allotted to it under the Geneva wavelength scheme.

Calculations made on this basis do not lead to a simple formula for the high-note loss, but it is possible to employ a simple formula and a curve in conjunction to supply us with the information that we require.

The formula is:—

$$A = \frac{3\ RR_a\ C}{100\ (R + R_a)} \quad \ldots\ldots\ (1.)$$

where R, R_a, and C have the meanings implied by Figs. 2 and 3, on which the calculation is based. The units employed are *megohms* for R and R_a, and micromicrofarads ($\mu\mu$F) for C, which are very convenient units in practice.

The value of A for any particular coupling between two valves can be found quite readily from this formula, provided that we know the values of R, R_a, and C for the case in question. A, however, is not actually the high-note loss itself, though to every value of A there corresponds some particular percentage loss. The actual numerical values of the loss can be obtained from Fig 4,

High-note Loss in Resistance Amplifiers.—

which shows the curves connecting the value of A with the percentage of high notes retained (left-hand scale) or the percentage of high-notes lost (right-hand scale). The upper curve refers to values of A from 0 to 1.2, as shown on the scale at the top of the figure. Within this range the loss of high notes is not greater than 35 per cent., so that this curve covers all cases that we are likely to want in practice. The lower curve shows values of A from 1 to 5.8, as shown on the scale at the bottom of the figure, and includes losses up to 80 per cent. We are not likely to try to design amplifiers whose high-note loss is as great as this, but the curve will nevertheless be useful to show us the dire results of faulty design.

To make the use of the formula and its attendant curves clearer, let us now determine the actual high-note loss to be expected in the two cases we have already discussed. These were :—

CASE I.

$R = 60{,}000$ ohms $= .06$ megohm.
$R_a = 10{,}000$ ohms $= .01$ megohm.
$C = 150\ \mu\mu F.$

CASE II.

$R = 600{,}000$ ohms $= .6$ megohm.
$R_a = 100{,}000$ ohms $= 1$ megohm.
$C = 150\ \mu\mu F.$

In Case 1, we find by substituting the numerical values for the letters in the formula, that

$$A = \frac{3 \times .06 \times .01 \times 150}{100\ (.06 + .01).} = .04 \text{ approx.}$$

Reference to the upper curve shows that the loss of high notes is truly negligible, being something less than one-half of one per cent. We may award a certificate of first-class merit to an amplifier designed on these figures, despite the apparently high value of the stray capacity

In Case 2, we find that the value of A is

$$\frac{3 \times .6 \times .1 \times 150}{100\ (.6 + .1).} = .385$$

Reference to the curve again gives us the actual loss at 5,000 cycles; it is here 6.6 per cent. Much larger than before, but still negligible, for the human ear is so very insensitive to small changes in intensity that this loss would be quite inappreciable.

Are we to conclude from these examples that the high-note loss can always be neglected? Not by any means, for the valve impedance R_a and the stray capacities C assumed in these examples are both very much lower than those in many modern amplifiers.

In the application and use of the formula given, it is especially to be noted that R_a is *not* the rated impedance of the valve, as given in the maker's catalogue, and which is only correct when there is not resistance in the plate circuit, but a very much higher value which represents the actual working impedance of the valve in the actual amplifier. This value depends upon the H.T. voltage and the grid-bias as well as upon the value of the anode resistance.

Similarly, C is not simply the sum of all the stray capacities indicated in Fig. 1, measured with the valve unlighted, but the working capacity with the amplifier in use, which is, again, a very much higher figure.

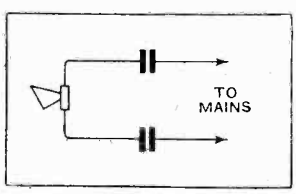
Before we can turn our formula and our curve to any really profitable use, we shall have to amass some data on the working values of both C and R_a; the second part of this article will deal with this aspect of the problem.

(To be continued.)

A SIMPLE TEST FOR SUPPLY MAINS.

VARIOUS methods have been suggested at different times for enabling those who wish to install a battery eliminator to determine whether their supply is alternating or direct current, but all such methods that the writer can remember reading about involve the possession of some apparatus which is not necessarily in the hands of every wireless enthusiast. A neon lamp can be used, for example, for mains with a voltage of 200 or thereabouts; a glow on one electrode only indicates direct current, while if the glow appears on both electrodes the supply is alternating. Or pole-finding paper may be employed, and works whatever the voltage of the mains; if both poles produce the same effect on the paper the supply is again alternating.

But the simplest method of all is to connect to the mains two small fixed condensers in series with a loud-speaker, as indicated in the diagram; the condensers should be of the mica-dielectric type. The loud-speaker hum will indicate the type of supply mains.



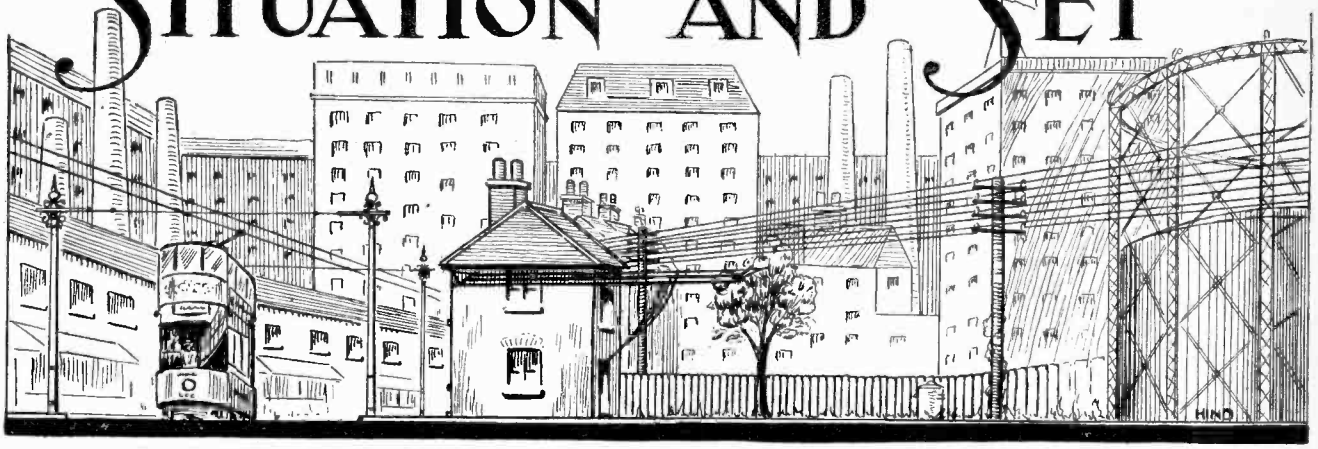
Small condensers connected in series with a loud-speaker for testing system of the supply mains.

If the note is low, so low that no bass singer could get down to it, so low, actually, that it partakes of the nature of a very rapid vibration, then the supply is quite certainly alternating, the frequency being that of the note heard in the loud-speaker. In fact, by picking out the note on the piano, it is quite possible to determine the frequency of the supply within reasonable limits of accuracy. A fifty-cycle supply, for example, gives a note almost exactly an octave above the lowest note of the piano.

A.C. or Commutator Ripple ?

If, on the other hand, the note is high and thin, recalling the singing of a mosquito, and is certainly too high for any male voice to reproduce, it is quite certain that what is heard is the commutator ripple on a direct current supply. This note, in addition to being very much higher pitched than that from an A.C. supply, will also be very much fainter, and it may be necessary to use quite large condensers before it becomes at all loud. Reliance should, however, not be placed so much on the volume of the note as on its pitch, which is, in either case, quite unmistakable, even if there is no standard of comparison other than the description just given.

SITUATION AND SET



The Importance of Local Receiving Conditions.

By "RADIOPHARE."

THOSE of us who have some small reputation in wireless matters are often asked for advice on the choice of receivers and circuits. The writer has noticed, when such questions are put to him by casual acquaintances, that the perfectly legitimate counter-question, "Where do you live?" is met, more often than not, by a raising of the eyebrows and the unspoken but clearly implied expression of the opinion that he is guilty of what amounts almost to a mild impertinence. Actually, nothing could be more pertinent. There seems to be a general lack of appreciation—even among many who should know better—of the importance of what is usually expressed by that all-embracing but ill-defined phrase "local conditions"; these notes are written in the hope that the less-experienced amateur may realise that these local conditions will make or mar the performance of his receiver, except, perhaps, for purely short-distance reception.

Three Stations or Thirty?

A simple statement of facts will serve better than anything else to point the moral; two receiving stations, typical of many thousands of others, will be described, and the results obtainable will be detailed. At each almost every conceivable type of receiver has been operated. The first, in the middle of London, about a mile from 2LO, is situated on the top floor of a three-storey house surrounded by higher and more modern steel-framed buildings. The aerial is rather better than the average (for a town), being raised a clear 30ft. above the flat roof, and is of a length but slightly below the P.M.G.'s allowance. There is the usual network of power and lighting circuits in the adjoining premises, in which electric lifts are installed. The second is on the outskirts of a small town, over thirty miles from the nearest broadcasting station. The aerial is by no means ambitious, consisting as it does of a single wire 30ft. above the ground, with a total length of 95ft. It is unscreened on three sides, and faces open country, with no other buildings within 100 yards.

Now for results. In the London flat, in spite of induction from power circuits, the local station can, of course, be received perfectly, because the signal-to-interference ratio is favourable, and there is no need for the set to be operated in a sensitive condition. Both Daventry transmissions are good, but the margin of safety in the case of 5GB is perilously small, and something rather exceptional in the way of receivers is required if this station's signals are not to be accompanied by a background of cracklings. No other stations are worth listening to; admittedly, several Continental transmissions, particularly those on long waves, can be tuned-in; but, due to local screening, the receiver has to be in such a sensitive condition that their signals are drowned in a welter of induction noises. Add to this the fact that an extremely selective circuit arrangement is necessary to eliminate the powerful near-by station.

Quite different conditions obtain at the country receiving station. Here—Morse interference and atmospherics permitting—the British and many Continental stations are receivable in daylight on a good H.F.-det.-2L.F. combination of the "Everyman Four" type; indeed, greater sensitivity than that provided by this kind of set is of no advantage, except on rare occasions. On a winter's night several German stations are generally audible on a crystal set. For ordinary requirements a detector-2L.F receiver would generally be considered sufficiently sensitive, and it is certainly sufficiently selective.

The Town-dweller's Handicap.

Here, then, we have two diametrically opposite sets of conditions; the first nearly as bad as possible, but not quite so bad as that shown in the drawing at the head of this article. The second is distinctly good, not only because of the absence of local screening, strong interference, and "man-made static," but because the topography of the surrounding country is favourable to wireless reception. The influence of these different conditions is shown by the fact that a set barely capable of receiving

Situation and Set.—three stations at the first place will receive dozens at the second.

It is safe to say that the long-distance enthusiast almost always labours under a severe handicap when he lives in a large town; conditions in the country are invariably more favourable. Moreover, they vary in different parts of these islands, and are generally best in the districts most remote from sources of interference. One may hazard a guess that the Post Office authorities did *not* move the transatlantic telephone receiving station to Scotland because the majority of calls handled (at £15 for three minutes) originated in that country

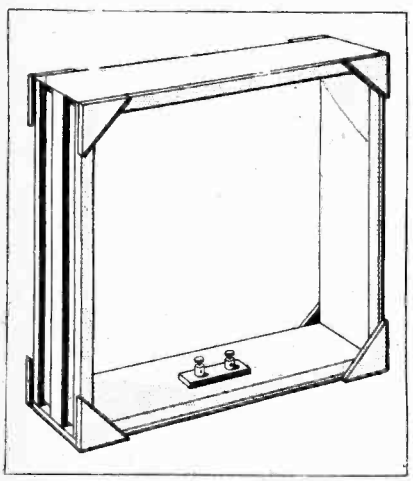
The prediction of results likely to be obtained in any locality with a given receiver is still largely a matter for guesswork, failing actual experience in that locality. This in spite of the fact that measurements of field strength have recently been made over wide areas; such measurements are most useful as a guide to the choice of circuit for short-distance work, but, unless made on the spot, are apt to be misleading when we are dealing with attenuated waves from distant stations. The beginner should always endeavour to benefit by the experience of his neighbours as regards both sensitivity and selectivity needed for his requirements.

The foregoing should show that the making of vague claims for receiver performance is often likely to cause disappointment to those unaware of the influence of locality. In the near future it may become customary to follow the lead already given by this journal (in the description of the "Everyman Four"), and to quote actual figures for H.F. amplification relating to all receivers with pretensions as to sensitivity. This conveys more useful information than a list of stations heard.

AN ENCLOSED FRAME AERIAL.

The difficulty of constructing a frame aerial which will be reasonably efficient, and at the same time more or less infrangible, is well known. This more particularly applies to the fitting of a frame aerial into the lid of a suitcase when constructing a so-called portable set.

The difficulty can be completely overcome by making use of the ordinary wood casing and capping so much used in electrical wiring. The casing which can be obtained from any large electrical firm, such as the G.E.C. or any local electrician of repute, contains two grooves. The method of using this, in the construction of a frame is clearly shown, the corners being fitted with triangular pieces of three-ply wood, this making the wooden framework quite rigid.



Frame aerial skeleton made of casing and capping used in the electrical industry.

In the case of a centre-tapped frame aerial, one half of each winding could be wound into each of the two grooves, and in the case of a portable set where a change-over was intended to be used from long to short wavelengths, the short-wave frame aerial could be wound in one groove and the long-wave aerial into the other. Efficiency on the short wavelengths will not be quite so high as in the ordinary type of spaced aerial, but the gain in complete protection to the wiring is an advantage which greatly offsets this.—L. M. R.

READERS' NOVELTIES.

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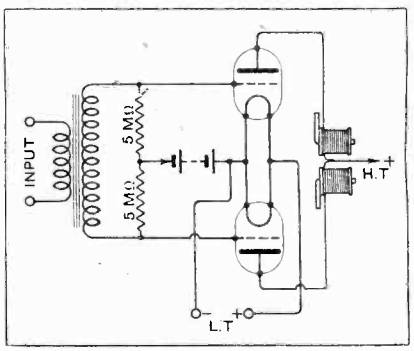
IT'S SO SIMPLE.

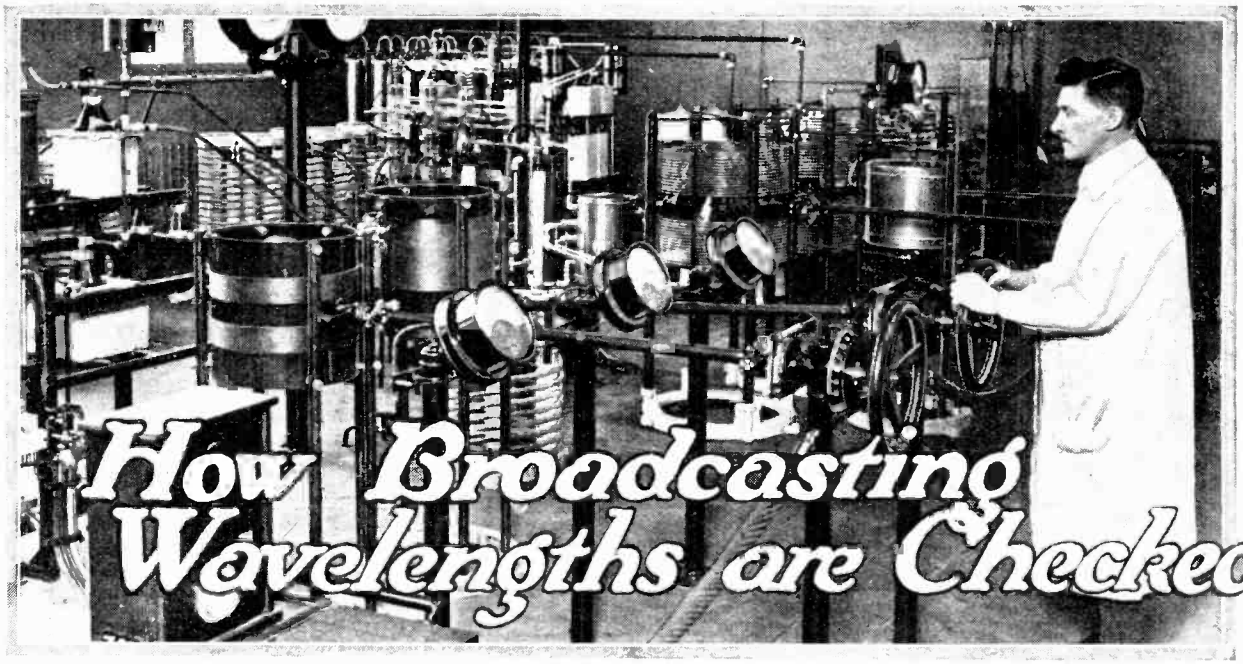
It often happens that the keen wireless man desires to experiment with the "push-pull" method of handling power in the last stage but is deterred by the high cost of the special input and output transformers needed. The method of using an ordinary good intervalve transformer as input transformer by the simple expedient of shunting the secondary with two resistances of very high value and making the grid bias connection at the juncture of the resistances is well known. It is not possible, however, to perform this operation on the primary of an output transformer owing to the large D.C. voltage drop which would be caused across them, with the result that the voltage on the anodes of the valves would be absurdly low.

As is well known, the windings of a 2,000 ohm loud-speaker, for instance, are wound on two bobbins, each bobbin having a D.C. resistance of 1,000 ohms. These bobbins are connected in series, and it is obvious that the anodes of the two output valves could be connected to the ordinary terminals of the loud-speaker, the H.T.+ connecting via a third terminal (which could be fitted in a convenient position) to the junction between the two bobbin windings where they are connected in series; care must be taken in the soldering operation.



Push-pull amplification employing an ordinary untapped intervalve transformer and using the loud-speaker direct in the plate circuit.

This can be done even in the case of a super-power valve, for no risk of magnetic saturation of the loud-speaker core will take place, as the magnetising current in each bobbin will cancel out just as is the case with the two halves of the primary of an output push-pull transformer.—F. B. H.



How Broadcasting Wavelengths are Checked

A Description of the International Listening Station at Brussels.

By R. BRAILLARD and E. DIVOIRE

President and Secretary respectively of the Technical Commission of the Union Internationale de Radiophonie.

THE readers of this journal are well aware of the circumstances which led to the formation of the Technical Commission of the Union Internationale de Radiophonie.

We shall not here repeat how, as a result of the work of this Commission, the general plan was established for the distribution of wavelengths to the European broadcasting stations, since known as the Geneva Plan. It will, however, be remembered that amongst the principles on which the Geneva Plan was based there was one which appeared to be of primary importance—that there should be a difference of frequency of 10 kilocycles per second between any two wavelengths.

It was seen by the Commission to be an indispensable condition of success that the wavelength of each station should be correct to within a few hundredths of one per cent. For this reason it was decided to design a new wavemeter, accurate, exact, and stable, and to supply each broadcasting station with one of these instruments.[1] There are now eighty of these wavemeters in use by the European Broadcasting stations; in addition, a dozen or more stations possess piezo-electric crystal devices or a vibrating tuning fork, which provide an additional check.

When the Geneva Plan was brought into force in November, 1926, an appreciable improvement in the reception of broadcast programmes was quickly observed, but this improvement was not so complete as was to be expected in theory. It is of interest to examine the reasons for this, and to discuss them.

As has been shown above, the success of the Geneva Plan, once this has been adopted, depends on each of its adherents keeping strictly to the wavelength allotted. Each station must maintain rigorously the difference of 10 kilocycles per second from its neighbour, not less and not more, as in the total band of broadcasting frequencies, which extends from about 200 to about 600 metres (500 to 1,500 kilocycles), there are only available 100 intervals, and every wavelength is in use.

In principle, therefore, no variation from the allotted wavelength can be tolerated. In spite of this, however, there are violations of this arrangement; the offenders being of two categories:—

(1) *Stations adhering to the Geneva Plan* who do not keep with sufficient exactitude to the allotted wave-

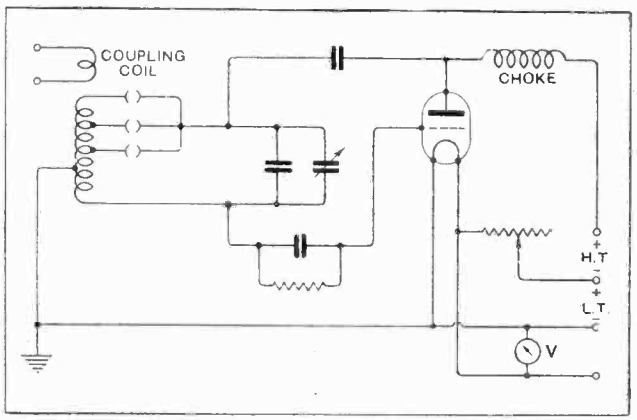


Fig. 1.—Diagram of connections of the heterodyne wavemeter

[1] Photographs of this instrument have already appeared in *The Wireless World*, and a detailed description will be found in *Experimental Wireless* of June and July, 1927.

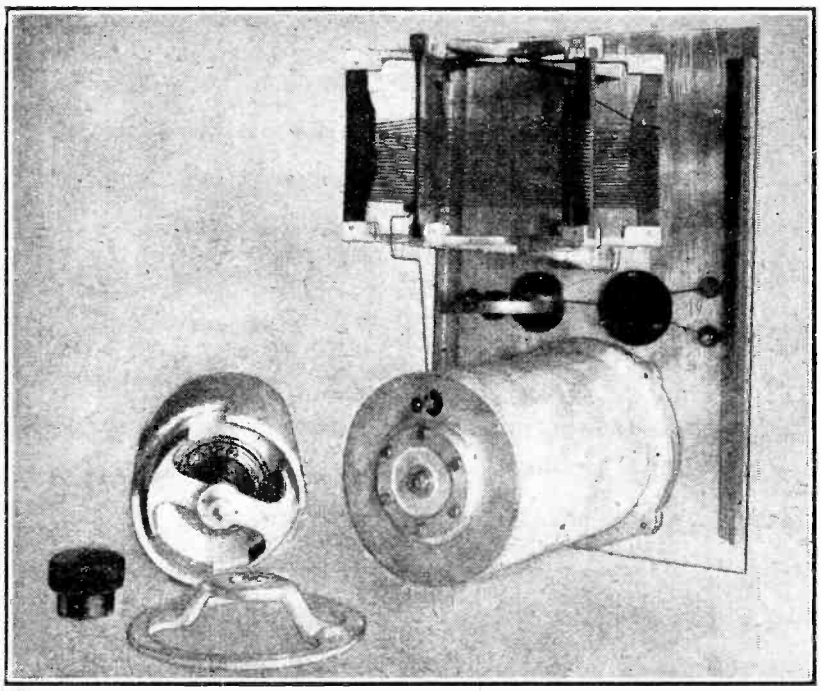


Fig. 2.—Rear view of the wavemeter which gives highly accurate readings.

length, either because they do not yet possess sufficiently accurate checking apparatus (a Technical Commission wavemeter, a piezo-electric crystal, or a vibrating tuning fork), or because the engineer on watch, whilst having such an instrument available, neglects to make full use of it. Such cases are, of course, exceptional.

(2) *Stations not adhering to the Geneva Plan.* It must be admitted that the greater part of the interferences are caused by stations not adhering to the Plan; these, whilst only a small minority of the European stations, are certainly one of the principal causes of trouble in the reception of broadcasting.

In view of this state of affairs the Union Internationale de Radiophonie decided, at its last meeting, to establish at the Technical Commission's offices at Brussels a permanent listening and wavelength checking station, and this started operations last November.

Apparatus Employed in Measurement.

Various methods for the accurate measurement of the wavelengths of distant transmissions were tried, and the following gave the most exact results:—

Signals are received by means of a powerful and selective receiver, and these are caused to beat with the wave transmitted by a local heterodyne wavemeter calibrated with great accuracy. At the moment when no beats are heard the adjustment of the heterodyne wavemeter indicates the wavelength of the transmission to be measured. It will be easily understood that numerous precautions must be taken to make certain of the accuracy of such measurements. Amongst others, it is evident that the precision and the calibration of the heterodyne wavemeter must be at least equal to the precision required for the measurements.

Care having been taken that the foregoing conditions were broadly satisfied, the following procedure was adopted:

1. A heterodyne wavemeter was obtained sufficiently stable for its calibration to remain practically unchanged for a long period, that is to say for several days or even more.

2. The calibration of this apparatus was checked as often as was necessary by an extremely accurate and absolutely stable instrument.

To carry out the first of these operations, the heterodyne wavemeter was constructed on the same basic principles as those adopted for the Technical Commission's wavemeter referred to above. It consists of specially robust components so as to be free from variations due to shocks, etc.; metallic construction has been used throughout; the volume of the insulating parts being reduced to a minimum, and the case is

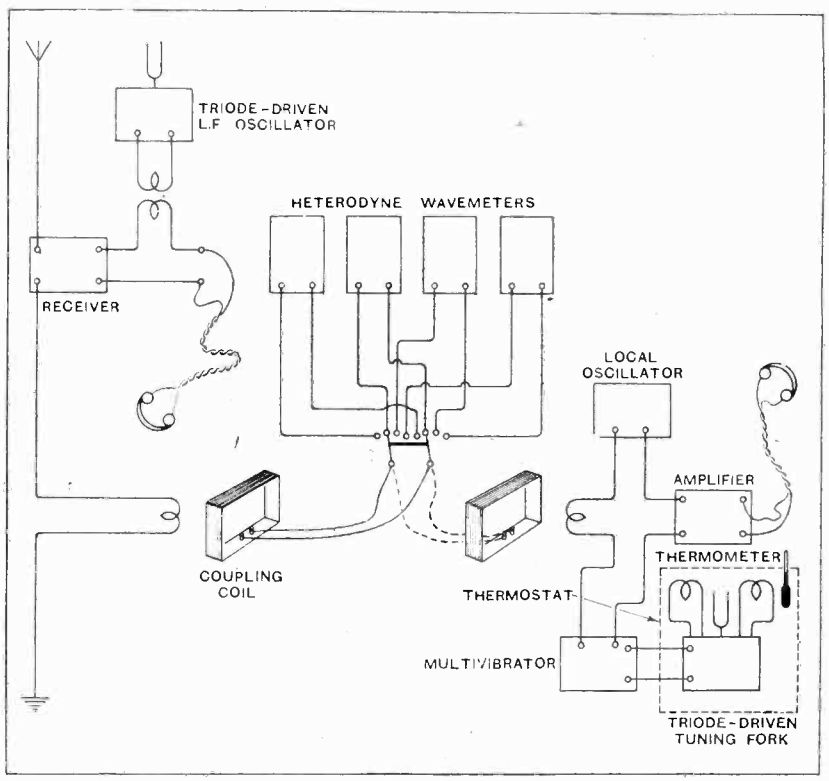


Fig. 3.—General arrangement of the apparatus.

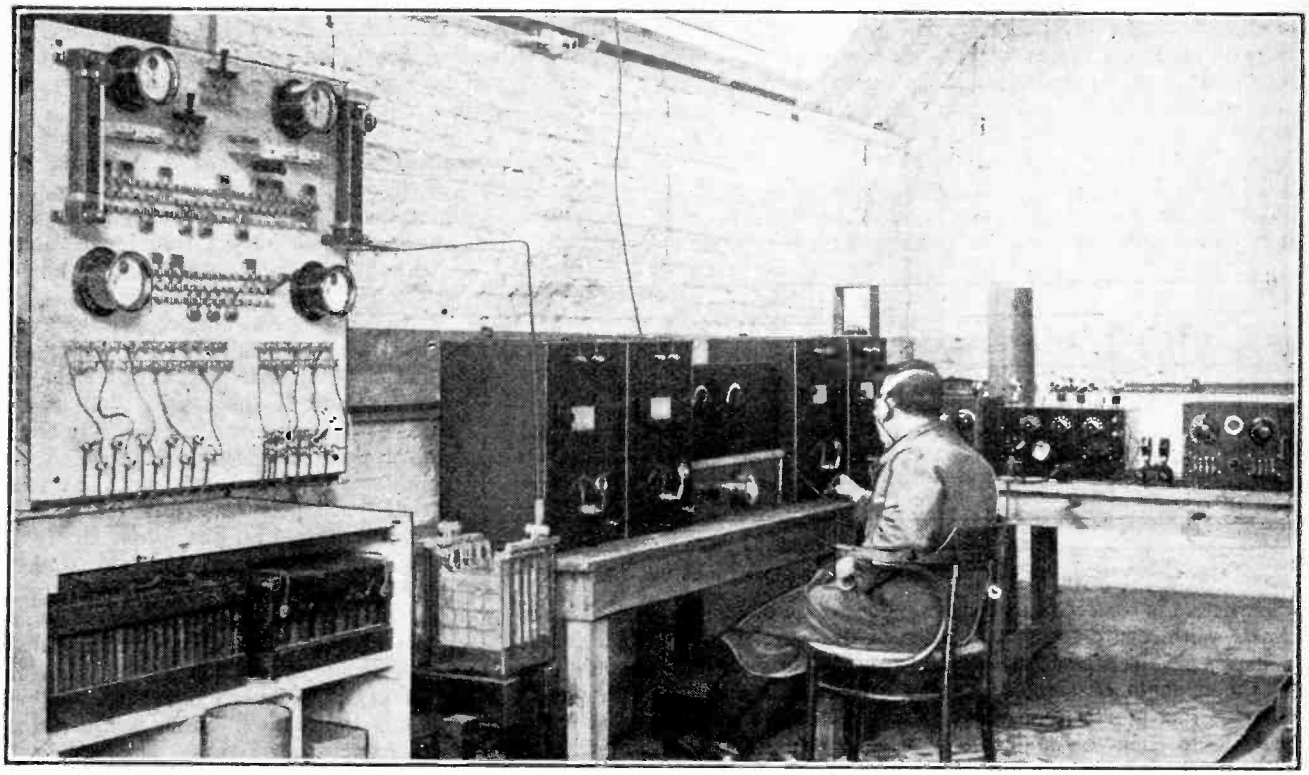


Fig 4.—View of the checking room. In front of the operator are four heterodyne wavemeters and a multivibrator with sustained tuning fork.

completely screened. The condenser is of the same type as that employed in the wavemeter already mentioned. The general arrangement is that of the Hartley circuit (Fig. 1).

The electrical dimensions of the components, and particularly those of the grid condenser and the leak, have been so selected that the calibration is practically independent of the heating of the filaments and the value of the H.T. employed. The 3-way Swiss commutator allows of three different values of inductance being used, and the vernier condenser gives a variation of 100 kilocycles.

Thus the entire range of wave-lengths from 500 to 1,500 kilocycles (200 to 600 metres) is covered by four heterodyne wavemeters.

To obtain great precision in the reading of the degrees of the condenser, this has been supplied with a geared dial of a type whose operation is particularly reliable. Further, a vernier scale has been fitted, allowing of readings to one-tenth and even to one-twentieth of a degree, the readings being rendered easier by a small magnifying glass fitted on the pointer.

The second operation requires an arrangement by which the calibration can be checked as often as necessary; this must be done quickly, but nevertheless with great accuracy. The arrangement adopted is shown in Fig. 3. As may be seen, the primary standard is a vibrating tuning fork, which, sustained by a triode, controls a multivibrator. This apparatus, constructed by Sullivan in a special alloy known as Elinvar, has been calibrated with the greatest care, under the direction of Mr. Dye, by the National Physical Laboratory. Its frequency is 1,000 periods per second, correct to within 1 to 2 thousandths of one per cent. The instrument is enclosed in a thermostat, so as to maintain this frequency perfectly constant however the temperature of the room may change. A heterodyne is adjusted, by the no-beat method, to the successive

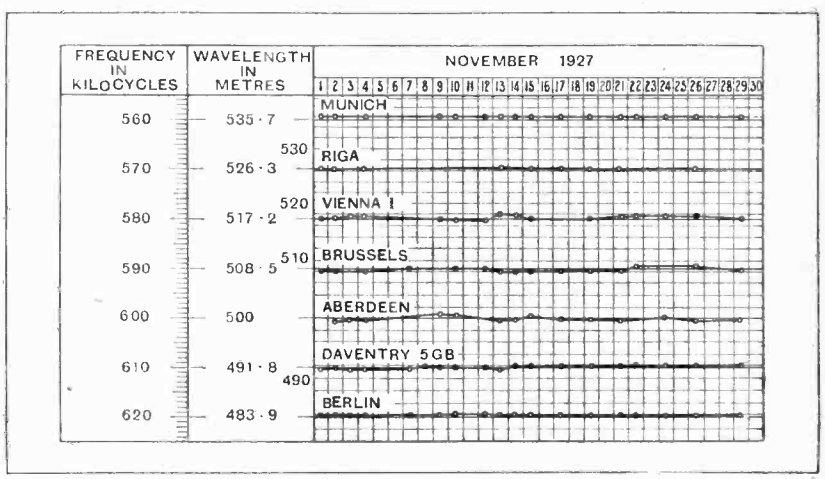


Fig. 5.—Graph showing measurements made during the month of November, 1927, on the 560 to 620 kilocycle waveband

How Broadcasting Wavelengths are Checked.—

harmonics of the multivibrator, and gives wavelengths of from about 1,000 metres to about 2,000 metres. Finally, the heterodyne wavemeters are themselves calibrated on the harmonics of the heterodyne. The method employed is well known, and has already been described in this journal.

In general, taking into consideration possible errors in observing the no-beat adjustment and in reading the scale, it may be estimated that the calibration of these heterodyne wavemeters is correct to at least one hundredth of one per cent. With regard to the evaluation of the wavelength of a station received by means of the receiver, this depends on the strength of signals. For a station at a medium distance (not greater than 1,000 kilometres) it is generally possible to count on a degree of accuracy of 1 to 2 in 10,000, which is at present more than sufficient.

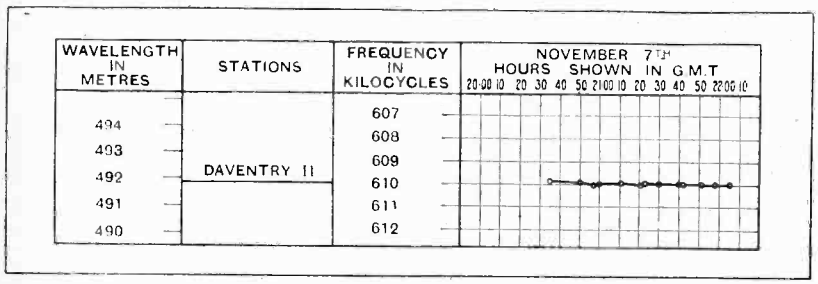


Fig. 6.—Wavelength measurement of 5.GB taken on November, 7th, 1927.

Nevertheless, should greater accuracy be found necessary, provision has been made for an auxiliary device; into the telephone circuit of the receiver is introduced current at a very constant audible frequency (about 1,000 periods), produced by a vibrating tuning fork; and instead of obtaining no-beats between the signal to be measured and the local wave of the heterodyne wavemeter, the latter instrument is adjusted to give a beat frequency equal to that of the auxiliary source of current. Two adjustments are found, corresponding respectively to $(f + 1{,}000)$ and $(f - 1{,}000)$, where f is the frequency to be measured. Each of these adjustments can be made with extreme accuracy (of the order of a few periods per second), and the average of the two is taken. In this manner the wavelength of signals from distant stations can be measured with a precision, expressed in relative values, of a few thousandths of one per cent.

Additional Checking Apparatus.

Finally, to give a further check on the accuracy of the primary standard, the calibrating apparatus will shortly be equipped with a complete set of piezo-electric quartz resonators, calibrated especially by the Physikalische und Technische Reichsanstalt of Berlin. Thus it is hoped that the measurements effected at the checking station will be covered by an international guarantee.

Some Results obtained.

The results obtained from the measurements made at the Brussels Listening Station are at once seen to be most interesting and instructive, and a few of these are here shown in the form of graphs.

The first graph, Fig. 5, shows the situation in a quiet and orderly region: the stations here represented all possess Technical Commission wavemeters and quartz resonators, and keep carefully to the wavelength allotted to them. The results are eminently favourable, and can only benefit the development of broadcasting.

Fig. 6, showing the result of observations made on November 7th last on the station 5GB, is an example of what can be achieved in the stabilisation of the wavelength with no other checking apparatus than a wavemeter, provided the characteristics of the transmitting station itself have been carefully established. Contrast this with the graph shown in Fig. 7, where, while certain stations adhere well enough to their wavelengths, we see others which, *in the course of a single evening*, vary within excessively wide limits and approach their neighbours' wavelengths in a manner which seriously endangers the quality of reception of the latter. It will be realised that in diagrams of this nature the injurious results of bad organisation and defective technique are strikingly demonstrated.

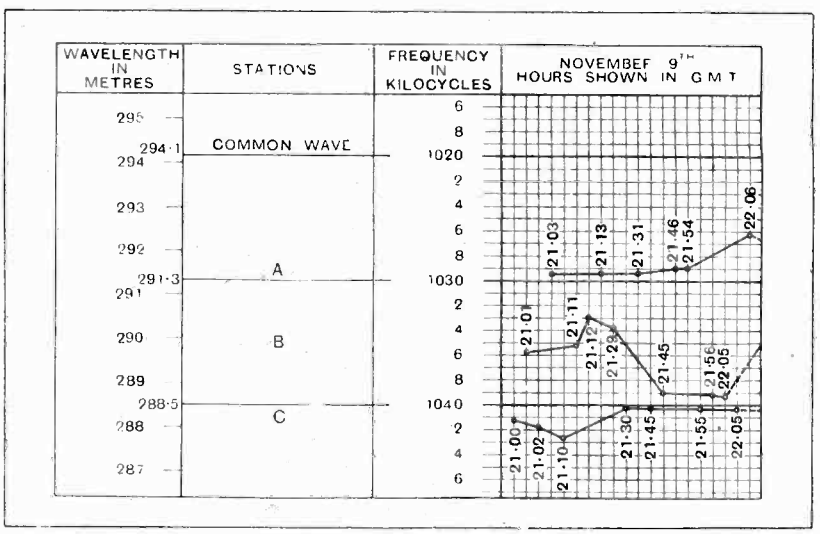


Fig. 7.—The wavelengths of various stations taken on the night of November 9th, 1927. Note the serious variations.

When interference is notified to, or observed by, the Brussels Listening Station, exact measurements are at once taken in order to ascertain which station or stations are at fault. The offender is at once notified by telegram and letter, and it is satisfactory to note that in most cases it has been possible to obtain a rapid improvement. There is no doubt whatever that the general adoption of such methods of supervision cannot fail to contribute to the improvement of the situation of European broadcasting in general.

NEW APPARATUS

"Wireless World"

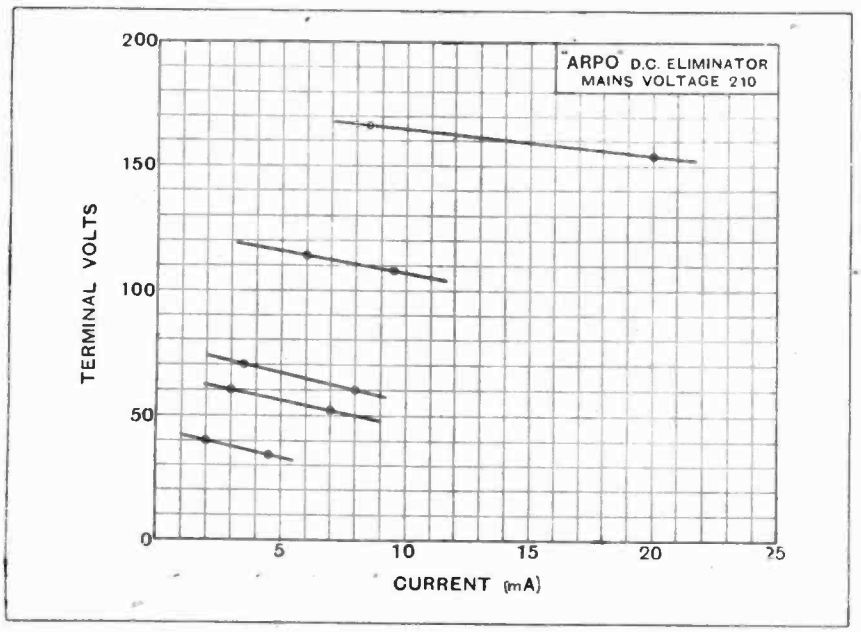
ARPO D.C. ELIMINATOR.

Owing to the large number of terminal voltages available, the Arpo D.C. eliminator, made by E. Arnold Pochin and Bros., Trafford Park, Manchester, should prove of particular interest to the experimenter.

Five different H.T. voltages are obtainable from the Arpo D.C. eliminator.

There are, in all, five H.T. terminal sockets connected to tappings on a potential divider; the voltages obtainable from these sockets are not marked, but can be seen from the accompanying output graph. As might be expected when using a potentiometer, the voltage regulation is good, *i.e.*, the terminal voltage does not vary appreciably with the load. The highest output voltage is given by the socket marked +, and the lowest by the one adjacent to the – (negative) socket.

The supply unit is effectively smoothed by condensers and chokes in each lead before passing to the potential divider, but no by-pass condensers are included in the output circuits. No doubt it is assumed that condensers will already exist between each H.T. terminal in the receiver and earth, but this point should be verified, and condensers fitted if necessary before putting the unit into use.



Output characteristics of the Arpo D.C. eliminator.

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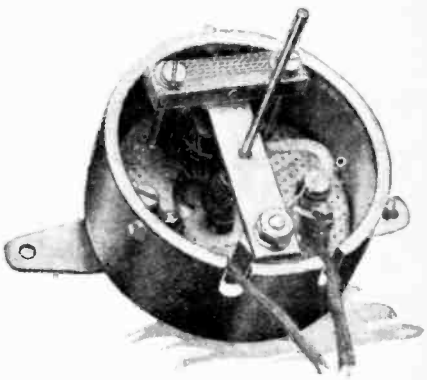
"VIOLA" REPRODUCER.

The home construction of cone loud-speakers is increasing in popularity, and this unit has been introduced by Messrs. Electradix Radios, 218, Upper Thames Street, London, E.C.4, to meet the demand for cone diaphragm movements.

Laboratory Tests.

A reed armature is used in conjunction with a special magnet system consisting of ring-type permanent magnets with a laminated pole-piece. The reed forms one pole of the magnet system and fits into a gap in the other pole, which is



"Viola" cone loud-speaker movement.

constructed like a miniature L.F. transformer. The speech-current winding fits over the centre limb of the laminated pole-piece and has a resistance of 2,000 ohms.

Adjustment of the reed is carried out by a knurled screw and coil tension spring.

The unit is supplied with flexible twin connecting cord and fixing bracket, and is priced at 15s. 6d.

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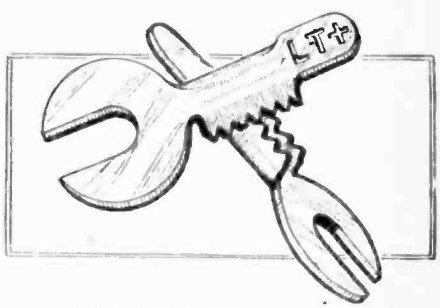
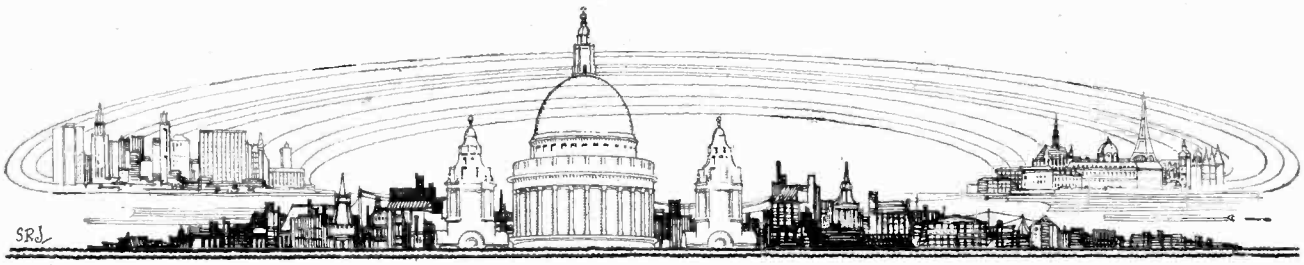
SPADE TERMINALS.

Messrs. Clarkes, Sinew Works, Redditch, Worcs., have introduced a novel form of spade terminal in which the



Clarkes' "Indicated" spade terminals.

shank is lengthened and stamped with lettering to identify the lead to which it is attached. Packets of assorted markings cost 6d. and contain a dozen terminals for L.T., H.T., G.B., .F., E. and L.S.



CURRENT TOPICS

Events of the Week in Brief Review.

RAILWAY TIME BY WIRELESS.

The Italian State Railways now employ the Paris and Nauen time signals for the checking of all clocks on the system. Fourteen railway "districts" have each been equipped with wireless receiving gear connected to the ordinary telegraph. When the time signal is received it is automatically relayed to all railway stations.

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HOME OF THE FUTURE.

All wireless optimists should make a point of inspecting the "most wonderful house in the world," now on view at the *Daily Mail* Ideal Home Exhibition at Olympia. Among the features of this striking domicile is a living room containing a radio receiver and transmitter, a telenewsprint device, and an instrument conveying the idea of television.

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SCOTLAND YARD AND BROADCASTING.

Scotland Yard made extensive use of broadcasting facilities for special calls during 1927. No fewer than 114 of these calls were sent out by the B.B.C., 41 of them attaining their objects. In 1926 there were 67 police calls, with 31 successes.

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SETS FOR SWEDISH BLIND.

A national committee has been formed in Sweden to provide wireless sets for the blind poor. Already 465 sets have been sent out.

BEAM BROADCASTING.

Beam broadcasting from Australia to Britain is the subject of experiment by the Australian Broadcasting Company in co-operation with Amalgamated Wireless (Australasia), Ltd. It is understood that in the course of a few months attempts may be made to transmit special programmes to this country.

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GENERAL ELECTION WIRELESS IN JAPAN.

Although not enlisted to aid any particular party, wireless played a prominent part in the recent general election in Japan. Shortly before the opening of the polling booths on February 20th a special address was broadcast exhorting the people not to overlook the importance of the occasion and to make use of their votes.

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MEDICAL PRESCRIPTIONS BY WIRELESS.

Antwerp is now the headquarters of a unique medical service conducted entirely by wireless. Founded for the benefit of ships not possessing doctors, the "Radiomedical Anvers Radio," as it is called, gives free medical advice to any ship asking for it. An inventory is kept of all ships with medicine chests, and the prescription is often framed in accordance with the known contents of the chest on board the particular ship seeking advice.

The call sign of this station is OSA, and messages intended for it, indicated by the letters SVH (Sauvegarde de la Vie Humaine), receive precedence over all others except the SOS.

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NEW FOG SIGNAL FOR SHIPS.

A new wireless fog signal station with the call sign GGK is to be installed at the Skerries Lighthouse off the Isle of Anglesey. A dash of 60 seconds' duration will be transmitted every four minutes.

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LISTENERS IN SWITZERLAND.

Broadcasting is slowly advancing in popularity in Switzerland. According to the *Times* Geneva correspondent, about 5,000 licences have been granted at Geneva, 6,000 at Lausanne, 16,000 at Berne, 32,000 at Zurich, and 3,000 at Basel.

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"PIRATE" TRANSMITTER FINED.

A fine of 60s. was levied from J. W. Moorhouse at the Royton (Manchester) Police Court on February 15th for installing and working a transmitting set without a licence.

Mr. F. Elliott, representing the Postmaster-General, said that Moorhouse applied for a licence in 1926, but did not fill up the necessary forms. Subsequently it was found that a number of people in Oldham and Manchester were transmitting without licences, and this led to enquiries by the engineering department. Fifteen months passed before messages could be traced to Moorhouse. The defendant admitted that he had worked under several call signs. He explained that he omitted to take out a licence because he feared the Morse test.

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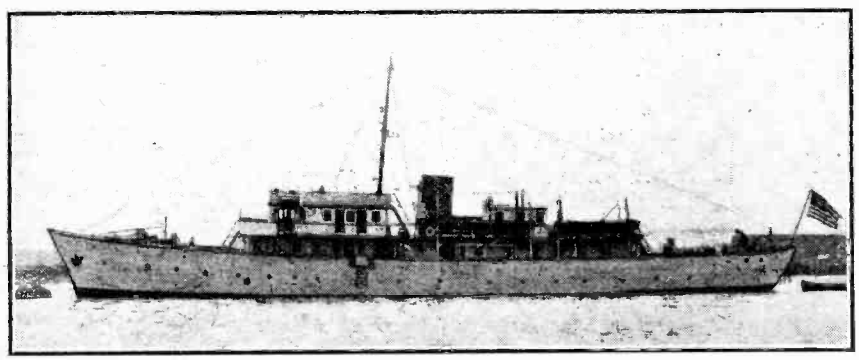
PCJJ SEEKS REPORTS.

British listeners are being cordially requested to co-operate in the present series of tests from PCJJ by reporting upon the quality of reception. Information is welcomed on the following points: (1) Is there any difference in reception since the station's transfer from Eindhoven to Hilversum? (2) Is fading experienced, and, if so, at what times? (3) What are the signal strength and general qualities of the transmissions? (4) Is the station heterodyned? (5) Is the wavelength constant, and what is the



BIG GAME HUNTING TO MUSIC. The "Crusader," a yacht specially equipped with a wireless telephony transmitter by the Marconi Company to the order of Mr. A. K. Macomber, a Californian magnate. Mr. Macomber desires private broadcasting programmes from the coast while he is big game hunting in East Africa.

type of receiving set used? (6) At what times are the strongest signals received?

PCJJ transmits on Tuesdays and Thursdays from 3 p.m. to 7 p.m. and on Saturdays from 2 p.m. to 5 p.m. The wavelength is 30.2 metres.

Listeners are asked to forward reports to Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2.

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IDEAL HOME EXHIBITION.

In the "Listeners' Hall" at the Ideal Home Exhibition, Olympia, the B.B.C. is displaying models of a broadcasting studio and the London control room.

The new Siemens and Halske public address loud-speaker, described in *The Wireless World* of February 8th, is being used to reproduce band music, broadcasting and gramophone records throughout the exhibition.

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SWEDEN 'PHONES TO U.S.

Count Hamilton, head of the Swedish telephone administration, has sent the British Postmaster-General a telegram expressing his appreciation of the fine technical achievement of the British and American engineers in establishing the new service which links Sweden with the United States by wireless telephone. The service was inaugurated on February 20th.

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WIRELESS FOR TRAIN SHUNTING.

In the German Government railway shunting yards at Hanover, Halle, Erfurt and Saalfield experiments have been conducted for some time with wireless telegraphy and telephony, writes a correspondent. The apparatus enables the shunting director to communicate with drivers and guards of goods trains over a distance of about a mile. The principle employed is "wired wireless."

FARADAY LECTURE.

Dr. S. Z. de Ferranti, F.R.S., who will deliver the Faraday Lecture at the meeting to-morrow of the Institution of Electrical Engineers at Savoy Place, W.C.2, has taken as his subject: "Electricity in the Service of Man."

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A BUDGET BROADCAST?

The Government attitude regarding the question of controversial broadcasting came up for scrutiny in the House of Commons last week when Captain Ian Fraser asked the Postmaster-General whether, in view of the desirability of including in broadcast programmes authoritative expressions of opinion upon topical matters of public interest and of the known desire of the B.B.C. for greater discretion in this direction, he could make any statement as to the Government's intentions.

Lord Wolmer, the Assistant-Postmaster-General, replied that the question was under consideration, but he was not yet in a position to state the Government's intentions. In answer to a further question Lord Wolmer said that the question of broadcasting the Budget speech was also under discussion.

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CHEAPER TRANSATLANTIC TELEPHONY.

The possibility of a reduction in the cost of Transatlantic telephone calls was hinted at by the Postmaster-General in an address before the Croydon Rotary Club last week. A cheap service was not yet possible, but, he added, "I hope it may be found possible to reduce the rate for America in the near future."

The present minimum rate is £15 for a conversation of three minutes.

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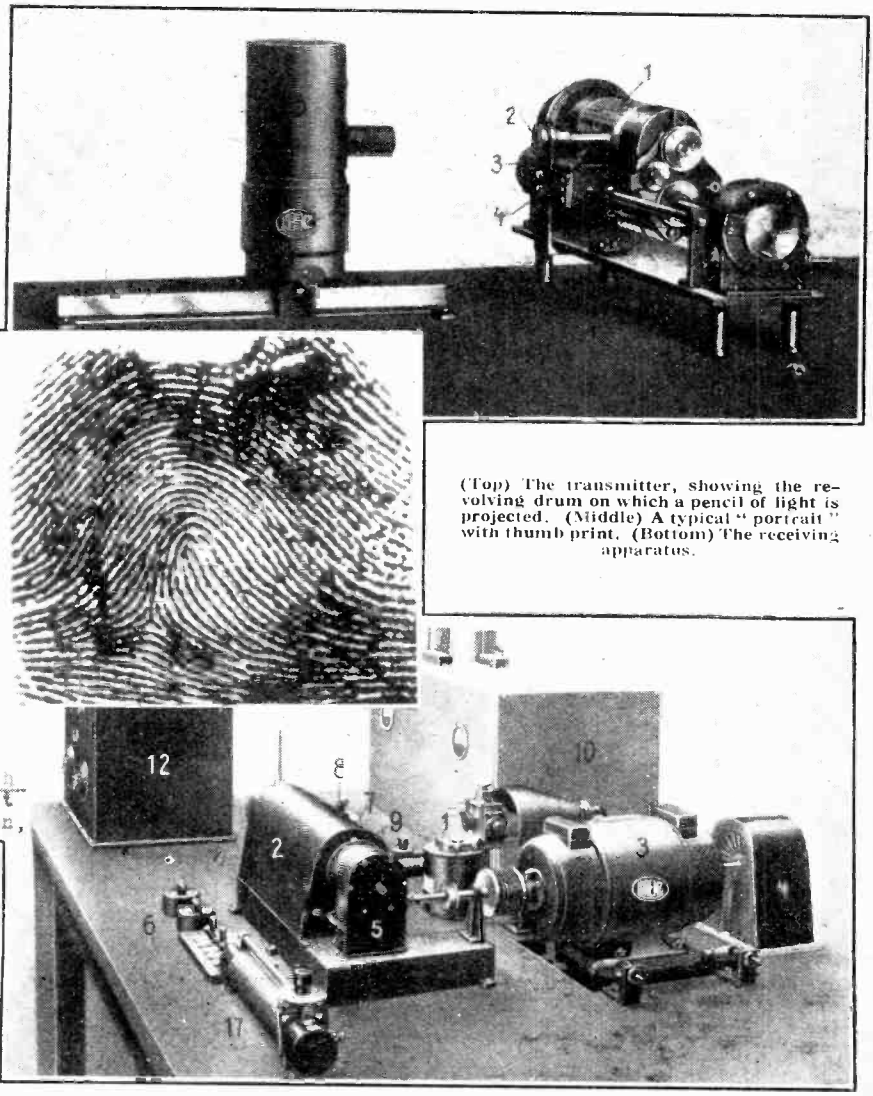
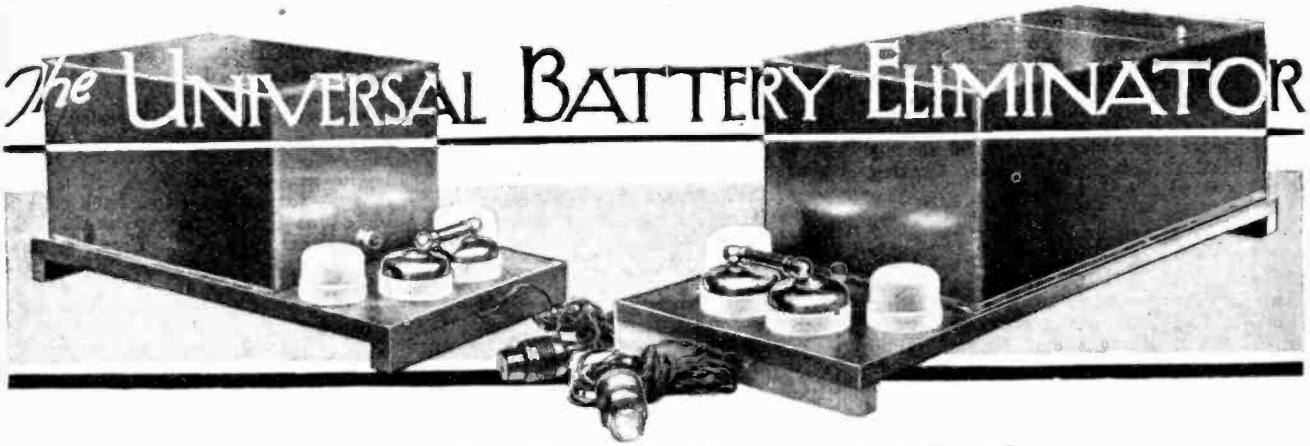
NEW "EVERYMAN FOUR" BOOKLET.

A new edition of the "Everyman Four" constructional booklet has been prepared and is now obtainable from all booksellers, price 1s., or direct from the publishers, Dorset House, Tudor Street, London, E.C.4, price 1s. 2d., post free.



(Top) The transmitter, showing the revolving drum on which a pencil of light is projected. (Middle) A typical "portrait" with thumb print. (Bottom) The receiving apparatus.

PICTURE TRANSMISSION BY GERMAN POLICE. The Prussian Police department is now making use of the Lorenz-Korn system of wireless picture transmission to assist in the capture of criminals.



Smoothing Filter for D.C. Mains or A.C. Rectifier.

(Concluded from page 187 of previous issue.)

By N. P. VINCER-MINTER.

LAST week we considered the general causes of trouble in both A.C. and D.C. battery eliminators, and discussed in detail the design of the A.C. portion of this particular instrument. We shall now consider the design of the D.C. part of the eliminator, together with the cause and cure of certain troubles peculiar only to D.C. eliminators before passing on to the constructional and operating details.

Special Smoothing Arrangements.

It will at once be noticed that a double pole smoothing arrangement is used, together with a particular arrangement of two H.F. chokes and two fixed condensers, the condensers being earthed at the junction between them. The writer would like to state that he arrived at this particular smoothing arrangement after very convincing tests. This arrangement is almost a *sine quâ non* to those having D.C. mains with the positive pole earthed, which are by far the worst of all mains from the point of view of eliminating hum. To those with the negative pole earthed, and to those on A.C. mains, this form of smoothing circuit is less important, and might be thought by some to be an unnecessary complication, but, nevertheless, it will be found to be well worth the extra trouble and expense if a really smooth output is desired. In the course of evolving this instrument, the designer was fortunate in being able to have access to both A.C. and D.C. mains, and in the case of D.C. to a supply with the negative pole earthed as well as to a supply with the positive pole earthed, and he is, therefore, in a position to vouch for the statements he has made. To intending constructors having D.C. mains with the positive pole earthed the writer would therefore say, do not depart from this design with the exception that it is permissible to use a single smoothing choke with a double winding in place of the two separate L.F. chokes in this actual instrument, but great care must be taken to connect the two windings of the double-wound choke in the correct electrical "sense," otherwise the inductance of the whole choke will be reduced to zero.

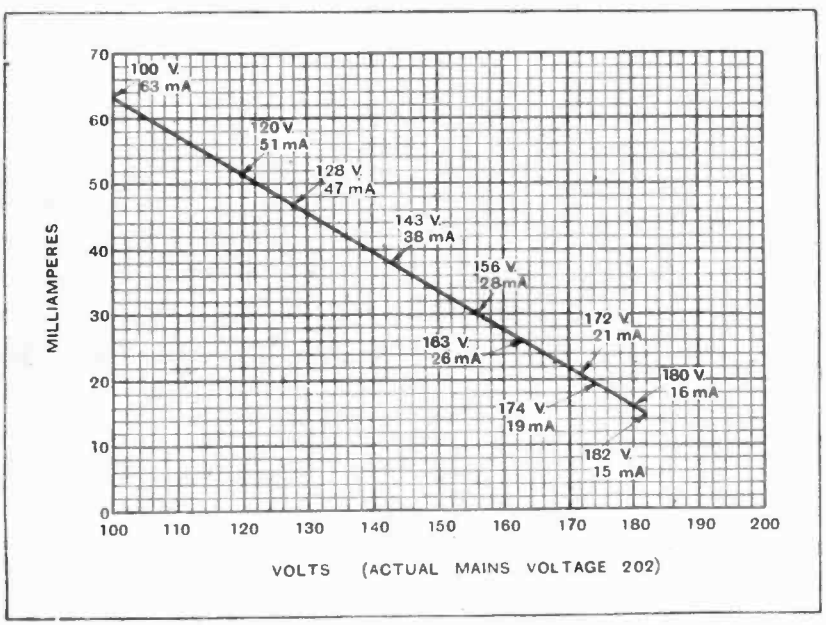


Fig. 4.—Characteristic curve showing the relationship between voltage and current output on 200 volt D.C. mains.

Tests Made on Various Receivers.

Unfortunately, the double smoothing circuit means that we have the combined D.C. resistance of an extra H.F. choke and L.F. choke in the circuit. Since the combined resistance of one H.F. and one L.F. choke in series was on measurement found by the writer to be, roughly, 700 ohms, we can see by Ohm's law that, if we are taking 60 or

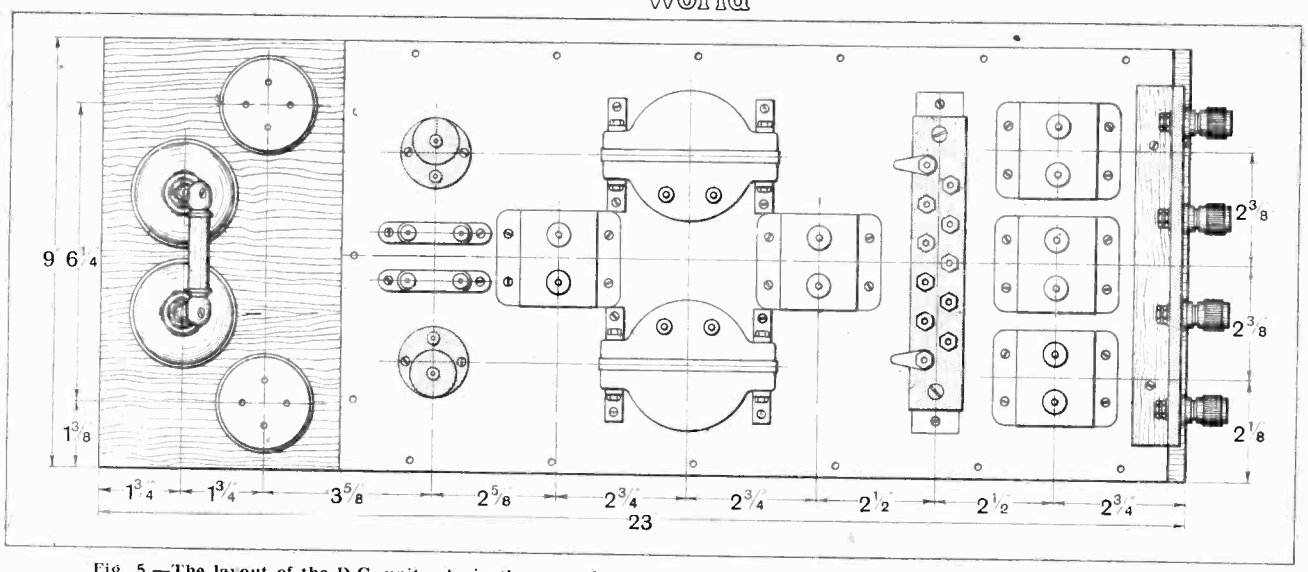
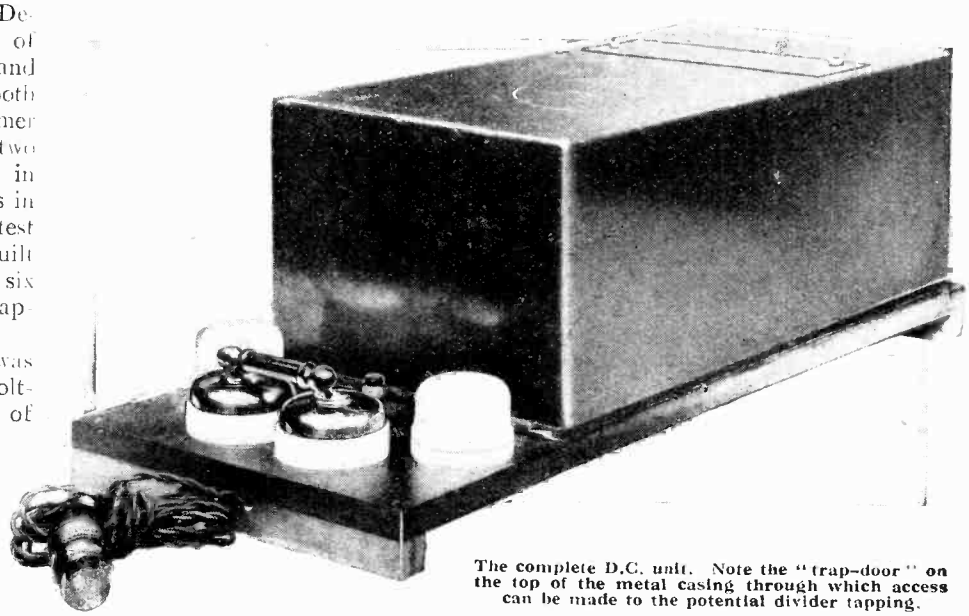


Fig. 5.—The layout of the D.C. unit. As in the case of the A.C. unit the white portion indicates the metal baseplate.

70 milliamperes from the eliminator for working a large number of power valves, we shall loose about 50 volts across these *extra* smoothing inductances. This can be clearly seen by studying the curve shown in Fig. 4. At 63 milliamps. the output voltage drops to 100, whereas, if we short-circuit one H.F. and one L.F. choke it would, of course, at once rise to a much higher value. Still, the eliminator is capable as it is of giving about 50 milliamps. at 120 volts, or 30 milliamps. at 150 volts, and will thus adequately cater for big receivers like the "Everyman-Four," the "Two-H.F. Everyman," even though we use two paralleled super-power valves in the last stage. It may be mentioned that, in addition to the 72 hours' test referred to last week, the eliminator has been tested on the following receivers, satisfactory results being obtained in each case. The "Wireless World Regional Receiver," both with and without an extra L.F. stage, the "Everyman-Four," several varieties of the "Detector and two L.F." type of set, including both grid and anode rectification, and with both mixed R.C. and transformer coupling, as well as with two transformer coupled stages, in one case, and two R.C. stages in another case. Finally, a test was made with a hastily built superheterodyne employing six valves without any trouble appearing.

The curve shown in Fig. 4 was taken on D.C. mains, whose voltage was measured at the time of making the tests, and found to be 202. It will be remembered that the power transformer used in this eliminator gives a 200-volt 80-milliampere output, and it was found that the A.C. curve was nonlinear, as in the case of the D.C. curve, a certain amount of "tailing off" occurring on heavy load. This was to be expected, and is due to the fact that the voltage drop across the valve is nonlinear, the ratio between voltage drop and current output changing when the valve approaches saturation in the matter of electron emission from the filament. The curve in Fig. 4 only applies to H.T. + 3, the maximum voltage tapping; two other output terminals are provided for valves such as the detector, which require lower voltages. The maximum voltage obtainable on 200-volt D.C. mains, then, is roughly 180, the output current in this case being 15 milliamperes. With regard to A.C. mains the output will be the same no matter whether they be, say, 110 volts or 220 volts. In the case of D.C., however, 240-volt mains will naturally give a bigger output, whilst the output voltage from

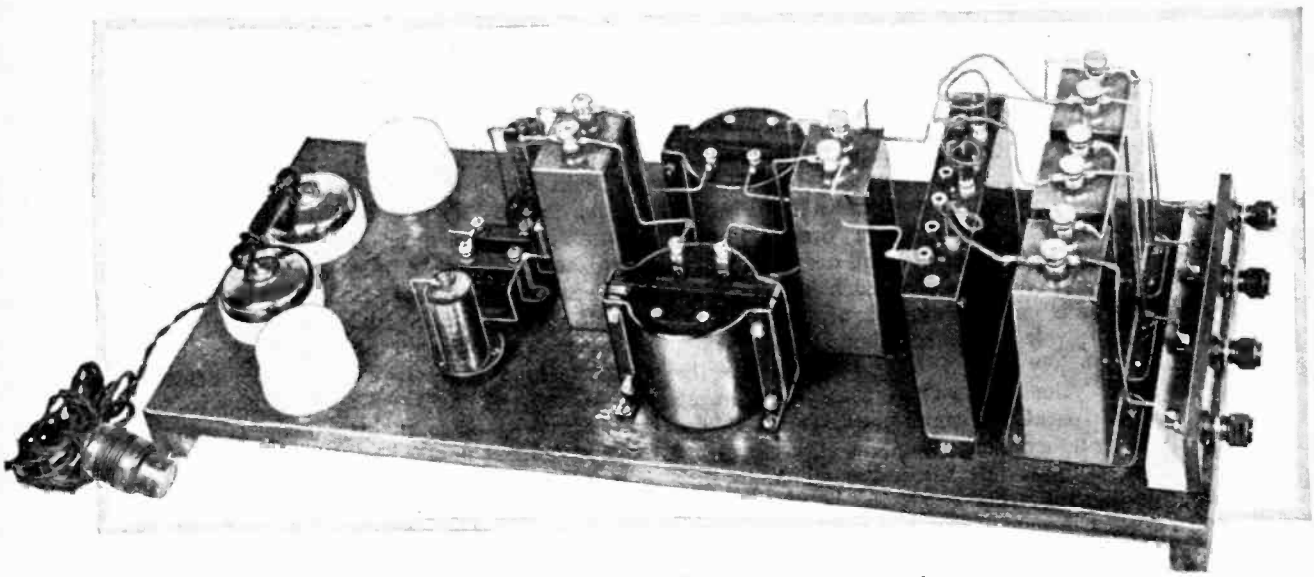


The complete D.C. unit. Note the "trap-door" on the top of the metal casing through which access can be made to the potential divider tapping.

The Universal Battery Eliminator.—

110-volt D.C. mains will always be lower than the mains voltage on even the slightest load, owing to the voltage drop across the chokes, etc. The solution for people on 100- to 110-volt mains is the "push-pull" system or, alternatively, they must reduce the input to their final valve and be content with less volume than is available to those more fortunately situated. All three output voltages are made variable by means of the plugs and sockets provided on the potential divider. The reason for not making the highest voltage a fixture was that it was thought there would be many not requiring such a high maximum voltage as can actually be obtained from the instrument.

With regard to the metal base plates and screening boxes, these need only be purchased if the set is to



The D.C. unit with the screening arrangements removed.

be placed close up against the receiver, in which case direct induction might take place. If, however, the receiver *is* to be placed up against the eliminator, they should be used, and also special "screened" flexible wire used for connection to the mains in place of the ordinary electric lighting "flex." In the writer's case neither screening boxes nor "screened flex" was needed, and the eliminator can be cheapened by omitting them.

Special Precautions on D.C. Mains.

Before proceeding with the constructional details which are absolutely straightforward and simple, there are one or two points concerning the earthing arrangements of our receiver which in the case of D.C. mains we *must* consider not only in order to avoid blowing fuses, but in order to prevent this or any other eliminator being an absolute failure. In the case of D.C. the first thing to remember is that one of the poles of our mains is earthed unless the supply system is very antiquated. Since filament wiring, and, therefore, H.T. −, in most wireless sets is earthed, it is usually stated that no precautions need be taken if the negative pole of the mains is earthed, whilst if the positive main is earthed a large-capacity fixed condenser should be put into the earth lead. No statement could be more untrue. Of course, if the positive main is earthed, and we use a direct earth on the filament wiring, obviously the mains will be short-circuited, but if we try to get over this by using a large-capacity condenser in our earth lead the hum may be distressing. The reason is that in nearly all cases there is a difference of potential between the "set" earth and the "mains" earth due to high resistance in one of the earthing systems. This difference of potential causes "hum," and naturally, therefore, isolation of the two earths cures this. The use of large fixed condensers in the earth lead is best avoided, because, although it successfully insulates the two earths from each other in the case of direct current it must be remembered that "hum" is caused by a pulsating or fluctuating current, and a condenser is not an insulator to this type of current any more than it is to A.C.

The Advantages of an Aerial Transformer.

The correct thing for us to do is this: In the case of a loose or aperiodic coupled set, of which the "All Wave Four" and the "Everyman-Four" are typical examples, we must remove the wire which connects the filament wiring with the earth terminal of the set. This is easily done in all sets of this type. We shall then have the aerial coil earthed through the normal earthing system, and the negative side of the valve filaments earthed through the earth on the mains. By this simple little operation we shall go a very long way towards cutting out "hum," no matter whether the positive or the negative main is earthed. In the case of a "direct-coupled" set, where it may be impossible in any case to separate the filament wiring from the earth terminal, it is usually better to abandon the use of an earth connection to the set altogether, and rely solely on the mains for an earth.

The Universal Battery Eliminator.—

Another very important precaution which must be taken with the receiver if we are to eliminate all possible hum is to use a choke filter output circuit, but we must not join the low potential terminal of the loud-speaker to H.T. +, as is so often wrongly done in these cases, or we shall be no better off than before with regard to the elimination of hum. Return the loud-speaker lead to L.T. − and use a good 2 mfd. condenser in the choke filter circuit—that is to say, a condenser which will stand up to the maximum plate voltage supplied to the output valve without breaking down. In addition, be sure to run the detector valve from a separate tapping on the eliminator. Of course, we know that very often the most flagrant case of "motor boating" can be cured by merely reversing the secondary connections of one of the transformers inside the receiver, but this rather resembles attempting to use a potentiometer to stabilise an "H.F." stage when we cannot find out where we have gone wrong in our neutralising arrangements.

The construction of this eliminator is a matter of the utmost simplicity, calling only for the use of a gimlet, a screwdriver, and a soldering-iron. It is not even absolutely essential to follow the exact layout. It will be noticed that the layout is such that the path of the current is always progressively forward through the eliminator, and the practical layout really follows the theoretical circuit diagram. This progressive form of layout should always be adopted, but need not be followed out exactly as the writer has done it. The condensers, etc., can have their positions altered without any resultant loss in efficiency, unlike the case of a modern receiver in which non-adherence to the layout may jeopardise success. We commence by simply screwing down the metal baseplate on the wooden baseboard by using four countersunk wood screws placed at the corners. This operation is not necessary if, for reasons explained earlier in this article, we decide to dispense with baseplates and covers. It is now necessary to remove the black enamel from the underside of the flanges of the metal covers, and from the top of the corresponding portion of the baseplates. This is in order that the baseplates will make electrical contact with their respective covers when they are placed in position. It is necesary also to remove the enamel from those portions of the baseplates on which will stand the transformer, chokes, metal-cased condensers, and potential divider. In a similar manner paint must be removed from the bottom of the components just mentioned. Thus the transformer core, the metal casings of the chokes, the condensers, and the potential divider, when screwed down to the baseboard by means of ordinary wood screws passed through the metal baseplate, are in electrical contact with the metal covers in each unit. An earth terminal is provided on the metal cover of each unit, and thus the metal sheathing of each component is, together with baseplates and metal covers, definitely "tied down" to earth potential. Special dotted lines are provided on the theoretical diagram to indicate these earthing connections. It is an excellent plan in all eliminators to tie down to earth potential every metal case housing a component and every piece of "free" metal associated with any component. This applies to wireless receivers also, and it is noteworthy that nowadays the metal cases of some types of large-capacity fixed condensers are provided with a third terminal mounted on the metal covering for this purpose.

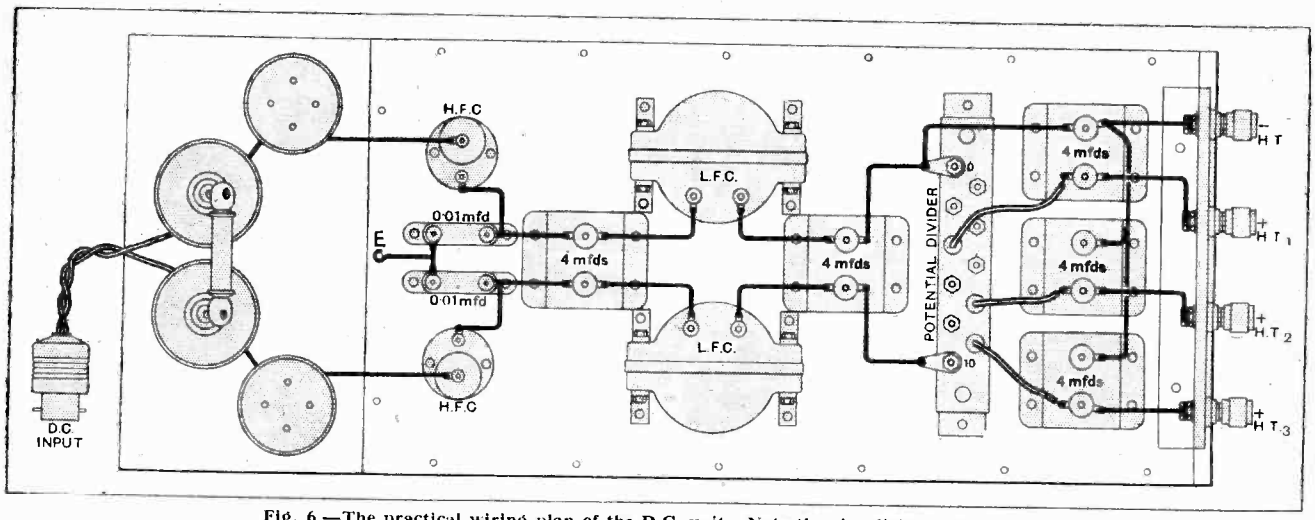
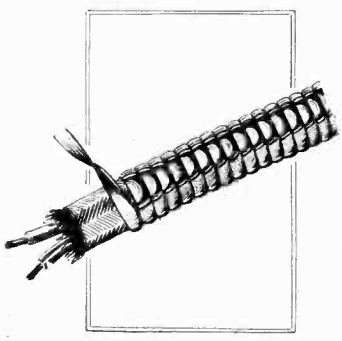


Fig. 6.—The practical wiring plan of the D.C. unit. Note the simplicity of the wiring.



The special "screened" flexible wire.

Screening the Mains Leads.

With regard to the screened flexible wire which the writer has already discussed, this should, if used, pass through one of the baseboard battens and be fastened by means of a metallic clip such as is used in securing the lead-covered cable house-lighting systems. This clip should also make contact electrically with the metal baseplate by means of a wire passed under the head of one

The Universal Battery Eliminator.—

of the screws holding the clip to the baseboard and running from there to the nearest baseboard-securing screw where it is attached as before, any black enamel being previously scraped away. Thus the metal sheathing of the flexible wire cable is also earthed, and this will greatly assist in removing any induction noises. No difficulty whatever should be experienced in screwing the components down on the baseboards in the positions indicated in the layout, and wiring them up according to the practical wiring diagram. It should be mentioned that there is no advantage whatever to be gained by using "anti-microphonic" valve holders in an eliminator. Access is given to the plugs and sockets of the potential divider by raising a small "trap door," closing an aperture 6½in. × 2¼in. in the top of the metal cover just over the potential divider. This "trap door" consists of a strip 7in. × 2½in. of the same material of which the cover is made. It overlaps the aperture, and is fastened down by two "cheese-headed" 4 B.A. screws (the requisite thread being tapped into the metal casing), or preferably by the simple expedient of hinging; it is, of course, supplied with the metal covers and baseplates.

We are now in a position to connect up to the set and insert the adaptor into the nearest lamp-holder. If nothing is heard, and the usual sound of "life" is not present in the telephones or loud-speaker, we have probably got a negative potential on the plates of the valves in our set instead of a positive potential. To remedy this simply reverse the adaptor in the lamp-holder. The lamp-holder adaptor should then be marked by a small scratch, so that this error will not occur again. In the case of A.C. it is immaterial in which way the adaptor is inserted into the lamp-holder but the adaptor attached to the input side of the D.C. unit must be inserted the correct way round in the lamp-holder attached to the output of the A.C. unit, or nothing will be heard. When once found small scratches can be made as before. The approximate voltage desired from any of the three H.T.+ terminals of the eliminator is obtained by adjusting the wander plugs to various positions in the sockets on the top of the potential divider. In this manner almost any voltage on varying loads can be obtained from a very low value up to the maximum obtainable from the eliminator. It was in view of this fact, and the fact that the instrument could be used on both A.C. and D.C. mains of all standard voltages, that the word "Universal" was applied to this instrument.

CODES AND ABBREVIATIONS.

Official and Unofficial Shorthand Used in Morse Transmissions.

WE are frequently asked the interpretation of the various code letters and abbreviations used in Morse transmission, of which some are officially employed in international Morse and others have come into more or less general use as a convenient means of transmitting words or sentences of common occurrence.

For the benefit of the uninitiated we would explain that the international "Q" code was originally devised for the rapid intercommunication between operators on snips of messages concerning the technicalities of transmission and reception. This code is well known and may be found in the Post Office Handbook for Wireless Telegraph Operators and many text books.

The original meaning of the three-letter codes has, in many cases, come to be the recognised Morse abbreviation for the principal word in the question or answer; thus QRA, which strictly means "What is the name of your station?" is used to denote the name and address of the owner of a transmitting station; QSL, "Have you got the receipt?" is applied to cards acknowledging reception of signals; QRK, "How are you receiving?" to reception in general; and QSS, "Are my signals affected by fading?" is used as a simple abbreviation for the word "fading."

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"Q" codes of four letters have also come into use among amateurs. These are:—

QRAR	Is your address in the "Call Book" correct?
QRDD	Where do you wish your message sent?
QRFT	From which station have you received message No. . . ?
QSLL	Send me notification of reception by card. I will do the same.
QSRM	Please forward message No. . . by post, if you cannot send it at once by Radio.
QSSS	Are my signals unstable? (applied to variation in wavelength as distinct from fading).
QSUF	Ring me up at once by telephone (land line).
QSTI	I am changing my wavelength to . . . metres.
QSYU	Please change your wavelength to . . . metres.

Other codes have been suggested for reporting on the quality of wireless signals. The following is, we believe, used in the United States to denote the tone:—

T1	Raw A.C., 25 and 50 cycles.
T2	Raw A.C., high-frequency.
T3	R.A.C. unfiltered.
T4	R.A.C. badly filtered.
T5	Almost D.C., well filtered but with unstable note.
T6	Almost D.C., well filtered and with stable note.
T7	Pure D.C., but with unstable note.
T8	Pure D.C., but not up to the standard of T9.
T9	Crystal-controlled D.C.

Another code to denote the quality of modulation in wireless telephony has been suggested by Italian transmitters:—

F1	Carrier wave only, without any modulation.
F2	Very confused.
F3	Only occasional words audible
F4	Difficult to understand.
F5	Not clear, modulation bad.
F6	Modulation fairly good.
F7	Modulation good.
F8	Modulation very good.
F9	Modulation perfect.

(It is not clear how a distinction is to be drawn between the last three degrees.)

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The approximate strength of received signals is reported by the "R" code. Unfortunately, the interpretation of some of the code signs is not standardised and varies slightly in different countries. We give below the rough measurements used by the Eiffel Tower authorities.

R1	Signals unreadable.
R2	Readable with difficulty.
R3	Weak but readable.
R4	Readable.
R5	Easily readable.
R6	Fairly strong.
R7	Strong.
R8	Very strong.
R9	Loud-speaker strength.

R8 is often described as "'phones on the table" strength. It is, of course, necessary to state the type of receiver and number of valves used.

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The "Z" code is used by operators engaged in transoceanic traffic for personal messages relating to the handling of traffic and other technical matters. This has already appeared in our issues of October 12th and December 21st, 1927.

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Finally, we come to the abbreviations largely used by amateurs in Morse transmission, sometimes known as "Radiese" or "Ham language." A complete list of these would occupy too much space. Their meaning is usually clear and they may fitly be compared to those employed in "small ads." in the daily Press. Among the commonest examples are CUL for "see you later," CUAGN, "See you again," HI, to denote amusement or a note of exclamation, and that meaningless interjectory stock-term which so freely garnishes the communications of many young amateurs, OM for "old man."

By Our Special Correspondent

The Cabinet and Controversy.—An Election Issue ?—Help from the Regional Scheme.—Captain Eckersley's Hour.—Programmes from the Continent.—Who is the Champion Cougher ?

A Cabinet Question.

The astonishing point about the sudden efflorescence of the broadcast controversy question is that it hasn't occurred before. Once or twice in the last five years there have been signs of sprouting, but official frosts have proved an effective blight. Now, thanks to the magnificent expansiveness of Mr. Winston Churchill, the question has assumed beanstalk proportions and is receiving the attention of the Cabinet.

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For and Against at Westminster.

I hear that Lord Birkenhead must be numbered with those who share the views of the Chancellor of the Exchequer, while several other leading politicians are equally ready to bring polemics to the microphone. The leading protagonist on the other side is, I believe, Sir William Joynson-Hicks, to whom broadcast controversy is anathema.

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A Bland Outlook.

Meanwhile the Postmaster-General can afford to survey the scene with the blandness of one who is relieved of further responsibility. In effect, the matter has passed out of the hands of the Post Office, for no action could now be taken at St. Martin's-le-Grand in the face of dissensions in the Cabinet.

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Warning to Platform Orators.

I have heard it suggested that broadcast controversy may become an issue at the next General Election. If so, political candidates had better tread carefully. An election crowd is the most discursive crowd in the world, and Heaven assist the candidate who gets side-tracked on the subject of broadcasting! From the topic of controversial broadcasting he may find himself inveigled into promises of brighter children's hours, shorter (or longer) talks, more (or less) Bartok, and a hundred and one items over which he has less control than the Savoy Hill cleaners' brigade.

A Doubt.

We may legitimately doubt, however, whether the question will ever reach the election platform. The fact that it is a non-party question robs it of savour in the eyes of the vote cadger, it being one of the most galling experiences in life to discover that your own high ideals are shared by your political opponent.

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Will the Regional Scheme Help ?

As suggested in last week's *Wireless World*, the regional scheme, with its principle of double programmes, may help to clear a path for "editors" with partisan views. But the regional scheme is still a good way off, despite the surreptitious goings-on at Potters Bar.

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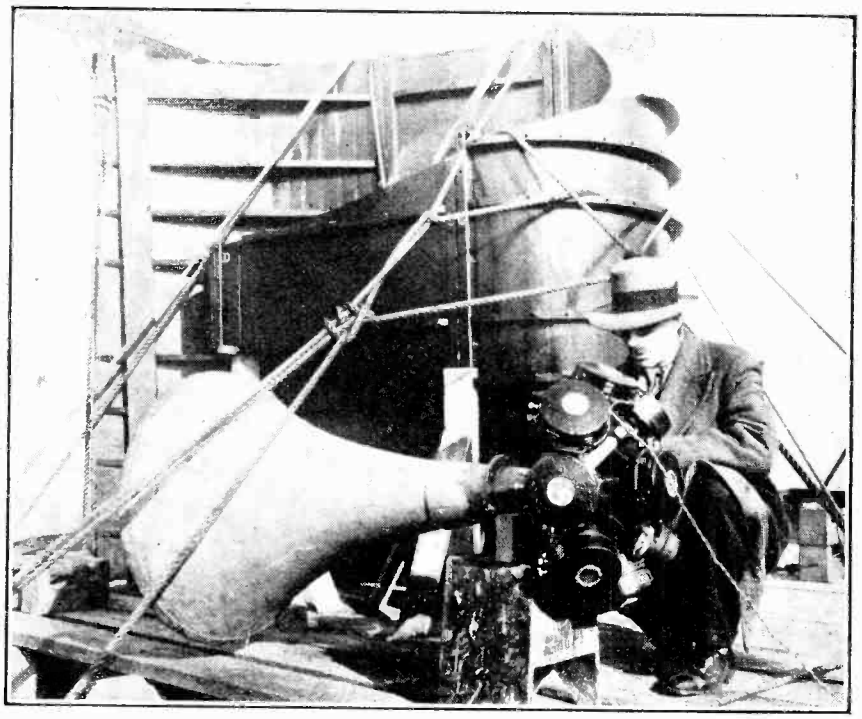
5GB to Move ?

Apropos the regional scheme, I hear that there is a distinct possibility of 5GB being moved *in toto* to one of the chosen sites in the North. New studios are under construction at Belfast, where the regional station for Northern Ireland will almost certainly be placed. Doubtless additional studio accommodation will be required at all the regional stations, in addition to studios which will probably be erected in most of the principal cities throughout the country.



GIANT LOUD-SPEAKER HORNS. A loud-speaker action, consisting of nine separate units, which recently startled the populace in the neighbourhood of the Hudson River, New York. The sounds were heard at a distance of over a mile. Note the two horns used in the experiment. It is stated that the smaller horn gave results equal to those from the folded exponential type in the background.

Blazing the P.O. Trail.

The efficiency of the Post Office anti-oscillator vans is probably more moral than technical. At all events, there is ground for this suspicion in the news that the advance publicity which preceded the arrival of the P.O. van in Glasgow a fortnight ago was followed by a period of sublime silence on the part of oscillators, and a wholesale jump in the issue of wireless licences.

How dramatic would be the situation if it were proved that the van never visited Glasgow at all!

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Nearing 2½ Million.

In January last there occurred the biggest jump in the licence figures since January, 1927. The increase amounted to 34,405, excluding 2,807 licences issued free to blind listeners. This brings the grand total to 2,432,386.

The increase is attributed partly to the growing popularity of 5GB, and partly to the number of sets given as Christmas presents.

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Expressive.

All the way from Stockholm comes "Radio," costing 50 öre, and containing a photo of the "Kristallsalongen och Savoy" broadcast dance band. The gentleman with the drums, chopsticks, cymbals, etc., is described as "Gunnar Asp, *Batterist.*"

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Longer than a Sermon.

One of the most courageous stunts in the history of broadcasting will be attempted to-morrow (Thursday) by Captain P. P. Eckersley. He is going to talk from 5GB for an hour. Yes, an hour. Appropriately enough, the Chief Engineer will deal with "The History of Broadcasting," and no doubt he will make the most of his unrivalled experience as a pioneer, both in the artistic and technical sides of his subject. But an hour, gentlemen, a whole hour!

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Cries for "More."

I hear that André Charlot's series of six "Charlot's Hour" programmes have met with such a warm welcome from listeners that the B.B.C. has commissioned Mr. Charlot to prepare a further series of twelve. The first of these is to be given on Thursday, March 8th.

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At the People's Palace.

Maurice Cole will be the solo pianist at the B.B.C. National Concert in the People's Palace on March 16th. The National Symphony Orchestra will be conducted by Sir Landon Ronald.

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Programmes from Belgium and Germany.

The broadcast to Britain of the famous Legia Choir, to be relayed by land line from Liège to 2LO on March 11th, will consist of "Les Emigrante Irlandais" (Gevaert), "La Vieille Chanson" (Radoux), and "Le Rossignol" (Gretry).

On March 12th the second act of Mozart's opera, "Figaro," will be transmitted from Cologne to London by land line. The artistes include Heinze Holwe as Count Almaviva, Fritz Baur as Doctor Bartolo, Karl Weiser as Basilio, the singing master, Wilhelm Streinz as Figaro, and Klare Hansen as the Countess. They will be assisted by the Cologne Station Orchestra.

FUTURE FEATURES.

London and Daventry (5XX).

MARCH 4TH.—Service from St. Martin's-in-the-Fields, with the first of a series of three addresses by Rev. Eric Southam.

MARCH 5TH.—A Programme of Moods (orchestral and vocal) interpreted by Mr. Percy Scholes (from Manchester).

MARCH 7TH.—"Rampa," a play by Max Mohr.

MARCH 8TH.—"The Gipsy Princess," a musical play.

MARCH 9TH.—National Symphony Concert conducted by Sir Henry J. Wood.

Daventry Experimental (5GB).

MARCH 4TH.—Symphony Concert and Soloist. Light Orchestral Concert and Vocalists.

MARCH 5TH.—"Their Point of View," a play by Wilfred T. Coleby.

MARCH 6TH.—"The Tinker's Wedding," by J. M. Synge.

MARCH 8TH.—Arts Theatre Chamber Concert.

MARCH 9TH.—"Kitty," a duologue by Robert Higginbotham.

MARCH 10TH.—Ballad Concert.

Cardiff.

MARCH 4TH.—Third Concert of Cardiff Musical Society, relayed from Park Hall, Cardiff.

MARCH 6TH.—"The Late Rebellion," a play by Shirland Quin.

Manchester.

MARCH 4TH.—St. George's Church Choir and the Irwell Springs Band.

MARCH 6TH.—A Chopin Recital.

Newcastle.

MARCH 6TH.—Concert by the St. Stephen's Silver Band.

Glasgow.

MARCH 4TH.—New Hymnary Recital by the Glasgow Orpheus Choir.

MARCH 8TH.—Irish Music.

Aberdeen.

MARCH 4TH.—A Gaelic Service relayed from King's College Chapel.

Belfast.

MARCH 6TH.—"The Lost Piper," a play by Mr. and Mrs. James R. A. Fleming.

Truth in Broadcasting.

Certain broadcasting interests in America have not been aware, apparently, that the "truth in advertising" slogan also applies to broadcasting, so an effort is being made to point out the little oversight. "Radio Broadcast," New York, cites the case of a well-known tyre manufacturing corporation with a broadcasting station of its own. The announcer has been telling the world that he would have it known that radiocast advertising cuts overhead costs so low that his company can offer tyres at 25 to 50 per cent. below ordinary prices.

Examining the prices of the tyres in question with their equivalent among the leading makes, "Radio Broadcast" found that the saving actually amounted to about 5 cents (2½d.) on a tyre costing $7.75 (about 30s.).

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Microphone Mumblers.

A northern correspondent, complaining of poor quality of transmission, says: "Some speakers seem to be only making noises in the roofs of their mouths." I can beat that. More than once I have heard them talking through their hats.

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World's Champion Cougher.

An obliging correspondent has sent a letter to the B.B.C. which deserves quotation:—

"Last night," he writes, "there was present at the Queen's Hall, in close proximity to the megaphone (*sic*) the World's Champion Cougher, whose staccato movement was evident during the whole of the concert. This gentleman usually attends the concerts in the Albert Hall, and, so far as I know, this was his first appearance elsewhere, and I hope it will be his last. . . . If you are unable to dispose of this individual I am willing to lead a murder party with that object if you will let me know."

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Bachelors—to Your Burrows!

Whether we like it or not, to-night we are being forcibly reminded of the date by a Leap Year programme from 2LO, 5XX, and other stations. The programme's great attraction is the appearance of Peggy O'Neil, who will lead the hunt for burrowing bachelors.

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Musical Dissections.

All congratulations to the B.B.C. and to Mr. Percy Scholes for introducing a very sane musical experiment. Much of the music played to-day never "gets home" for the simple reason that it was never intended to be judged at a single hearing. Who on earth can fathom a Bach fugue or Beethoven symphony at a sitting? Most of us are lucky if we grasp the theme.

When we find ourselves confronted with "modern music," often, apparently, themeless and formless, is it any wonder that our ears occasionally go on strike?

The new experiment is a genuine effort to help us. It aims at dissecting a piece of music, turning it inside out, and piecing it together again in such a way that we can appreciate what was formerly an enigmatic succession of sounds.

The first recital, on Tuesday of last week, was devoted to Debussy's "L'isle Joyeuse." On Wednesday next (March 7th) the works of John Ireland will be examined. The pianist will be Laffitte, and the "analyst" Mr. Percy Scholes. The transmission will be from 5GB.

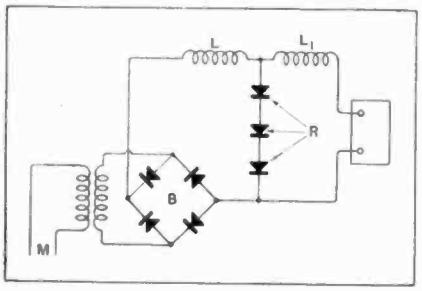
Some Recent Patents

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

A.C. Current Rectifiers.
(No. 259,537.)

Convention date (U.S.A.): 7th October, 1925.

Alternating current from the mains M is first rectified by a full-wave bridge B comprising four metal-oxide rectifying elements arranged as shown, and is then passed through a filter or smoothing unit. The smoother comprises two inductances L, L_1 shunted by a series of unidirectional conducting elements R similar to those used in the bridge B; or they may consist of galena or crystalline selenium. Such elements have a falling resistance characteristic as the applied voltage is increased.



Metal-oxide full-wave rectifying circuit (No. 259,537.)

Accordingly as the voltage applied to the inductance L rises, owing to fluctuations in the output from the rectifier B, the resistance of the shunt R diminishes, and vice versa, the combination thus serving to eliminate pulsations. At the same time the power consumed in the shunt circuit R is only a small fraction of that which would be wasted across an ordinary resistor, so that the filtering circuit is economical in operation. Patent issued to the Westinghouse Brake and Saxby Signal Co.

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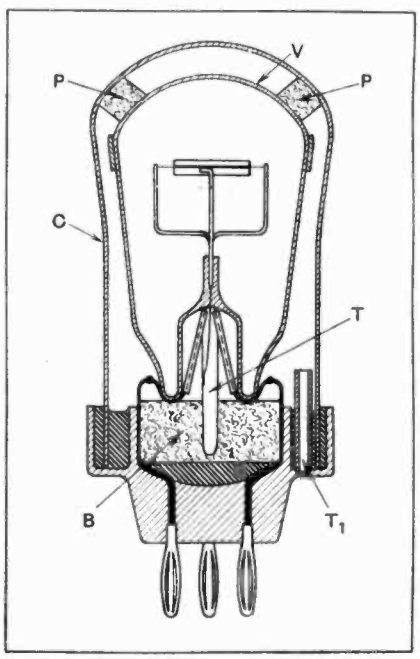
Anti-Microphonic Valves.
(No. 278,800.)

Application dates: July 13th and November 24th, 1926.

In order to isolate the electrodes from mechanical shocks and vibrations, and also from the effect of sound waves, the bulb is mounted inside an outer container fitted with shock-absorbing pads. The principal object appears to be to safeguard the valve from the sound waves coming from the loud-speaker, which is usually in close proximity to the set.

As shown in the drawing the usual bulb V is surrounded by a glass casing C provided with spacing pads P and a bottom block B of rubber. The base consists of a moulded cap formed as a trough to contain the sealing composition, and fitted with the usual contact pins, from which flexible leads are taken to the valve electrodes. The inner bulb is exhausted through a glass tube T fixed to the pinch, whilst the outer casing is evacuated to a less degree through a tube T_1. The space between the two glass vessels may be utilised to accommodate a grid leak or other components necessary to make a complete detector, amplifier, oscillator or frequency-changing unit.

Patent issued to A. J. Stevens and Co., Ltd.

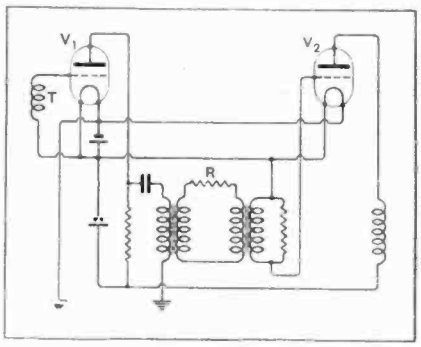


Valve fitted with anti-microphonic outer shell. (No. 278,800.)

Low-Frequency Amplifiers.
(No. 255,875.)

Convention date (France): July 22nd, 1925.

In order to prevent distortion, particularly in multi-stage L.F. amplifiers interposed between the studio microphone and the modulator, one or more of the inter-valve couplings are fitted with a resistance element of the type in which the ohmic resistance increases with the intensity of the applied current. For instance, the microphone input is applied at T and after amplification by the valve V_1 is passed to the second stage of amplification V_2 through a transformer which



L.F. amplifier for interposition between microphone and modulator. (No. 255,875.)

comprises a resistance element R of the type mentioned. In practice, the metal filament of an incandescent lamp will serve this purpose.

Owing to the calorific inertia of the element R, the resistance variations are not instantaneous, and therefore do not give rise to distortion by wave deformation. On the other hand, they are sufficiently rapid to give an automatic regulation superior to that which can be secured by the usual method of "gain-control" through manual supervision. The arrangement is sufficiently flexible to allow a tenfold increase of the smaller amplitudes relatively to the large amplitudes, and in addition to permit of a wide variation in the overall amplification.

Patent issued to Société Française Radio Electrique.

CLUB REPORTS AND TOPICS

Wireless Classes in Balham.

The Streatham and Tooting Institute Radio Society holds weekly meetings at the Bec School, Beechcroft Road, Balham, S.W.17.

Hon. Secretary, Mr. A. L. Odell, 171, Tranmere Road, S.W.18.

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Wigan Society's Progress.

In his presidential address before the Wigan and District Radio Society on February 10th, Mr. F. J. Harlow, M.B.E., B.Sc., chose as his subject "Wave Transmission," and gave a number of elaborate experiments. The elementary principles of wave motion were first described. Transverse waves were then illustrated by means of ripples on the surface of a pool of mercury, and some impressive experiments showed the reflection and interference of waves. The modulation of electro-magnetic waves by speech frequency waves was demonstrated by transmitting speech along a beam of light.

Although the society is only two months old it has already received civic recognition, His Worship the Mayor of Wigan, Alderman J. Lowe, J.P., honouring the society as chairman at the above meeting.

Prof. E. W. Marchant, D.Sc., M.I.E.E., will be the lecturer on March 2nd.

Hon. Secretary, Mr. M. M. Das, B.Sc.

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Battery Resistance in L.F. Amplifiers.

Mr. W. I. G. Page, B.Sc., of "The Wireless World" technical staff, was the guest at the meeting of the Wembley Wireless Society on Friday last, February 24th. Mr. Page dealt with the dangers of battery resistance in L.F. amplifiers.

The President of the Society reports that nearly £45 has been collected towards providing the Wembley Hospital wireless installation.

All communications should be addressed to the Hon. Treasurer, Mr. H. E. Comben, B.Sc., 24, Park Lane, Wembley.

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Troubles of Valve Designers.

When Mr. G. C. Marris, B.Sc., of the G.E.C. Research Laboratories, at Wembley, lectured recently before the Golders Green and Hendon Radio Society, he dealt with the valve, dealing particularly with the question of design. One of the chief difficulties of the manufacturer, said the lecturer, was to exclude the air not only from the inside of the valve but from the metal and glass. Mr. Marris gave details of the methods of exhaustion, including the final stage of "gettering." Another problem was how to support a long filament in the inside of a fragile globe, the surface of which is contaminated with gas that cannot be expelled. Transmitting valves, said the lecturer, had their own problems, not the least of which was the necessity for the sealing wires and the glass globe to have the same coefficient of expansion.

Many new members have recently been enrolled, and anyone interested will be sent particulars on application to the Hon. Secretary, Lt.-Col. H. A. Scarlett, D.S.O., 357a, Finchley Road, N.W.3.

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Avoiding Interference by Transmitters.

A lecture on "keying a Medium Power Transmitter" was given by Mr. G. W. Thomas (5 YK) at a meeting of the QRP Transmitters' Society on February 16th. Several new circuits were shown, each design having the merit of reducing possible interference to broadcast listeners to other transmitters.

Hon. Secretary, Mr. C. D. Abbott, 120, Cavendish Road, S.W.12.

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H.F. v. L.F.: A Debate.

"Should H.F. amplification be used in the design of a 3-valve general purpose receiver?" was the question debated at the last meeting of the Queen's Park and District Wireless Club. Mr. Biddle contended that a H.F. set was likely to give trouble to the beginner, and that an extra low frequency stage compensated for the omission of H.F. Mr. Josey, as opposition speaker, said that a neutralised H.F. stage introduced non-radiation besides giving selectivity and louder signals on distant transmissions. At the conclusion of the debate the meeting was nearly unanimous in favour of the former speaker.

The value of a debate of this kind cannot be over-estimated, as it brings to light good and bad points alike, and leads members to think for themselves.

Hon. Secretary, Mr. F. Batho, 37, Embrook Street, Queen's Park, W.10.

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Loud-speakers in the Making.

"Loud-speaker Design" was the title of Mr. R. Lucy's talk before the South Croydon and District Radio Society at a recent meeting. Lantern slides depicted the manufacture of a loud-speaker in the workshop, and the lecturer answered many questions.

Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Road, S. Croydon.

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Pick-ups Compared.

The Rice-Kellogg Moving Coil Loud-speaker was demonstrated by Messrs. Clifford-Smith and Chandler, of the B.T.H. Co., at the last meeting of Slade Radio. The instrument, which was tested by wireless and gramophone records with a variety of pick-ups, gave excellent results. The function of the baffle was strikingly illustrated, and it was shown how it gave fulness to the notes and brought out the lower frequencies. The instrument was operated from the mains.

Hon. Secretary, Mr. H. Clews, 52, St. Thomas Road, Erdington, Birmingham.

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Small Cones or Large?

Mr. P. K. Turner, sometime Editor of "Experimental Wireless" and now on the Research Staff of Messrs. Graham Amplion, Ltd., gave an absorbingly interesting lecture on quality in reproduction at the last meeting of the Tottenham Wireless Society. Mr. Turner said that a good receiver depended upon good quantitative work. Poor valves and poor components could produce a good set, providing that the constructor knew exactly what each separate component could do. The lecturer demonstrated a receiver of his own design in conjunction with a moving coil loud-speaker containing a small conical diaphragm of bakelised paper. Mr. Turner described as a fallacy the notion that large cones were necessary in order to reproduce the low notes at their proper strength. A small gap, he explained, was essential because the frequency of response was better. He maintained that faithful reproduction was impossible unless music or speech was reproduced at its actual volume.

Hon. Secretary, Mr. F. E. R. Neale, 10, Bruce Grove, Tottenham, N.17.

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Characteristic Curves.

The subject of valve characteristics provided a fascinating evening for members of the Bristol and District Radio Society on January 27th, when Mr. G. E. Burgess, of the Mullard Wireless Service Co., was the lecturer. After a brief description of the working principles of the valve, the lecturer described the filament of the modern dull emitter, proceeding to a discussion on characteristic curves. By means of a large diagram of the curve of a P.M.4 valve, Mr. Burgess showed how alterations of H.T. and grid bias values completely changed the conditions under which the valve worked.

Hon. Secretary, Mr. S. J. Hurley, Arno's Vale, Bristol.

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Wireless in Hampstead.

Captain Jack Frost is conducting the fortnightly meetings at the Hampstead Garden Suburb Institute Radio Club. At the same meetings interesting demonstrations are given by well-known radio manufacturers. Meetings are held on alternate Thursdays, and the next will be on March 1st.

Hon. Secretary, Mr. Lacey, Hampstead Garden Suburb Institute, Central Square, N.W.11.

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The Association of British Radio Societies.

The first public meeting of the new Association of British Radio Societies was held on February 16th, when Mr. J. Ree, of the Mullard Co., lectured on the valve. Lantern slides were shown depicting the birth and development of the thermionic valve from the first Fleming 2-electrode to the latest silicon transmitting type. Mr. Ree concluded with some valuable hints on the choosing of valves.

Hon. Secretary, Mr. L. A. Gill, Hope House, South Reddish, Stockport.

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Electrical Elimination of Gramophone Scratch.

Excellent electrical reproduction of gramophone records characterised the demonstration given by Mr. Leonard Hartley, B.Sc., at the meeting of the Muswell Hill and District Radio Society on February 15th. Mr. Hartley gave details of the scratch filter used by some manufacturers to eliminate the needle scratch on about 6,000 cycles. This filter does not impair the quality of reproduction. Pick-ups designed by the lecturer were described and tested, and organ gramophone records were played with a balanced armature type pick-up. No scratch was discernible.

Applications for membership of the Society should be addressed to the Hon. Secretary, Mr. Gerald S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

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Irish Television Experiments.

Experiments in television carried out in Dublin were described by Mr. Hugh Butler at the last meeting of the Wireless Society of Ireland. Dealing with the difficulties of the problem, Mr. W. A. Beatty furnished what was described as the most complete explanation of television yet given in Ireland or Great Britain.

Hon. Secretary: Mr. H. Hodgens, 12, Trinity Street, Dublin, C.1.

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Two-Way Working with Mission Station.

GW-12B, the experimental station of the Wireless Society of Ireland has several times been in two-way communication during the past month with the Grenfell Mission station 8AE, St. Anthony, Newfoundland. 8AE employs a power of 35 watts with a loose-coupled Hartley circuit.

FORTHCOMING EVENTS.

WEDNESDAY, FEBRUARY 29th.

Tottenham Wireless Society.—Lantern and Cinema Demonstration, with slides showing Society's past activities.

South Croydon and District Radio Society.—Lecture: "Recent Developments in Components," by Mr. B. Haywood, of the Dubilier Co.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration of Coil-driven Loud-speaker by the Chairman, Mr. Edmund H. McCormack.

THURSDAY, MARCH 1st.

Institute of Wireless Technology.—At 7 p.m. At the Engineers' Club, Coventry Street, London, W. Continuation of talk on "Experiments with Multi-feed Aerials," by Mr. W. H. B. de M. Leathes.

Stretford and District Radio Society.—Demonstration of Sets by "Radiodu," of "The Manchester Evening Chronicle."

Leyton and Leytonstone Radio Society.—Discussion on Instruments in Wireless Receivers.

FRIDAY, MARCH 2nd.

Leeds Radio Society.—At the University. Lecture: "Direction Finding," by Mr. T. Brown-Thompson.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Open evening.

MONDAY, MARCH 5th.

Croydon Wireless and Physical Society.—At 8 p.m. At 5, Altyre Road, East Croydon. Talk on "Recent Practical Improvements in Wireless Reception," by Mr. A. W. Knight.

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

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

EMPIRE BROADCASTING.

Sir,—I feel you will be glad to know that last evening when searching round for the very successful short-wave station, Java, Dutch East Indies, I picked up a carrier which resolved into a lady singing, then a man, followed by a voice, "One moment, please," and Big Ben chimed out the four quarters and one deep boom (1 p.m.), then a voice announced that we were going over to Southwark (?) Cathedral for an organ recital, and for twenty minutes some splendid organ music came through. Imagine the thrill! If this was from the new station, 5SW, may they be congratulated, for the transmission is wonderful, no fading, and I was able to hold on to it without once readjusting the dials. The set I used is your "Empire Broadcasting Set," made up in the metal case as described in your June, 1927, issue, and for which I am grateful. The signal strength was such that I was able to follow each item with the phones on the table, using an ordinary 80ft. aerial between the roof and a tree and no earth connection. M. S. HALES.

Calcutta, India.
January 24th, 1928.

Sir,—At last we are able to receive the transmissions from 5SW here. The 12.30-13.30 G.M.T. period comes in at good strength, but the combination of time and wavelength appears to be unsuitable for India, as fading of the rapid variety is very troublesome. The programmes are much appreciated from the point of view of their novelty, but reception is below the standard necessary for enjoyment. No doubt changes will be made later on to find a more suitable time and wavelength for transmission to India. At present the reception of the 5SW transmission here bears no comparison with that of PCUU during the summer of 1927. As the Dutch station is not in operation at present a comparison for this time of the year cannot be given. E. J. H. MOPPETT (AI2AJ).

Roorkee, U.P., India.

PURE REPRODUCTION.

Sir,—Surely the time has come when people should be educated to realise what is meant by pure reproduction.

A few days ago I was speaking to a man who had heard a set, using a L.F. valve in its output stage, working a small horn loud-speaker. He was enthusiastic about the purity of the reproduction. He evidently thought that because there was no mechanical rattle, no blasting, no lack of intelligibility of speech, that the result was pure. He quite overlooked that the volume was minute, that the lower notes were absent, that the upper notes were weak, that the middle notes were strengthened by blurring resonances, and that, although the overall result was not positively unpleasant, it was a mere travesty of the original.

Now could not some enterprising manufacturers or traders in various towns arouse a certain amount of interest amongst the general public and give some demonstrations?[1]

They could show what sets of various prices were capable of doing, and by constant comparison (for the human ear is terribly short in memory) with a moving coil speaker, show that for quite a reasonable sum of money a very high degree of purity is obtainable.

I feel sure that many people would be amazed at the advances made during the past few years, and the slight outlay necessary for the demonstrations would be amply repaid by the increased sale of new apparatus.

Margate. B. N. BETTRIDGE.
January 30th, 1928.

[1 We have repeatedly recommended that some such action should be taken by the manufacturers.—ED.]

POWER OF CONTINENTAL STATIONS.

Sir,—Referring to Mr. Roberts' letter, wherein he mentions the power of Germany's transmitters in comparison with our own, is this not a blessing in disguise, as, if it were not for their stations and one or two others such as Prague, one would be forced to listen to the tosh and weird music pumped out by the B.B.C. stations day after day for hours on end?

Burgess Hill, Sussex. E. T. SOMERSET.
February 16th, 1928.

PERFORMANCE CLAIMS.

Sir,—I wish to correct an error I made in my letter to you which was published in February 1st issue. On referring to back issues I find the correct description of my 0-v-2 receiver was "The Quality Three."

I hope you will publish this correction as I have already had letters from various parts asking me how I got over the long and short wavelengths. This is accomplished very successfully in "The Quality Three." WM. SMURDEN.

King's Lynn.
February 2nd, 1928.

Sir,—There is a tendency lately for some of your readers to suffer from a bad attack of Americanitis in the matter of receiving sets. We are enjoined to lock at them (*vide* Britisher (?)), and regard them as the panacea for all broadcast reception troubles (*vide* Mr. North). But what do we really find? Undoubtedly the better class sets show great skill in layout, etc., but when it comes down to the question of individual components or quality, I do not think we need worry.

We have no city surrounded with 'umpteem stations through which we have to cut before receiving distant broadcast. Why, therefore, spoil quality by using a set designed for razor-edge tuning? We have two wave bands to cover, and I think our designers deserve a pat on the back for having successfully coped with this trouble. We prefer to "roll our own," whereas in the States the B.C.L.'s rely chiefly on manufactured sets or essential kits. I believe if readers continue to build sets described from time to time in *The Wireless World* for European conditions they will not go far wrong. Nine to fourteen "toob" sets may suit the U.S.A., but they will not go down over here, where most of us have Rolls-Royce ideas but—and it is a very big but—Baby Austin incomes.

St. Austell, Cornwall. W. A. E. ROWELL.
February 8th, 1928.

READERS' PROBLEMS

"The Wireless World" Supplies a Free Service of Technical Information.

The Service is subject to the rules of the Department which are printed herewith; these must be strictly enforced, in the interest of readers themselves. A selection of queries of general interest is dealt with below, in some cases at greater length than would be possible in a letter.

A Simple Method of Adding Reaction.

I wish to increase the sensitivity of my "Coastal Broadcast Receiver" (your issue of July 13th, 1927) by the addition of reaction, if this is likely to be worth while, and if it can be arranged without any extensive alterations. Perhaps you can suggest a simple method? T. W. D.

The H.F. amplifying valve of this receiver can be brought to the oscillation point by judicious operation of the neutralising condenser, the vanes of which should be rotated slightly away from the position giving a perfect balance. If further regeneration is required, we suggest the method shown in Fig. 1. As will be seen from the diagram, it is necessary only to add an H.F. choke in the anode circuit of the detector and a very small variable reaction condenser of from 0.00005 to 0.0001 mfd. (with a low minimum capacity). This latter is connected between the detector plate and the aerial terminal, and its setting controls the amount of H.F. energy fed back through the aerial inductance, which now acts as a reaction coil in addition to fulfilling its normal function. Its magnetic sense with relation to the grid coil must be correct; thus if reaction effects are not obtained at the first attempt, the leads must be reversed.

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Eliminator Precaution.

I understand that damage is likely to occur to an A.C. battery eliminator when this is switched off after the receiver. If this is correct, will you please inform me in what order the eliminator and receiver should be switched on and off? T. D.

This precaution is necessary only with supply units fitted with series resistances for the purpose of obtaining intermediate voltages. When the eliminator is running on no load the smoothing condensers will have the full peak voltage across their terminals, and, in addition, when the switch is turned off, the current surges may develop momentarily very high voltages, and these may rise to a value of 1,000 volts if high inductance chokes are incorporated. This voltage, being very much in excess of that which the condenser will normally stand, may puncture the insulating material between the plates, and thus ruin the condenser. If a high resistance is permanently connected across the output terminals of the unit, the surge voltages can leak away, and the condensers will not be subjected to big differences in potential. When this precaution is taken, the order of switching off the eliminator and receiver will be immaterial. The above remarks will not apply to those units incorporating a potential divider for the purpose of obtaining intermediate voltages.

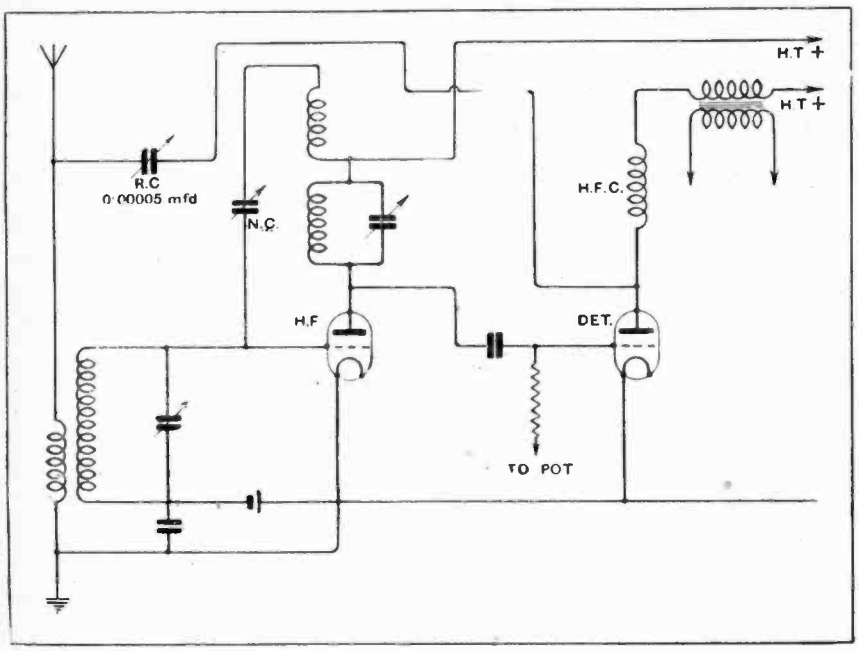

Fig. 1.—An "aperiodic" aerial inductance may be made to serve as a reaction coil.

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Long Wave Instability of the "Two H.F. Everyman" Receiver.

I have constructed the "Two H.F. Everyman Four" Receiver, but cannot stabilise the set on the long wavelengths. With the short wave coils the set is perfectly stable, and gives excellent results on both nearby and distant stations. I should be obliged if you could suggest a means of achieving satisfactory long-wave reception. E. G. S.

In a number of similar cases encountered the instability on the long waves in the "Two H.F. Everyman Four" receiver has been traced to a slight discrepancy in the impedances of the high frequency valves, and the receiver has been rendered stable by increasing the value of the resistance in the primary circuit of the H.F. transformers from 2,000 to 5,000 ohms.

RULES.

(1.) Only one question (which must deal with a single specific point) can be answered. Letters must be concisely worded and headed "Information Department."

(2.) Queries must be written on one side of the paper, and diagrams drawn on a separate sheet. A self-addressed stamped envelope must be enclosed for postal reply.

(3.) Designs or circuit diagrams for complete receivers cannot be given; under present-day conditions justice cannot be done to questions of this kind in the course of a letter.

(4.) Practical wiring plans cannot be supplied or considered.

(5.) Designs for components such as L.F. chokes, power transformers, etc., cannot be supplied.

(6.) Queries arising from the construction or operation of receivers must be confined to constructional sets described in "The Wireless World" or to standard manufacturers' receivers.

Readers desiring information on matters beyond the scope of the Information Department are invited to submit suggestions regarding subjects to be treated in future articles or paragraphs.