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EMPIRE BROADCASTING.

IN our issue of last week we put forward the case for a central short-wave station for Empire broadcasting. By a coincidence, within a day or two we received a letter from a reader in Western Australia, of which we publish the text under "Correspondence" in this issue.

Our reader deplores the fact that they have but one broadcasting station in Western Australia, and goes on to ask "When are the Englishmen going to broadcast on short waves?" He reports reception of WGY's programme relayed on 32.79 metres from 2XAF, and also reception of the concerts from Holland, the only telephony heard from England being from the experimental station of Gerald Marcuse, G2NM.

This letter no doubt expresses the feelings of almost every representative of the British Empire abroad, who must feel very strongly that we in the mother country are neglecting a wonderful opportunity which short-wave broadcasting offers for strengthening the bonds of Empire unity, for, quite apart from the fact that listeners would be hearing concerts and other programme items emanating from this country, the station could also be employed as a means of broadcasting events of national, and therefore Empire, interest, and the usefulness of the station could well be extended, at some future date, to direct communication to the assembled parliaments of the individual sections of the Empire.

We do not, perhaps, hear enough from our readers overseas, and we take this opportunity of extending to all of them the invitation to write to us on this subject and give us their views on the establishment of a short-wave home broadcasting station specially erected for the purpose of overseas broadcasting. If our Colonial readers show their interest in sufficient numbers it will help us in our endeavour to impress the authorities with the need for such a station.

CONTENTS

POWER AMPLIFICATION WITH LOW VOLTAGE H.T.

In the design of receivers where considerable amplification is required at low frequency it has customarily been recognised that it is requisite that the plate voltage available should be of the order of 120 volts or more, since modern power valves are not designed to function on voltages below that figure. Considerable interest is therefore likely to be aroused in the power amplifier for 40 volts H.T., which is described in this issue. By the employment of specially designed 4-electrode valves it has been found possible to obtain an output for the operation of loud-speakers using approximately one-third of the plate voltage required with a three-electrode valve giving equivalent output. The four-electrode valve has hitherto been very much neglected, and this application is calculated to stimulate new interest in its development in the very useful direction of reduction of high-tension voltage, which, from the point of view of compactness or portability is so important

POWER AMPLIFIER for 40 VOLTS H.T.

An Efficient Arrangement Using Four-electrode Power Valves.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

UNTIL quite recently the idea of using only forty volts high-tension supply for a low-frequency amplifier to give large volume output *with good quality* reproduction would have been dismissed as absurd, and yet the amplifier illustrated in this article gives really good strength and good quality on as little as 30 volts high-tension supply.

A short time ago[1] the writer described an amplifier using a four-electrode power valve embodying certain of his suggestions which gave sufficient loud-speaker results for the average room when operated from a crystal set giving loud signals in telephones.

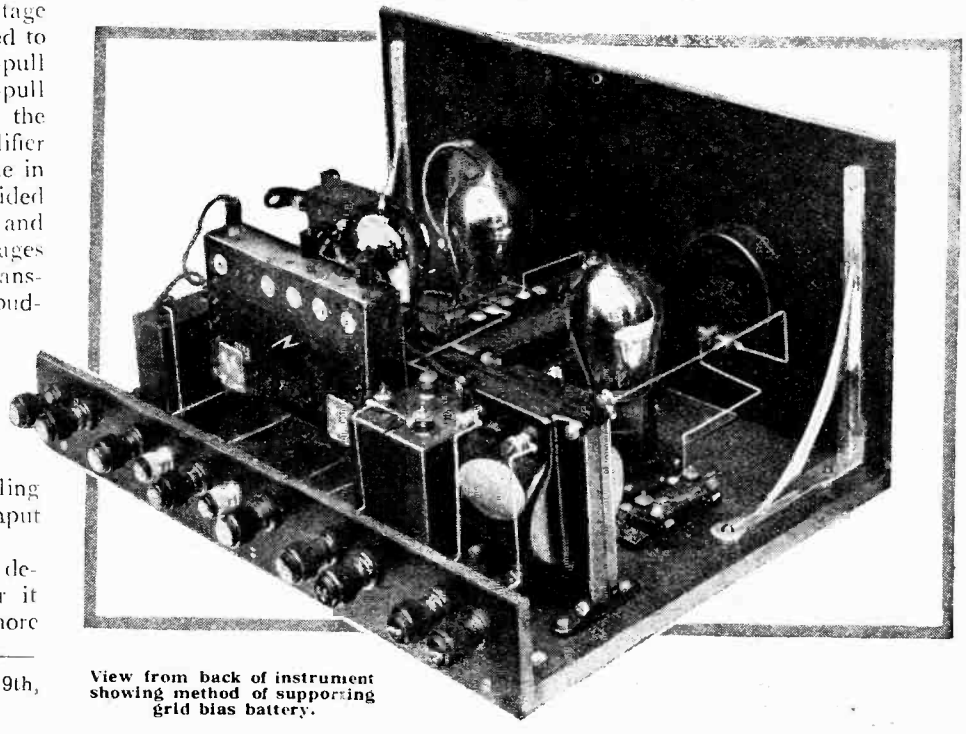
After the tests on this single-valve amplifier had been completed, further experiments were carried out using two stages of amplification with a view to obtaining sufficient volume output for a very large room or small hall, the high-tension supply having an absolute maximum of 60 volts.

In order to take full advantage of the low H.T. it was decided to make the last stage a push-pull one, since suitable push-pull transformers were already on the market. A push-pull amplifier may briefly be described as one in which the input voltage is divided equally between two valves, and in which the amplified voltages are combined in a special transformer to pass on to the loud-speaker or on to the next stage of amplification. In this way an input voltage which is too great for one valve to handle without distortion is split up between two similar valves, each dealing with half the applied input voltage.

Before proceeding with the design details of the amplifier it will be as well to discuss more fully the advantages of push-pull amplification when low H.T. valves are used. In Fig. 1 is shown the usual plate current-grid voltage characteristic curve for an amplifier valve for one particular value of plate voltage. This curve may be considered as consisting of a straight portion AB, followed at its lower end by a curved portion, the straight part corresponding to a range of negative grid voltage from D to C, and the curved part to grid voltages greater than that corresponding to C.

Permissible Grid-swing.

The straight section AB is the only portion of the characteristic curve which is of use for distortionless amplifying purposes since it is only in this region that the plate current varies *exactly* in accordance with the variation of grid voltage, so that the maximum permissible variation of grid voltage—or grid-swing, as it is usually called—is from C to D.



View from back of instrument showing method of supporting grid bias battery.

[1] *The Wireless World*, March 9th, 1927.

Four-electrode Power Amplifier.—

In Fig. 1 (also in Figs. 2 and 3) the curves showing the relation between grid voltage and corresponding plate current are only shown for negative values of grid voltage, for the reason that when the grid of the valve becomes positive electrons will be attracted from the stream going from filament to plate, thus causing grid current to flow—which will cause serious distortion. It is not here proposed to go into the reasons why grid current in an amplifier produces distortion as this subject has been dealt with many times in the pages of this journal—so that it is sufficient to say that it is only the straight portion of the characteristic curve corresponding to *negative* values of grid voltage which is permissible for distortionless amplification.

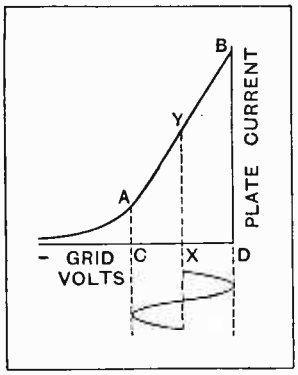


Fig. 1.—Typical grid volt-plate current characteristic.

The next point to consider is the effect of varying the plate voltage on this straight part of the characteristic curve. If this voltage is increased the relation between grid volts and plate current will be shown on the diagram by a new curve lying to the *left* of the old curve and of substantially the same shape, while reducing the plate voltage gives a corresponding curve to the *right* of the old one. In effect, then, increasing the plate voltage may be regarded as moving the characteristic curve bodily to the *left*, and reducing, to the right. This point will be made clearer on reference to Figs. 2 and 3, which show characteristics for actual valves on two different plate voltages. It will be seen from these figures that increasing the plate voltage effectively increases the *available* length of the straight portion AB of the characteristic curve, and therefore increases the permissible grid-swing CD. At this stage it should be clear that, for any given amplifier valve, the maximum permissible grid-swing is fixed when the voltage on the plate of the valve is fixed.

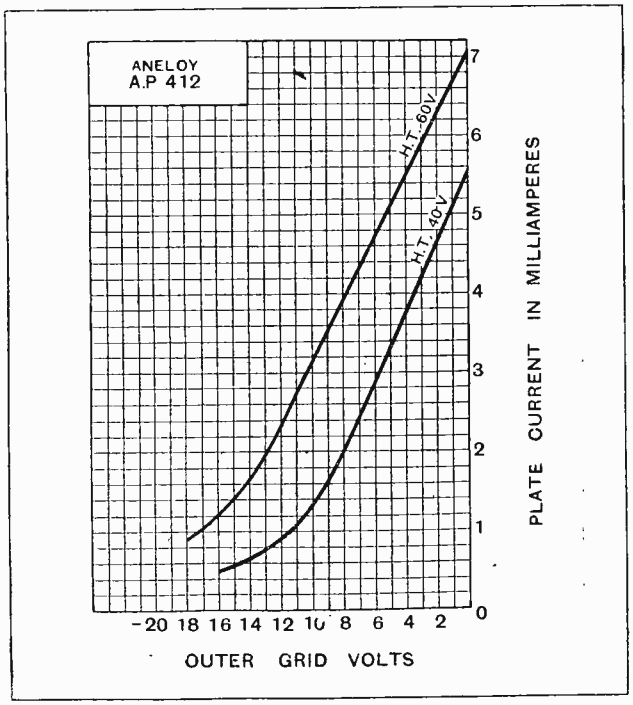


Fig. 2.—Four electrode L.F. amplifier. Amplification factor, 4.5; A.C. resistance, 10,000 ohms; inner grid volts, + 20.

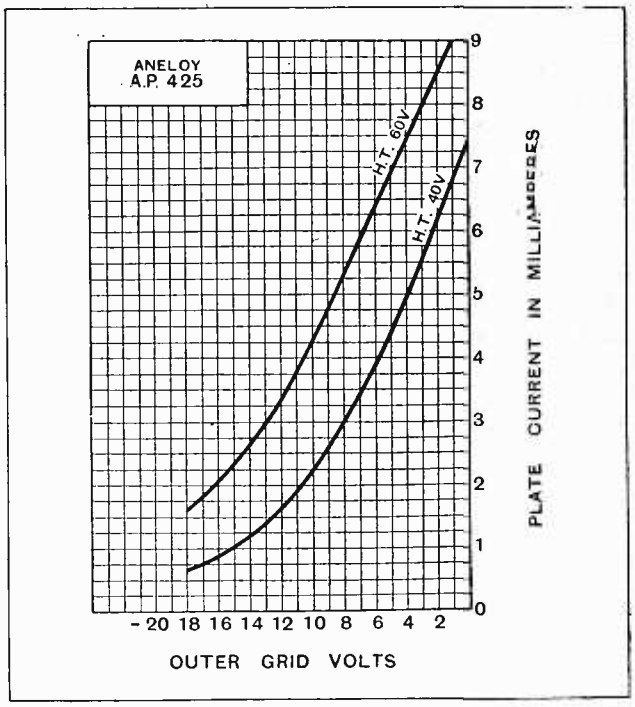


Fig. 3.—Four electrode power valve. Amplification factor, 4.5; A.C. resistance, 8,000 ohms; inner grid volts, + 30.

If the input voltage required to be amplified is greater than the permissible grid-swing for a given plate voltage, then either the latter must be increased or, if this is not convenient, then the input voltage must be split up between two or more valves.

By the use of a special input transformer with a centre-tapped secondary, and a special output transformer with a centre-tapped primary, it is possible to divide the amplification evenly between two valves and then combine their outputs to operate a loud-speaker. Fig. 4 shows the complete circuit of the amplifier in which T_2 is the special input transformer to the push-pull stage, *abc* being the centre tapped secondary, while T_3 is the output transformer, with the centre-tapped primary *xyz*.

Increased Power Output.

It has now been shown how bigger power outputs may be obtained on low H.T. voltages by the use of push-pull amplification, so that the combination of this method of amplification with the use of *power* four-electrode valves, which are essentially low H.T. valves, will give still further power output from such low H.T. voltages as thirty to sixty. The four-electrode power valve is one in which an extra grid, connected to a tapping point on the H.T. battery, is used to reduce the resistance of the valve by the reduction of the space charge.

Four-electrode Power Amplifier.—

The Valves.

The valves used in this amplifier are the A.P.412 L.F. and the A.P.425 power, made by Messrs. Ancloy Products, and two of their characteristic curves are given in Figs. 2 and 3. In Fig. 2 the inner grid voltage is +20, while in Fig. 3 this voltage is +30, which is a little high for 40 volts on the plate, but about right for 60 volts. Both valves begin to show signs of saturation at 60 volts H.T., which results in slight bending over of the characteristic curve at the *top* end. It is not noticeable in Fig. 2, but in point of fact it is quite noticeable with another six volts H.T., while in Fig. 3 the 60-volt curve begins bending just off the diagram at about 9 milliamperes plate current.

However, as will be seen from Figs. 2 and 3, quite large plate current variations are available with these valves with even 40 volts on the plate, so that they may truly be placed in the power class.

The Circuit.

The circuit of the complete amplifier is given in Fig. 4, in which two grid batteries are shown for convenience in drawing and explanation. In the actual set only *one* grid battery is used, and a lead from the secondary of the first transformer T_1 taken to it. A filament rheostat is provided for switching on the valves, and a volume control is also fitted. This latter consists of a variable high resistance K (Duvarileak) in series with a fixed resistance of from half to one megohm. These two resistances are placed in series across the secondary of the transformer T_1, as shown in Fig. 4, and the first valve (outer) grid and filament connected across the fixed resistance.

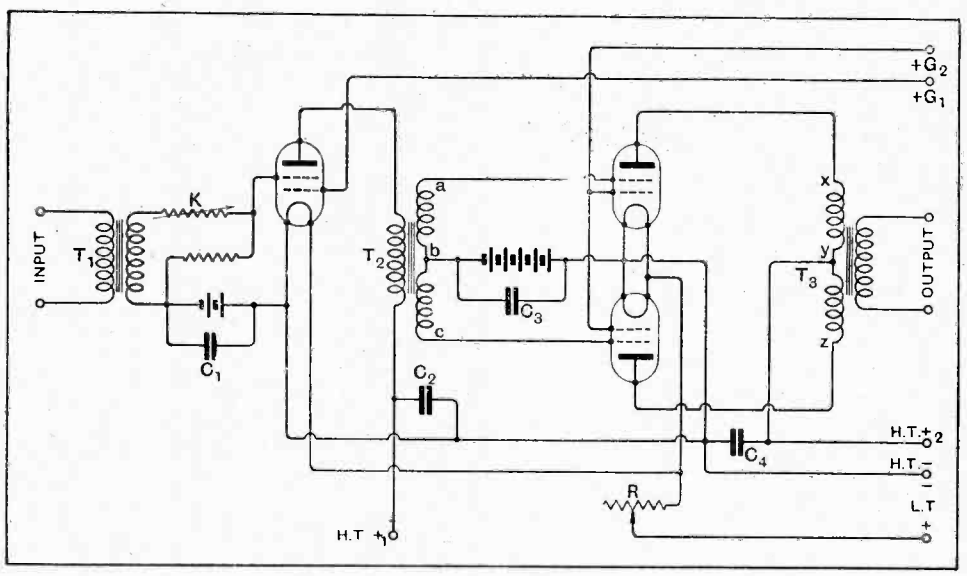


Fig. 4.—Circuit diagram of two-stage amplifier. The final stage comprises two valves operating on the push-pull principle.

In this way, when K is at a minimum value (practically zero resistance), the full voltage across the secondary of T_1 is delivered to the valve, while as K is increased in value so the valve gets less and less of this voltage—thus K acts as a volume control. The volume control is not from zero output to full output, which is rather too much control for most requirements, but from about a quarter or so to full output, which is much more convenient.

Fixed condensers C_1, C_2, C_3 and C_4 of one-microfarad capacity are provided across H.T. and grid bias batteries, and separate H.T. and inner grid terminals used for each stage as a refinement for experimental work, although it is not strictly an absolute essential. In the actual amplifier all the transformer cores should be connected together and to −L.T. to prevent any trouble due to L.F. howling, which may possibly occur otherwise—this is a precaution which should be observed as a matter of course in building any kind of amplifier using iron-

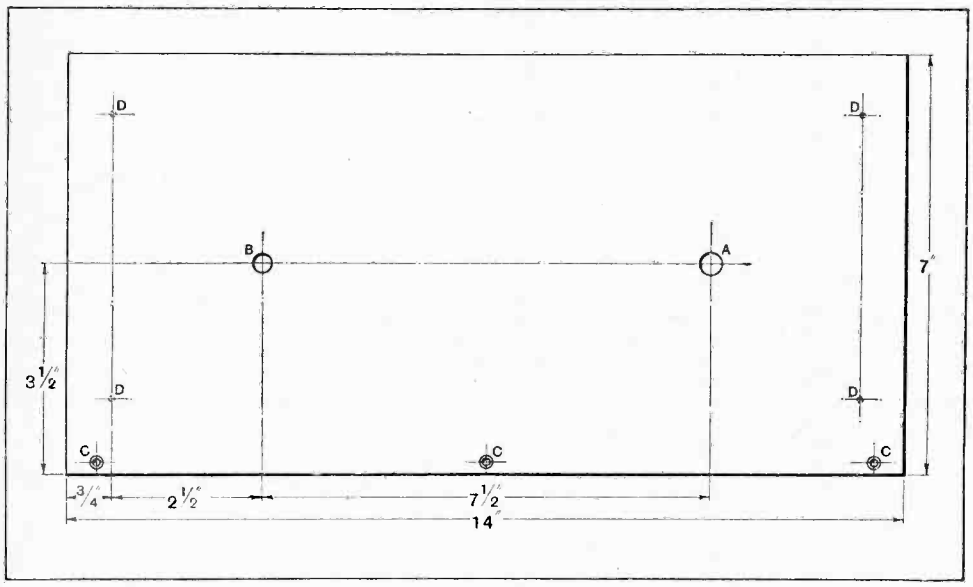


Fig. 5.—Drilling details of panel. A, 3/8 in. dia.; B, 5/16 in. dia.; C, 1/8 in. dia., countersunk for No. 4 wood screws; D, blind hole drilled and tapped No. 6 B.A. from rear of panel.

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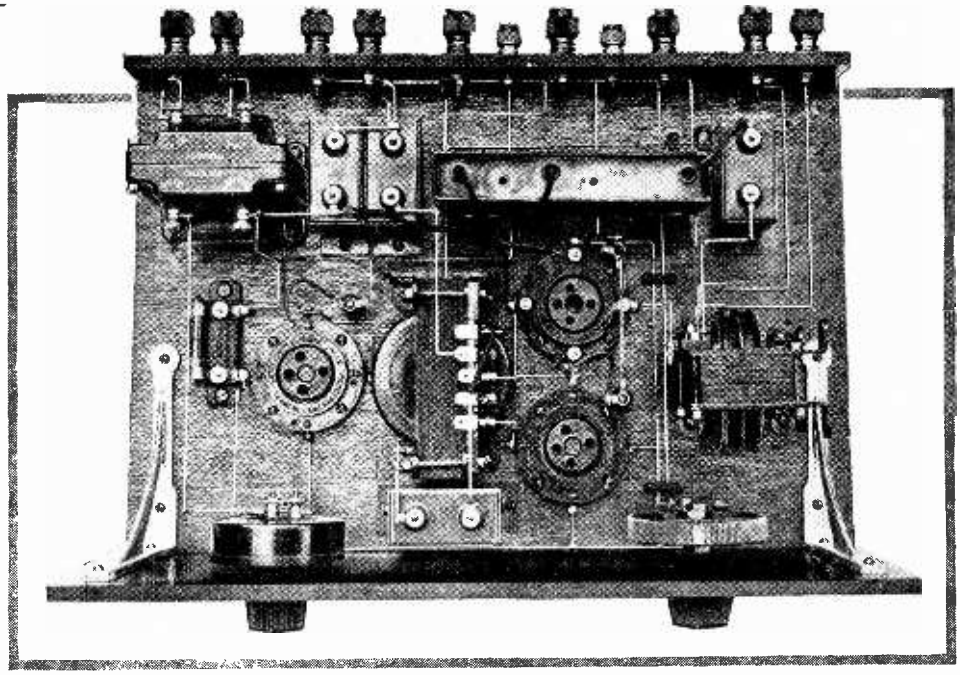
cored chokes or transformers. This connection is not shown in Fig. 4 nor in the wiring diagram, Fig. 7, as it might perhaps confuse the reader unused to this excellent practice. The input transformer T_1 actually used on the set is a Ferranti A.F.3, which has an earthing terminal for this purpose, while the connections to the cores of the other transformers are most conveniently made by threading soldering tags on two of the holding-down screws before fixing, making sure that the tags are in good contact with the frames by well scraping the latter.

A general view of the amplifier in its case is shown in the title block, and a rear view with the case removed in the photograph on the first page.



Plan view showing wiring and layout of components.

With the aid of the photographs, the layout of Fig. 6 and the wiring diagram of Fig. 7, it should be quite a simple matter to follow the construction of this power amplifier—there are no snags in the construction, as it is simply a matter of screwing down the components as indicated and then wiring up in any convenient order. There is only one point which is perhaps not directly obvious, and that is the way the grid bias battery is mounted. It will be found convenient to mount this battery a short distance—say, about an inch or so—above the baseboard so as to allow short and direct wiring to some of the terminals on the back strip.

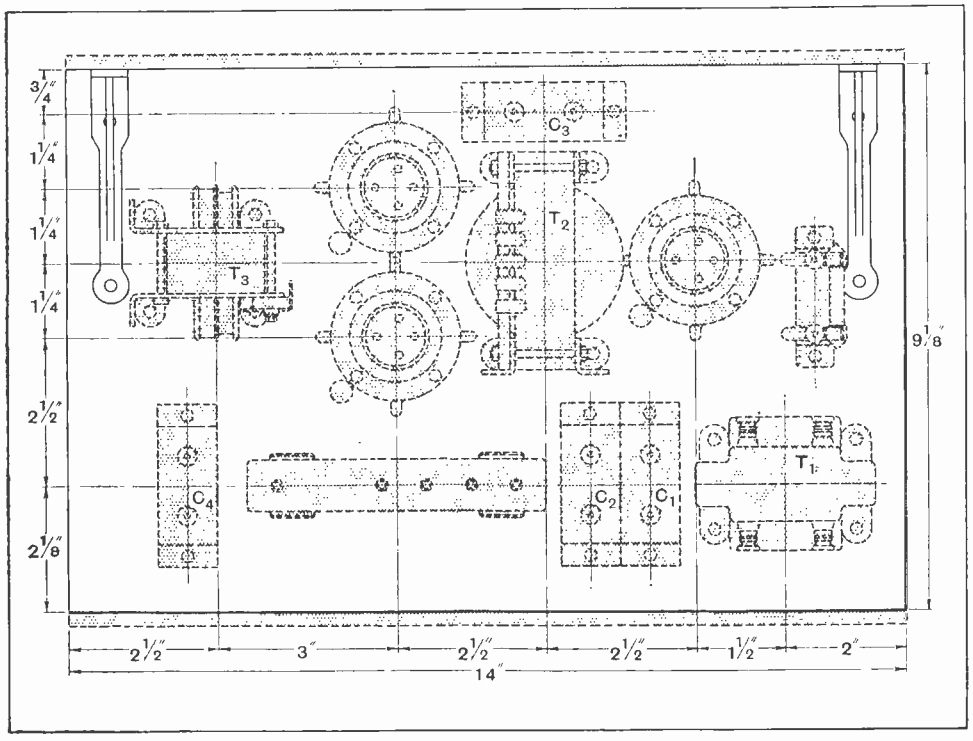


Fig. 6.—Dimensioned layout of baseboard components.

The method of mounting is by means of two U-shaped clips made of aluminium sheet supported on two pillars of ⅜in. ebonite tubing through which are passed wood screws of suitable length. If the photograph at the bottom of the first page of this article is studied carefully it is possible to see one clip and ebonite pillar complete—the "lightning" trade-mark of the Siemens battery illustrated is directed towards the clip in question.

H.T. Supplies.

It is strongly recommended that either accumulator H.T. of 40 or 60 volts be used for the amplifier, or, as an alternative, the very large Super Radio 50-volt Siemens dry battery.

A 60-volt Exide accumulator costs only 45s., and a 40-volt only 30s., and with

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reasonable care should last a good many years and will probably require charging only four times per year with normal use. The large 50-volt dry battery should give about 8 to 12 months' good use, after which it will have to be renewed.

The ordinary small size H.T. dry batteries should not be used as they will be overloaded and will not last, besides giving bad quality results after a short time—as has been pointed out several times in this journal by the writer and by others.

It is probable that many readers who want good quality reproduction with comparatively powerful output cannot afford the 120 to 160 volts of accumulators, or very large dry batteries necessary with three-electrode valves, but could afford 40 to 60 volts of this nature, so the set described in this article will enable them to obtain what they want without the big expense in batteries.

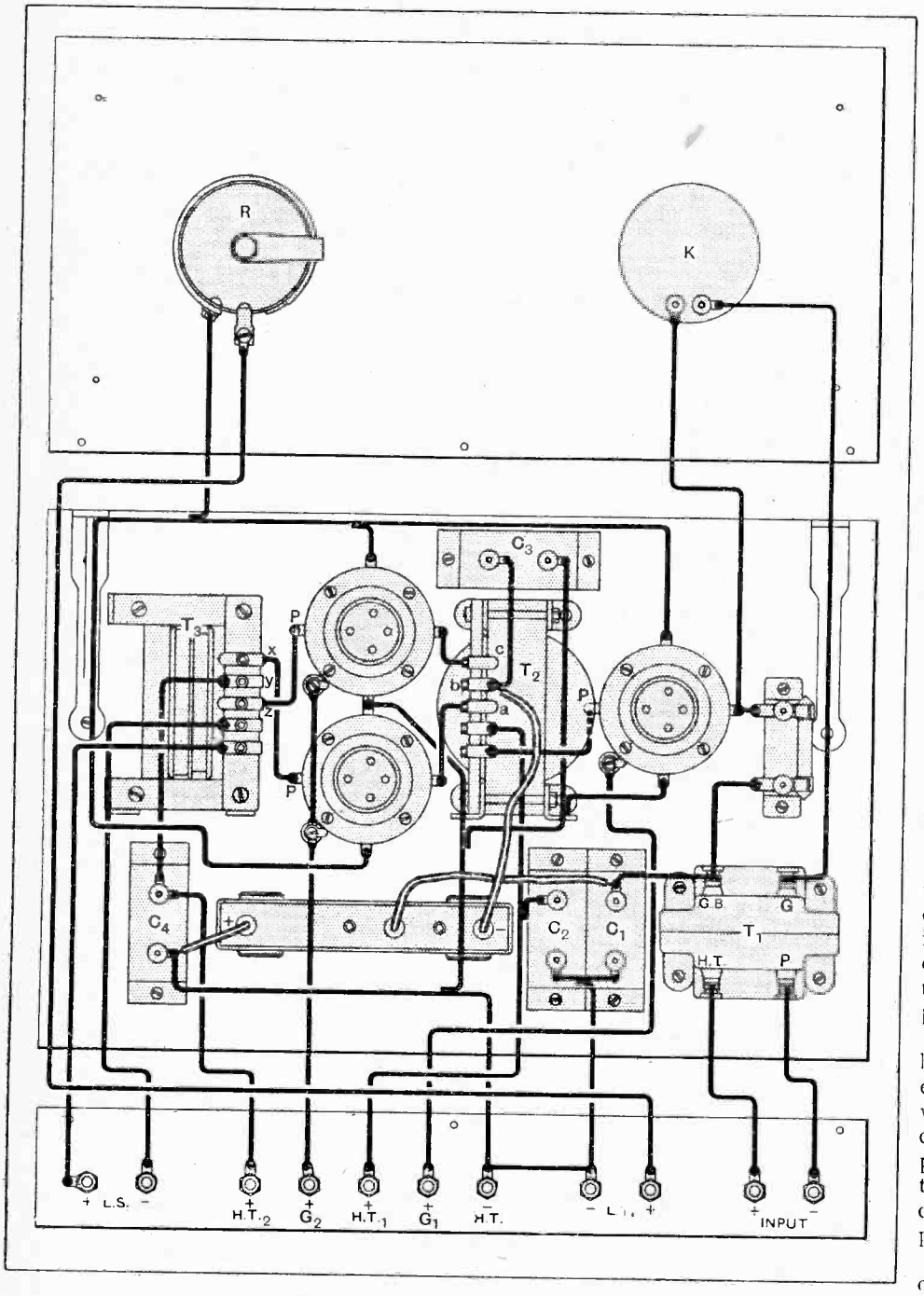

Fig. 7.—Complete wiring diagram.

This power amplifier is quite suitable for adding after a crystal set which gives reasonable signals in the telephones, while with a set which is quite close to the local broadcast station and gives loud signals in the telephones the output from the amplifier using 60 volts H.T. should be much too loud for an ordinary room with the volume control adjusted for maximum results—in fact, it should be quite sufficient for a small hall.

Good Quality.

The writer tested the amplifier illustrated in this article on a crystal set, with an efficient aerial, about three miles from 2LO, and obtained really good volume, combined with good quality of reproduction. It is quite surprising to some how easy it is to get good quality results with these power four-electrode valves—and the real reason for these results is due to the ease with which they may be supplied with *relatively* high plate voltages from large-capacity batteries. From the point of view of upkeep costs for good quality output in places where lighting mains are not available, or it is not convenient to use them, the four-electrode power valve scores heavily.

In a future article it will be shown how the overall efficiency of a four-electrode valve designed for low-frequency amplification compares with the efficiency of typical three-electrode valves designed for a similar purpose.

The method of comparison of these efficiencies is an extremely interesting problem,

Four-electrode Power Amplifier.—

LIST OF PARTS

FOUR-ELECTRODE POWER AMPLIFIER (A.P.C.).

1 Push-pull L.F. Transformer, type 660 (Pye).
1 Push-pull Telephone Transformer, type 662 (Pye).
1 Duvarilak (Dubilier).
3 Valveholders, "Lotus" (Garnett, Whiteley & Co., Ltd.).
1 Transformer, A.F.3, 3½ to 1 (Ferranti).
4 Fixed condensers, 2 mfd. (T.C.C.).
1 Grid bias battery, 9 volt (Siemens).
1 Grid Leak, Dumetohm 1 meg. and holder (Dubilier).
1 Rheostat, 15 ohms (Burndept).
1 pair "Camco" brackets (Carrington Mfg. Co.).
1 "Camco" cabinet, 14in. × 7in. × 9in. deep (Carrington Mfg. Co.).
1 Ebonite panel, 14in. × 7in. × ¼in. (British Ebonite Co.).
1 Baseboard, 14in. × 9½in. × ½in.
9 Ebonite shrouded terminals (Belling & Lee).
2 Nickel-plated terminals (Belling & Lee).
1 Four-electrode L.F. valve, A.P. 412 (Aneloy Products, 36, Forest Hill Road, East Dulwich, London, S.E.22).
2 Four-electrode power valves, A.P. 425 (Aneloy Products), Wire, screws, sleeving, etc.

Approximate cost (excluding valves) £7 7 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.

and one which is rather difficult to solve in a manner which gives a fair basis of comparison; but the investigation has proved worth the trouble involved and throws interesting light on the probable development of the thermionic valve.

General Notes.

Mr. C. R. Ponting, 11, Woolcott Street, Redland, Bristol, sends us a somewhat lengthy extract from his log book which we intend printing under "Calls Heard" as he wishes to compare notes with other readers interested in long-distance reception. We would warn them, however, that we do not encourage long lists of this kind, for which there is seldom available space, nor any endeavour to create a record for the number of DX stations logged. Mr. Ponting states that last month proved phenomenal for DX conditions on short waves, especially the night of March 27th, when he logged ten Australian stations in half an hour.

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Norwegian Amateurs.

Through the courtesy of Mr. J. Diesen (LA 1A), we are able to give the following list of licensed Norwegian short-wave transmitters :—

LA 1A	J. Diesen, Stoen i Maalselv, near Tromsö.
LA 1D	G. H. Petersen, Industrigaten 30, Oslo.
LA 1E	Værvarslingen paa Vestlandet, Bergen.
LA 1F	O. Bingen, Hasle pr. Sandefjord.
LA 1H	Oslo sjömannsskole, Oslo.
LA 1K	Akademisk Radioklub, Trondhjem.
LA 1M	Det Norske Meteorologiske Institutt, Oslo.
LA 1N	Alf G. Nielsen, Snaröen, Bærum.
LA 1O	Ragnar Larssen, Tyholtveien 43, Trondhjem.
LA 1P	N. J. Soberg, Höiskole, Trondhjem.
LA 1R	Walter Rieck, Vaagsallmenning 8, Bergen.
LA 1X	J. O. Berven, Uelandsgate 14, Stavanger.

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Belgian Amateurs.

Through the courtesy of Mr. Louis Era, we are now able to give our readers a complete list of all Belgian amateur stations licensed on April 10th :—

4AA	(ex CH5)	R. Verstrepen, 23, rue Van Shaelen, Antwerp.
4AC	(ex Y8)	P. Duingnan, 16, rue de l'Eglise, Antwerp.
4AE	(ex D33)	P. Lamalle, 110, rue Franklin, Brussels.
4AI	(ex A44)	A. Rombauts, 30, Place de Jamblinne de Meux, Brussels.
4AJ	(ex C11)	J. Hersleven, 50, rue du Bailly, Brussels.
4AK	(ex O1)	P. Mattlet, 37, rue entre 2 Portes, Huy.
4AL	(ex L4)	U. R. C. L. Cpt. Boudart, 28, rue Louvrex, Liège.
4AM	(ex L1)	M. Laloux, 19, rue Bonne Fortune, Liège.
4AP	(ex U5)	M. Antoine, 48, Place de l'Eglise, Perronnes, Binche.
4AR	(ex F4)	R. Boel, 253, rue Francois Gay, Wolowe, Brussels.
4AT	(ex G11)	L. Charlier, 32, rue de Merode, St. Gilles.
4AU	(ex H5)	J. Mahieu, "La Manoir," Peruwelz.
4AX	(ex X2)	H. Boogaerts, 22, Avenue Mont-Kemmel, St. Gilles.
4AZ	(ex 13)	F. Masson, 22, rue de Husquet, Dison-Verviers.
4BB	(ex A22)	M. Michelet, 59, rue E. Van Driessche, Ixelles.
4BC	(ex B1)	L. Era, 46, Avenue Van Put, Antwerp.
4BF	(ex I4)	R. Brachot, 141, rue des Grogeres, Marcinelle.
4BG	(ex A4)	G. Depauw, 73, rue des Ailes, Schaerbeek.
4BH	(ex J44)	J. Marchal, 222, Avenue Moliere, Ixelles.
4BI	—	M. Much, 40, Rue Vinave d'Ile, Liège.
4BK	(ex T1)	H. Servais, 6, rue Mali, Verviers.
4BL	(ex K3)	H. de Thier, 115, Avenue du Chêne, Heusy-Verviers.
4BT	(ex C2)	J. Mussche, 63, Boulevard Poincaré, Anderlecht.
4BX	(ex M8)	J. G. W. Stevens, rue Joseph Lies, Antwerp.
4BY	(ex D2)	G. Pollart, 62, rue de Hollande, St. Gilles.
4CA	—	M. Comyn, Wireless Inspector, Antwerp-Radio O.S.A., Pilotage, Antwerp.
4CB	(ex P7)	A. Depuydt, 6, rue d'Anvers, Ostende.
4CC	(ex C5)	R. Henri, 32, rue du Midi, Chatelet.
4CD	(ex A7)	A. Deporter, 63, Digue de Mer, Middelkirke.
4CF	—	Radio Verviers, Verviers
4CG	(ex F8)	G. Blanquaert, 20, rue de Rome, Lokeren.
4CK	(ex CH2)	M. Meunier, 105, Bd. des Etats-Unis, Mons.
4CM	—	Dr. M. Polain, 107, rue Louvrex, Liège.
4CO	(K44)	J. Duprez, 52, Vlostraat, Ghent.
4CP	(K33)	W. Geronez, 1, rue à Charrettes, Flénu.
4CU	(H6)	F. Callebert, 29, Oostraat, Roulers.
4DA	(ex CH8)	F. Jorsen, 15, rue de Witte, Berchem, Antwerp.
4DF	(ex E22)	E. Van Gasse, 43, rue Dupont, Brussels.
4FT	(ex O8)	G. Neelemans, 15, rue du Luxembourg, Brussels.
4FU	(ex Z8)	M. Ocreman, 8, Avenue Léon Mahillon, Schaerbeck.
4FY	(ex V3)	E. Neirynckx, 2, rue de Pélichy, Isegnem.
4QQ	(ex A2)	A. Bergneman, 17, rue Fontainas, St. Gilles.
4SA	(ex P2)	R. Deloor, 26, Avenue Mont Kemmel, St. Gilles.
4TM	(ex L4)	M. Tricote, Vellereille-le-Brayeux.
4UA	(ex U2)	L. Huminckx, 108, rue d'Anderlecht, Brussels.
4UC	(ex M2)	V. Lilsens, 25, rue Ernotte, Namur.
4UU	(ex U3)	P. de Neck, 33, rue A. Renard, Ixelles.
4VU	(ex S4)	M. Dirieq, 33, rue du Progrès, La Croyère.
4WW	(ex W1)	G. Reguier, 17, Bd. Frère Orban, Liège.
4XX	(ex C22)	M. Van Namvermeiren, 29, rue Ch. Van Leerberghe, Brussels.
4ZZ	(ex Z1)	E. Liane, 44, Bd. Frère Orban, Liège.

TRANSMITTERS' NOTES AND QUERIES.

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New Call-signs Allotted and Stations Identified.

2BGU	J. G. Ritchie, 15, Cloberhill Rd., Knightswood Glasgow. (Change of Address.)
2ANO	E. H. Walker, Woodgrange, Overton Rd., Sutton, Surrey.
EU 08	(Ex 08RA). Gilarov, 19, Ulitca Mira, Leningrad, Russia. (Transmits on 36.5, 42.5, and 50 metres.)
EI 1CR	Vincenzo Quasimodo, Goriza, Italy.
ED 7HP	Henrik Petersen, Hatsseminariet, Mönder, Denmark.

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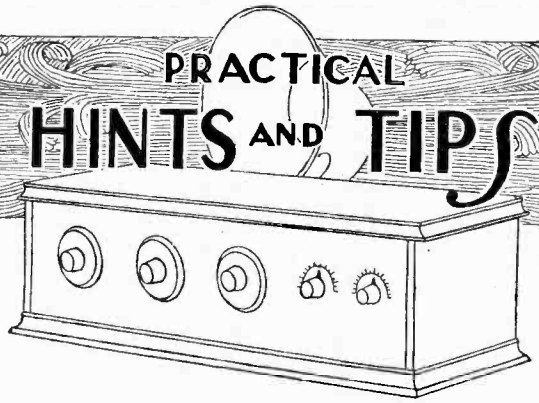
QRAs Wanted.

AC 8FJE (or 8FJT), EB 4AU, 4BK, N33, EK 4XY, 4MC, 4RL, 4XR, 4KBL, 4S AR, SB 2AX, JBW, EC 2YD, AF 1B, NU 8BFA, G 5BC, G 6WW, NO 13X.

PRACTICAL HINTS AND TIPS



Aids to Better Reception.

Theoretical Diagrams Simplified.

SOURCES OF DISTORTION.

Unless an elaborate equipment of testing and measuring instruments is available, it is fairly safe to say that it is a much more difficult matter to locate faults in a wireless receiver than to repair them. The only method possible to the average amateur is to narrow down the field of search by eliminating possible sources of trouble.

When the quality of reproduction is poor, it is advisable first to decide whether the fault lies in the amplifier or the loud-speaker; for example, any mechanical looseness in the parts of the latter instrument may give rise to symptoms which are similar

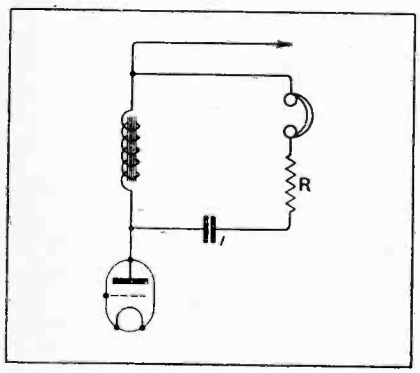


Fig. 1.—A test for amplifier distortion.

to those produced by an overloaded output valve. Although head telephones are by no means perfect reproducers, it is possible by their use to obtain a very fair idea as to whether the amplifier is delivering undistorted signals to the output terminals, but only when volume is reduced to what is generally referred to as "telephone strength." This reduction, however, must take place *after* the output valve, as misleading results will be obtained unless the amplifier is working at normal magnification.

A good method of obtaining this condition is shown in Fig. 1, which represents the connections of the last valve of a receiver. In place of the loud-speaker, an L.F. choke is inserted in series with the anode, and across it are connected a large stopping condenser, a volume-reducing resistance, and the phones. The best value for the resistance can only be found by trial and error; it should be sufficiently large to reduce the audibility of signals to a sufficient extent, and several megohms will often be necessary.

If a low-frequency choke is not available, the windings of the loud-speaker, with the diaphragm removed, will serve fairly well in this capacity.

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SEPARATING H.F. AND L.F.

Poor reproduction or even instability is often attributable to the action of H.F. energy in the L.F. amplifier, and every effort should be made to prevent, or at any rate to restrict, the development of high-frequency voltages across the grid circuit of the first low-frequency amplifier. In the case of a transformer-coupled instrument, this is a simple matter, and provided that the usual practice of shunting the primary with a small condenser is followed, no special precautions need be observed.

When the detector valve is followed by a stage of resistance-capacity coupling, the problem becomes a more difficult one, and the methods shown in Fig. 2, either separately or in combination, are to be recommended. The first makes use of an H.F. choke, which is inserted in the anode circuit of the detector, with a by-pass condenser (C_1) connected between plate and filament of the valve. C_2 is, of course, the usual coupling condenser.

The second device consists of a high ohmic resistance R, which is inserted directly in series with the grid of the first L.F. valve. Its resistance may be from 0.1 to 0.25 megohm, and in any case should be low in comparison with that of the grid leak. This is an extremely important point; if we use, say, a

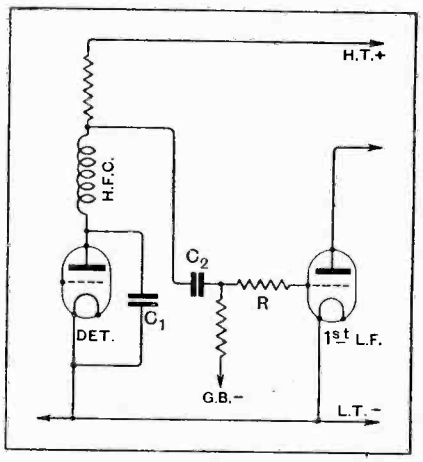


Fig. 2.—Keeping H.F. currents out of the L.F. amplifier.

quarter-megohm grid resistance (R) in conjunction with a half-megohm leak, the available L.F. voltage applied to the grid will be reduced by one-third, with a very considerable reduction in signal strength.

An efficient H.F. choke may often be substituted for the resistance, and, indeed, it is certainly better when the receiver is primarily intended for work on long wavelengths (over 1,000 metres).

METAL PANELS.

In constructing receivers with metal panels it is often overlooked that the shaft of the variable tuning condenser is often at a slightly different potential from the negative side of the low-tension battery and "earth," to which the panel is generally connected. This is because it is customary nowadays to bias negatively the grids of H.F. amplifying valves, and also because a bias is required for "anode bend" detectors. In such cases, when using a "one-hole fixing" condenser, it is necessary to fit an insulating bush. Where several fixing screws are required it will be easier to drill clearance holes through the panel, to the back of which a small sheet of ebonite may be screwed.

A similar precaution should be observed when fitting filament rheostats to the panel, as a consideration of any of the circuit diagrams in these pages will show that there is a probability of introducing a L.T. short-circuit unless this precaution is observed.

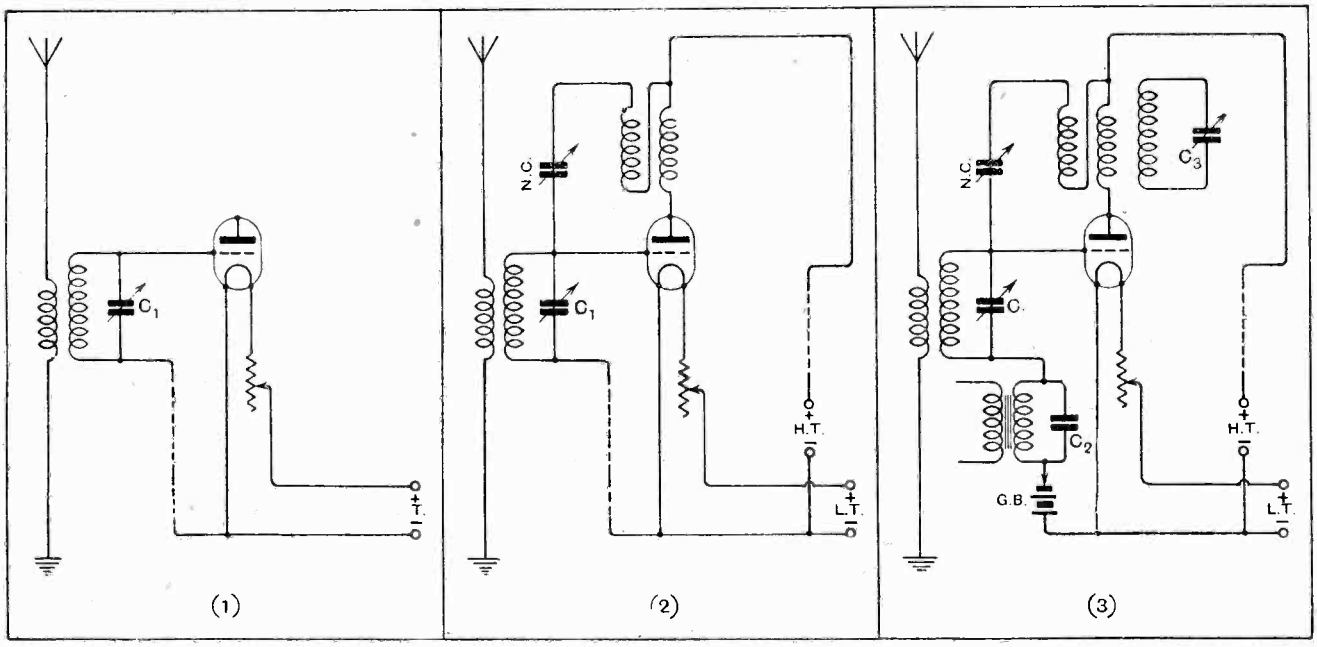
DISSECTED DIAGRAMS.

Practical Points in Design and Construction.

No. 70.—A Single-valve and Crystal Reflex.

(To be concluded in next week's issue.)

The present series of diagrams is intended to show progressively, and in an easily understandable manner, the various points to which special attention should be paid in the design of typical wireless receivers, and at the same time to assist the beginner in mastering the art of reading circuit diagrams. If components and values are carefully chosen, the single-valve reflex receiver shown below is capable of operating a loud-speaker. The data given apply to the normal broadcast waveband, on which all reflex receivers work at their best.



The tuned secondary of a conventional "untuned aerial" coupler is connected between grid and filament of a valve; the filament circuit of which is completed in the usual manner.

The plate circuit is completed through the primary of an H.F. transformer and H.T. battery. The neutralising winding is connected back to grid through a balancing condenser.

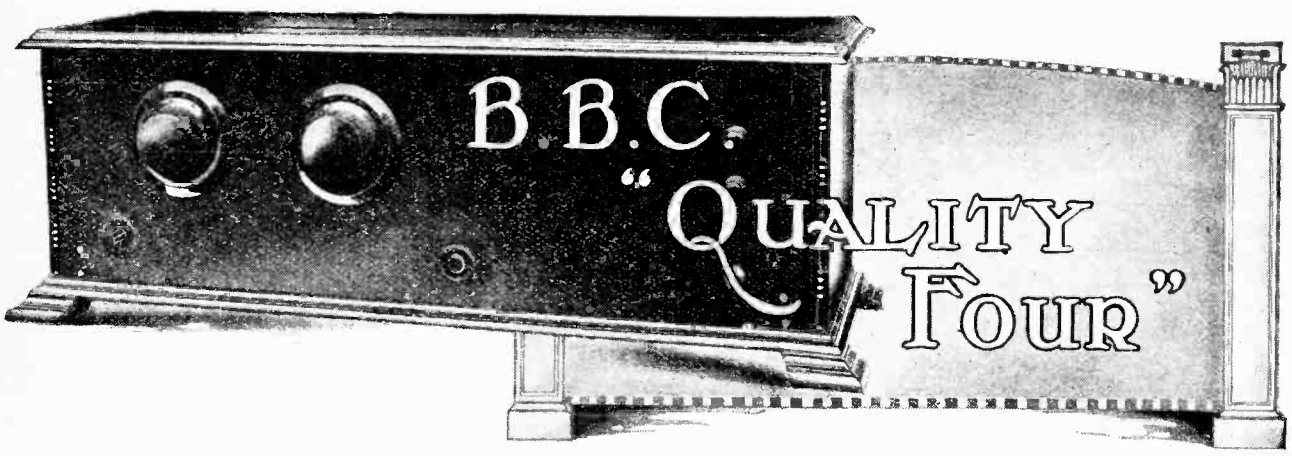
The tuned secondary is added. The secondary of an L.F. transformer, shunted by an H.F. by-pass condenser, is inserted in series with the grid circuit, with the addition of a bias battery.

THE aerial-grid transformer may be wound on a 3in. former, with a secondary of 72 turns of No. 22 D.C.C. wire. The primary, wound on spacing strips over the "filament" and of the secondary, has about 15 spaced turns of fine wire (No. 30 D.S.C. is suitable). The tuning condenser C_1 should be of 0.0003 mfd., although a capacity of 0.0005 will serve.

The production of grid currents (which result from overloading) is even more serious in a reflex receiver than in a straightforward L.F. amplifier. The valve should accordingly have an adequate voltage-handling capacity, and one of the "power" type, with an impedance of 6,000 to 8,000 ohms, is suitable.

The neutralised H.F. transformer may be modelled on the general lines of that used in the "Everyman Four" receiver, although the use of "litz" multi-stranded wire is probably not worth while in this case, due to the inevitable damping effect produced by the crystal. When using a 3in. former, the secondary has 72 turns of No. 22 D.C.C. wire. The primary and neutralising windings may have about 12 turns each of fine wire. A tuning condenser (C_3) of 0.0003 mfd. is assumed.

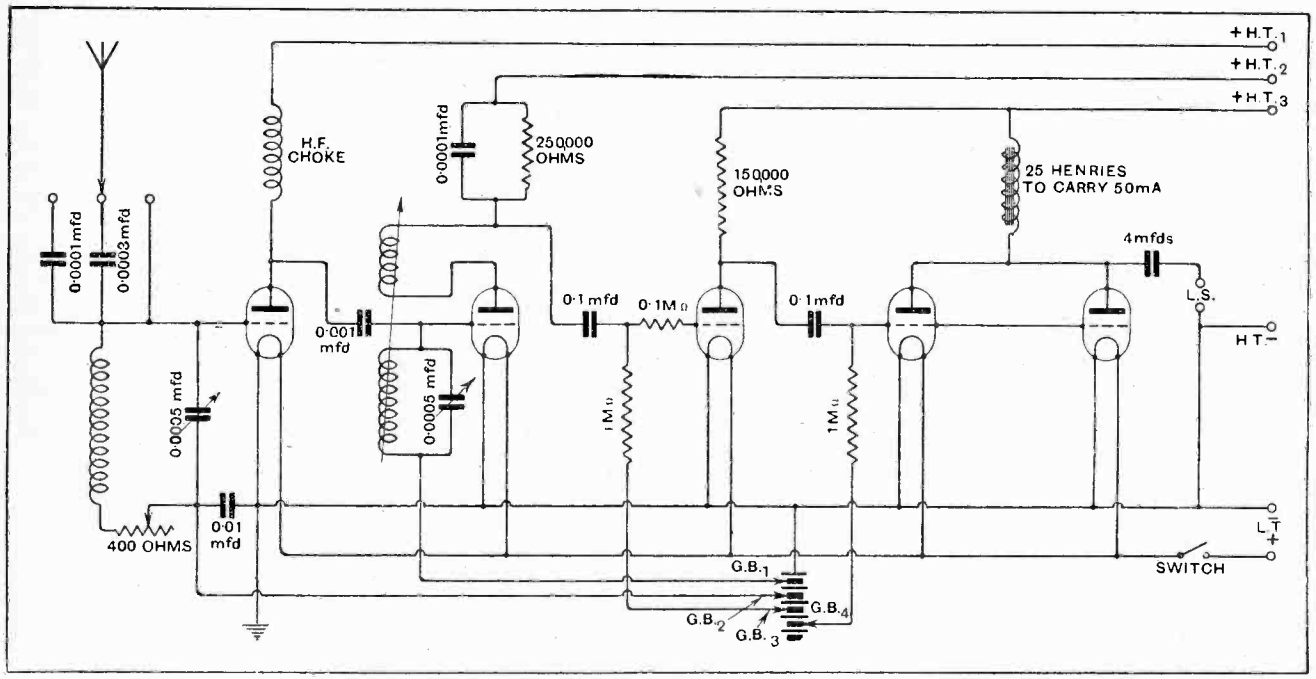
As the great majority of crystals have a comparatively low resistance under working conditions, it is possible to obtain a considerable step-up of voltage in the L.F. transformer, so an instrument having a ratio of 5 : 1 or more should be chosen. An 8 : 1 ratio is not too high when a galena crystal is used. The best value for the H.F. by-pass condenser C_2 is best ascertained by trial; the smallest possible capacity should be used here, and about 0.0001 mfd. is often large enough.



Design Suggested by B.B.C. for Good Quality Reception, with Liberal Output.

WHY it should be necessary to create so many and varied designs of broadcast receivers may be somewhat perplexing. Each, however, has its definite purpose, and, on asking for the particular application of the four-stage set exhibited by the B.B.C. at the Ideal Home Exhibition one would be told that it is essentially a local station receiver, which, with a good loud-speaker requiring, perhaps, liberal input, would give the most perfect reproduction that can be obtained under home conditions.

Reference to the circuit diagram shows a direct-coupled aerial, a tuned H.F. inter-stage coupling followed by two resistance-coupled L.F. stages. Minor points of interest are the provision of series aerial condensers to sharpen the tuning of the aerial circuit, a variable resistance to control the input to the first valve, and self-oscillation in the H.F. stage, a choke H.T. feed to the H.F. valve with tuned grid coil, and reaction coupling at the detector. Anode bend detection takes the place of the customary leaky grid condenser, while comparatively high values of anode and grid resistances are employed in the L.F. couplings. To prevent interaction between the successive L.F. stages, which might give rise to parasitic oscillation, a damping resistance is interposed in the grid leak to one of the L.F. valves. Parallel connected power valves with a choke of liberal current-carrying capacity and condenser loud-speaker feed form the output stage.



Four stage selective receiving circuit. A resistance in the tuned aerial circuit serves as a control of volume and self-oscillation.

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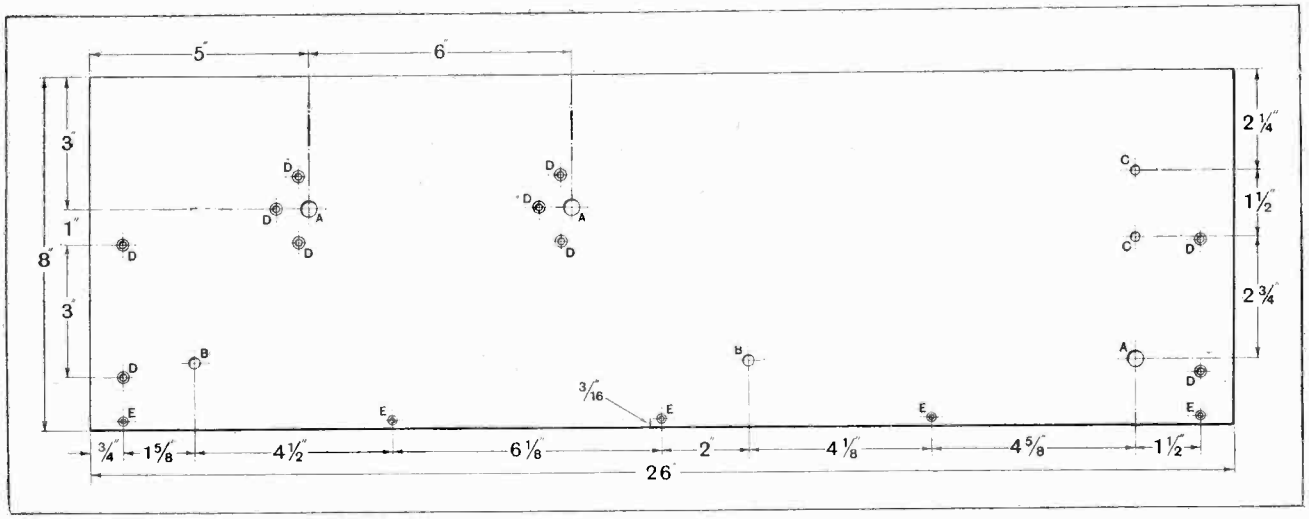
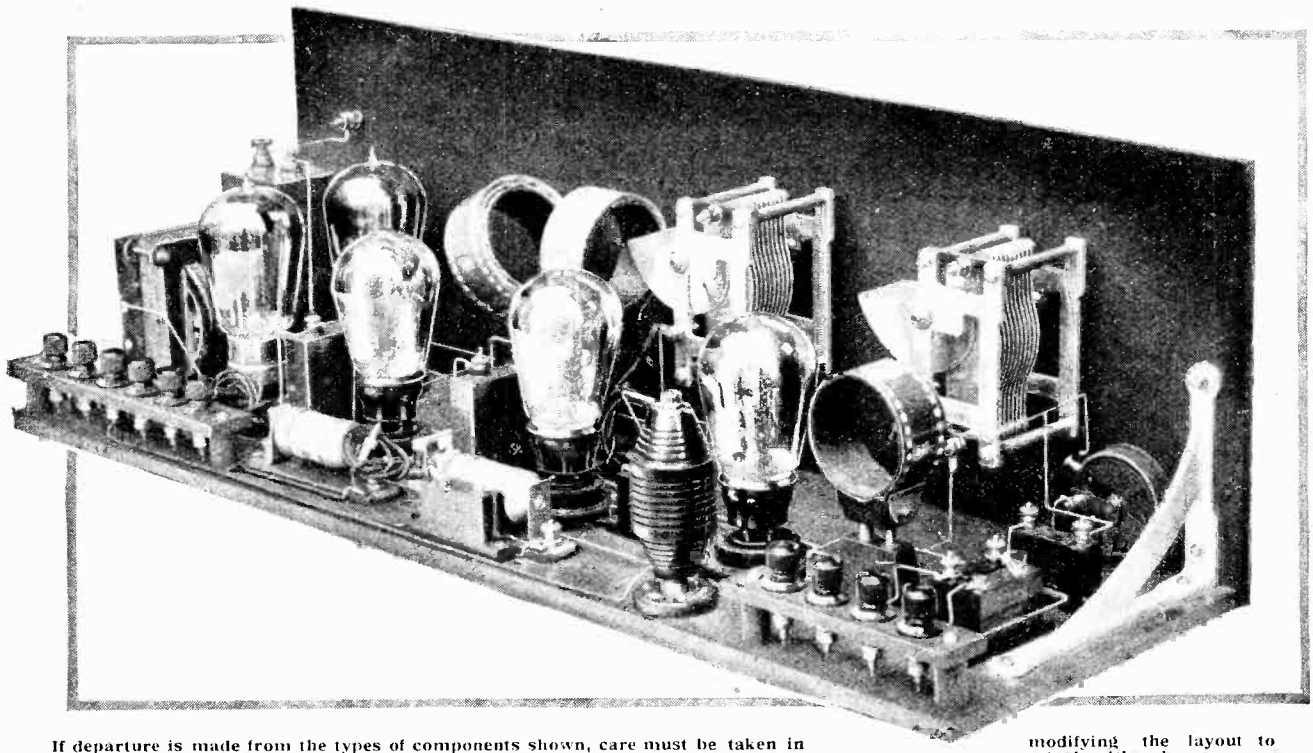


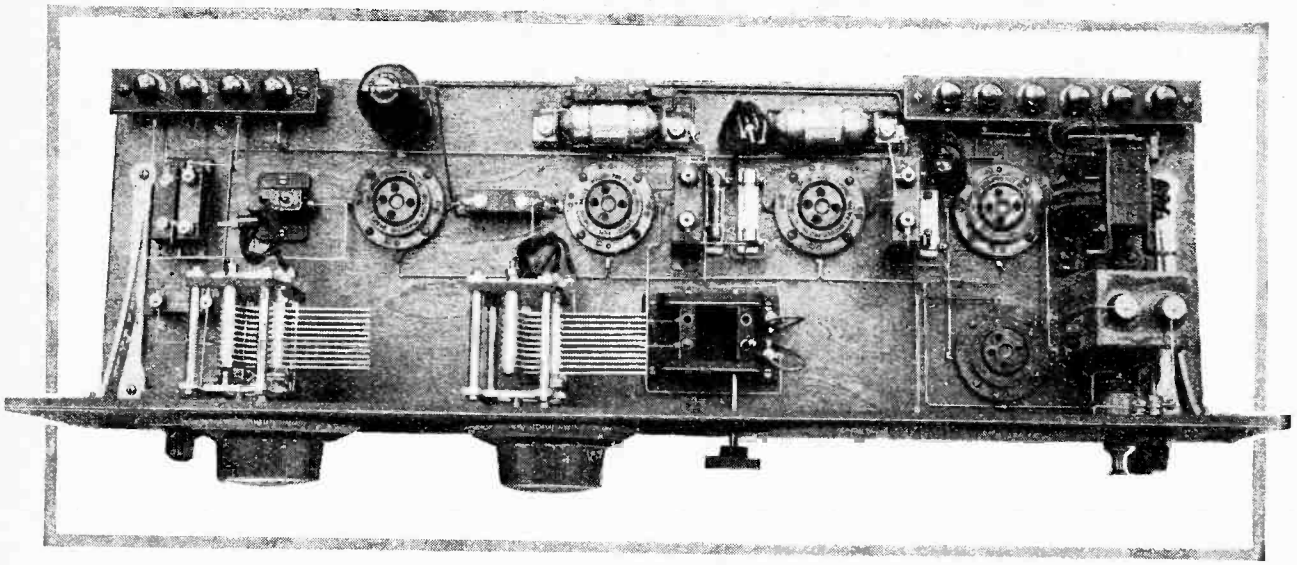
The front panel showing drilling details. Size of holes: A, 3/8 in.; B, 1/4 in.; C, 7/32 in.; D, 5/32 in. and countersunk for 4 B.A. screw; E, 1/8 in. and countersunk for No. 4 wood screws.

In the actual receiver, from which the set here described has been modelled, the tuning condensers were spaced widely apart, but in order to provide simple wiring closely following the theoretical circuit in its arrangement, it was necessary to locate both the tuning controls towards the left-hand end of the panel. Only standard components have been selected for making up the set, all of which are attached to the baseboard or panel without experiencing difficulty or trouble arising owing to positions for screws being found inaccessible.

Construction is commenced by fitting panel and baseboard to the cabinet and then securing them together with the brackets. The cabinet was supplied with a five-ply baseboard so as to obviate the fitting of cross battens, though the longer side of the brackets when screwed to the board provide additional stiffening. The terminal supports are made up from 1in. × ¼in. strip and elevated from the baseboard by means of ebonite tube or wooden spacers of sufficient length to give clearance to the terminals on the underside. Long connecting tags cut from



If departure is made from the types of components shown, care must be taken in modifying the layout to provide for the movement of the reaction coil. Connection is made to the terminals either by means of a multi wire cable or through a row of 3/8 in. holes at the back of the cabinet.



All leads are above the baseboard. This view shows the actual arrangement of the connecting wires. The H.T. and L.T. battery leads are covered by sleeving.

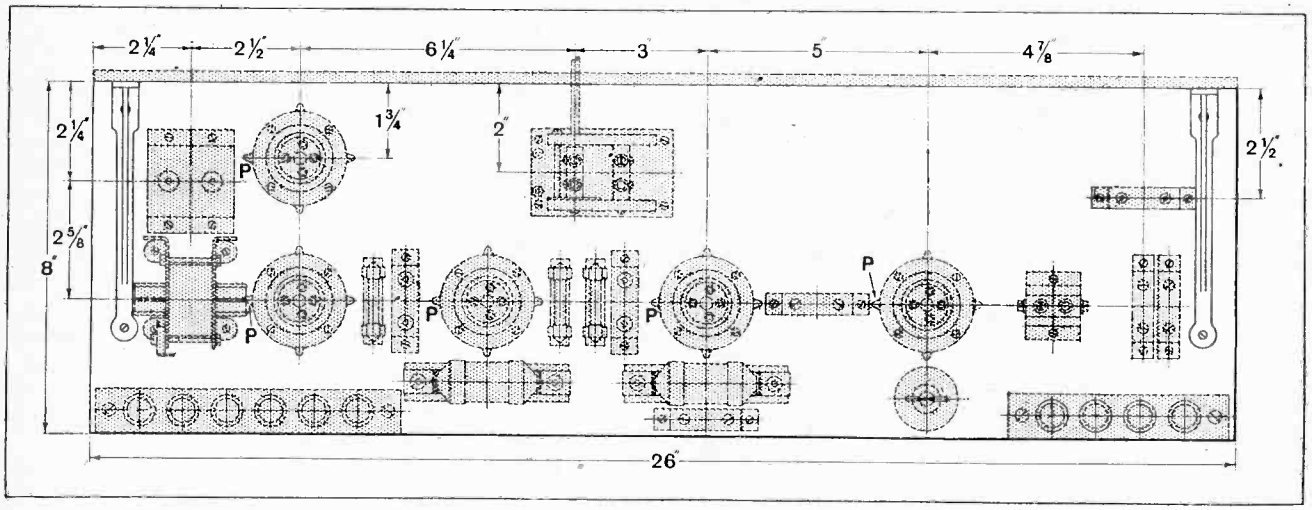
tin plate are secured to the terminals, as shown in the diagram, so as to facilitate connecting up when the terminal strips are in position.

The precise positions for some of the components is not given, but from the location of the principal parts the smaller components can be set out among them falling on the centre lines as positioned in the scale drawing showing the layout. Various round-headed screws are used for fixing the components, and blued screws give a good appearance.

As terminal connectors will facilitate making the connections to the flexible wires of the reaction coil holder, a small $\frac{1}{4}$in. ebonite base has been fitted, which, as well as carrying two small screw terminals, serves to elevate the control knob, so that it falls in line with the volume control and on and off switch, and provides an easy screw-down attachment to the baseboard. It measures 2in. × $3\frac{1}{4}$in. The hole through the front panel is, of course, very slightly larger than the spindle which operates the moving coil, so as not to serve as a bearing.

Practical Points in Wiring.

Wiring up is carried out throughout with No. 18 tinned wire straightened by stretching, and sleeving is used on all the positive H.T. and L.T. battery leads, while short pieces are slipped over any other wires where, in crossing others, there might be a danger of contact. It is worth while carefully studying the photograph of the interior of this set in regard to the arrangement of the wiring, and it will be found that the grid and plate circuit leads, excepting in the case of the connections to the reaction coil, are little more than an inch in length.



Dimensional drawing showing the layout of the components on the baseboard. Care should be taken to arrange the parts so that they fall symmetrically about the dotted lines.

COMPONENTS REQUIRED.

1 "Polar Junior" two-way coil holder (Radio Communication Co., Ltd.).
1 One-way panel coil plug, (Edison Bell, Ltd.).
5 "Lotus" valve holders (Garnett Whiteley & Co.).
1 "MH" H.F. choke (McMichael).
2 Fixed condensers, No. 620 type, 0·0001 mfd. (Dubilier).
1 Fixed condenser, No. 620 type, 0·0003 mfd (Dubilier).
1 Fixed condenser, No. 620 type, 0·001 mfd. (Dubilier).
1 Fixed condenser, No. 620 type, 0·01 mfd. (Dubilier).
1 Fixed condenser, 4 mfd. 300 v. type (T.C.C.).
2 Fixed condensers, mica 0·1 mfd.
1 Anode resistance, 150,000 ohms (Varley Magnet Co.).
1 Anode resistance, 250,000 ohms (Varley Magnet Co.)
1 32 henry choke (Pye).
2 15 volt grid bias batteries (Siemens).
2 "Ediswan" grid leaks, 1 meg. (Edison Swan Elec. Co., Ltd.).
1 "Ediswan" grid leak, 0·1 meg. (Edison Swan Elec. Co., Ltd.).
3 "Decorem" grid leak holders (A. F. Bulgin & Co., Ltd.).
12 Terminals (Igranic Electric Co.).
1 "On-and-off" switch (Igranic Elec. Co.).
2 "Cyldon" log mid-line condensers, 0·0005 mfd. (Sydney S. Bird & Sons).
1 pair "Magnum" panel brackets (Burne-Jones & Co., Ltd.).
1 Potentiometer (Lissen, Limited).
1 Ebonite panel, 26in. × 8in. × ¼in.
1 Baseboard, 26in. × 8in.
1 Cabinet, 25in. × 8in. × 8in. deep, mahogany (Caxton Wood Turnery Co.).
Wire, Sleeving, screws, 4 wander plugs and flex, etc.

Approximate cost £11 0 0

As the connections are so near the surface of the board, a small piece of blotting paper should be inserted under the joints to prevent flux or scorching marking the board when soldering. All valve-holder tags should be scraped and tinned before mounting the holders, and when making a connection the set should be tilted so that the solder flows away from the joint. Provided plenty of solder is applied to the "T" joints, there will be no need to make bends at the points of jointing, as shown in the practical wiring diagram. Access to the connections of the "on and off" switch is obtained by removing the output condenser. Connecting tags are used in every case for making contact under a screw. Where sleeving is used, it is, of course, slipped over the wire prior to bending, the exact length required being first measured off by laying it along the route to be taken by the lead.

Selection of Suitable Valves.

As the performance of any set is dependent upon the careful selection of valves, the accompanying table has been drawn up, showing the type of valve to employ in each of the stages.

	H.F.			Detector.			1st L.F.			Power.		
	2 v.	4 v.	6 v.	2 v.	4 v.	6 v.	2 v.	4 v.	6 v.	2 v.	4 v	6 v.
B.S.A.	H.125	—	—	H.125	—	—	H.125	—	—	G.125	P.425	—
B.T.H.	—	B.5H.	B.4H.	B.8	B.5H.	B.4H.	B.8	B.5H.	B.4H.	—	—	B.11
Burndept .	—	H.310	H.512	—	H.310	H.512	—	H.310	H.512	—	—	L.L.525
Cosmos	S.P.18G.	—	—	S.P.18G.	—	S.P.55B.	S.P.18G.	—	S.P.55B.	S.P.18R.R.	—	—
Cossor	210H.F.	410H.F.	610H.F.	210R.C.	410R.C.	610R.C.	210R.C.	410R.C.	610R.C.	215P.	410P.	610P.
Ediswan ..	G.P.2	G.P.4	—	R.C.2	G.P.4	—	R.C.2	G.P.4	—	—	—	—
Marconi ..	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.P.215	D.E.P.410	(D.E.5A. (L.S.5A.
Mullard ..	P.M.1H.F.	P.M.3	P.M.5X.	P.M.1A.	P.M.3	P.M.5B.	P.M.1A.	P.M.3	P.M.5B.	P.M.2	P.M.254	P.M.256
Osram	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.2H.F.	D.E.H.410	D.E.5B.	D.E.P.215	D.E.P.410	(D.E.5A. (L.S.5A.
S.T.	S.T.21	S.T.41	S.T.61B.	S.T.21A.	S.T.41A.	S.T.61A.	S.T.21A.	S.T.41A.	S.T.61A.	S.T.23	S.T.43	S.T.63

The first valve is of a type customarily styled a H.F. valve with an amplification factor of about 20, and the corresponding impedance value depending upon the type of filament.

The anode bend detector valve may be one of the special resistance coupling valves with a very high amplification factor, though it is doubtful if in this circuit any greater signal strength will be obtained, while the grid potential adjustment will be found exceedingly critical, consistent with a smooth control of self-oscillation, if it is hoped to make use of the reaction coil. For reception at distances exceeding fifty miles, when a somewhat critical adjustment of reaction may be required, it will be found better to use a high-frequency valve with an amplification factor of about 20 as the detector.

For local station reception, with a good aerial, a L.F. valve should be inserted in the third valve holder. It is advisable, however, to test the results obtainable with a H.F. valve in this stage, and if one of the special resistance-capacity coupling valves is available then the H.F. valve can be taken from the detector and used as the first L.F.

To avoid the need of purchasing an additional valve in this way, it can generally be taken that up to distances of four miles from a main station and an average aerial that a H.F. valve should be used in the detector stage, and a L.F. in the first L.F. stage. Up to distances of, perhaps, twelve miles the detector should be a special resistance coupling valve, and the first L.F. a H.F. valve. At greater distances these valves should be interchanged to permit of smooth reaction control.

Power valves are used in the output stage. The H.F. valve should be operated with about 70 volts H.T. and a grid bias of 1½ to 3 volts; 90 to 120 volts can be applied to the detector, the exact value being carefully adjusted in conjunction with 3 volts grid bias. Although quite good results can be obtained with 150 volts applied to the L.F. stages, a higher value is recommended in order to maintain good quality with liberal signal strength. Grid bias cells up to 30 volts are secured to

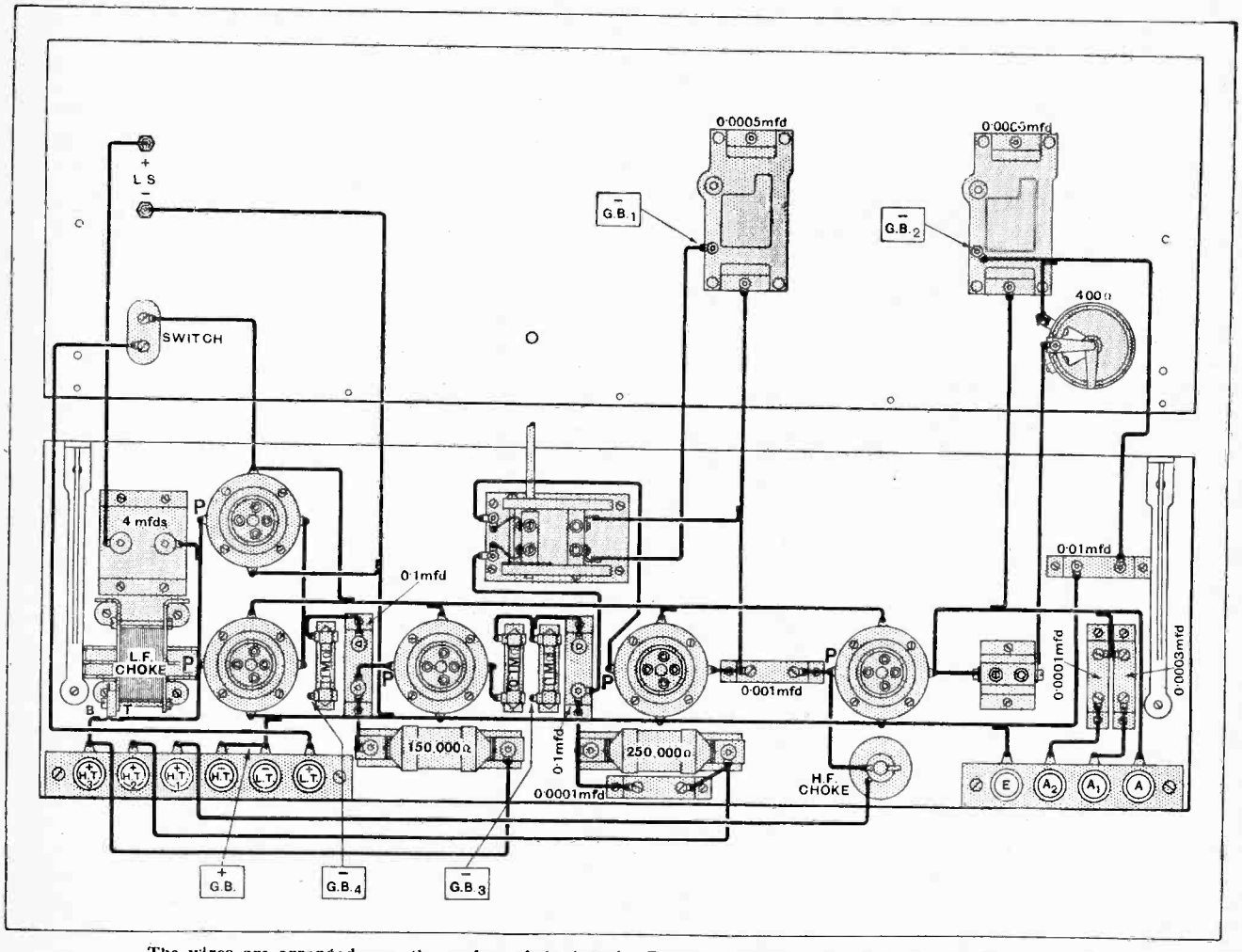
B.B.C. "Quality Four."—

the inside of the cabinet at the back by means of small metal clips.

Grid bias values must be carefully adjusted, particularly if any tendency towards the setting up of low-frequency self-oscillation is observed. When a battery eliminator is used as a source of H.T., as is suggested by the B.B.C., special care must be taken to avoid low-frequency oscillation, and many amateurs have recently experienced difficulty when using an entirely resistance-coupled set supplied with H.T. from an eliminator. Parasitic oscillation of a frequency as low as 10 cycles is quite common, which, instead of producing audible "pops," gives a periodic variation of signal strength. The effect arises from the detector stage oscillating or being on the verge of oscillation, and the heterodyne beat note in turn beating with a normally suppressed, say 100-cycle, ripple from a 50-cycle supply. Where a transformer is used in one of the L.F. stages, this effect does not occur, and it is prevented in the case of an entirely resistance-coupled set, should it arise, by readjusting the tuning condensers away from the oscillating point, increasing the value of the resistance in the tuned aerial circuit, or judiciously introducing a choke by way of the primary of a L.F. transformer in series with one of the anode resistances. Parasitic oscillation should not be overcome by increasing the value of grid bias to the point where a weakening of signal strength occurs.

Under normal conditions with an average aerial many distant stations can be tuned in at satisfactory loud-speaker strength, with a critical adjustment of reaction coupling. Although the set is moderately sensitive as a long-range receiver, the object of including the H.F. stage is not for the purpose of distant reception. This set, which can, if necessary, be adjusted to be highly selective, is intended to provide good quality reception from the nearest station anywhere throughout the country. The control provided by the damping resistance was most helpful in finding the best settings for the tuning dial.

There is a considerable demand for a not-too-costly local station set in which every endeavour has been made to give the very best quality of reprodutcion. It is doubtful if this straightforward set suggested by the B.B.C. can be bettered for fulfilling this purpose.



The wires are arranged near the surface of the board. Battery leads are covered with insulating sleeving.

CURRENT TOPICS

News of the Week—in Brief Review

TOO BAD.

An Aberdeen listener is distressed because his wireless set picks up conversations from the flat below. Evidently the talkers fail to give anything away.

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ROYAL VISIT RAISES WIRELESS SALES.

A mild boom in the Australian wireless industry is being created by the visit of the Duke and Duchess of York, due to the broadcasting of some of the official ceremonies

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AUSTRALIA HEARS THE ARCTIC

Mr. Phillips, a wireless experimenter, of Glenelg, Adelaide, has picked up for the first time in Australia a message from Captain Wilkins' expedition in Alaska, says a *Times* correspondent. The expedition station was transmitting on 42 metres.

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POLICE WIRELESS PIONEER.

The late Sir Harry Lane, Chief Constable for Lancashire since 1913, who died last week, was a pioneer in the use of wireless for the detection of crime. As a result of his efforts, the Lancashire police were among the first in the country to have a wireless patrol van.

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BROADCASTING AND THE WASHINGTON CONFERENCE.

At its meeting on April 25th at Savoy Hill, the Wireless Organisations Advisory Committee expressed its concern at the absence of a definite official pronouncement on the representation and status of broadcasting at the forthcoming International Wireless Conference in Washington.

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LECTURES ON THE VALVE.

"The Thermionic Valve and its Use in Wireless Circuits" is the title of a special course of six lectures to be given by Capt. W. H. Date, B.Sc., A.M.I.E.E., at the Polytechnic, 307-311, Regent Street, London, W.1, on Wednesday evenings, commencing May 11th.

The fee for the course is 7s. 6d. Full particulars can be obtained on application to the Electrical Engineering Dept., the Polytechnic.

BRAVO, PCJJ!

The short-wave transmissions from PCJJ, the now famous Dutch experimental station, are being heard with remarkable clarity by amateurs in India.

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SIR JOHN REITH TO VISIT U.S.

We understand that Sir John Reith has accepted an invitation from Mr. Mervin H. Aylesworth, president of the American National Broadcasting Company, to visit New York and attend the inauguration of the company's new building and studios.

TO VISIT AMERICA. A new portrait of Sir John Reith, Director-General of the B.B.C., who, we learn, will shortly proceed to New York to attend the inauguration of the new offices of the National Broadcasting Company.

The growth of the National Broadcasting Company since its foundation in November of last year has been watched with the greatest interest by broadcasting authorities in all countries. Aiming at co-ordination among the principal stations in the United States, the National Broadcasting Company has already built up an impressive chain of transmitters, and the inauguration of central offices in New York should mark the beginning of a new era in the hitherto troublous field of American broadcasting.

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BROADCASTING FOR RHODESIA.

The African Broadcasting Company is applying to the Southern Rhodesian Government for permission to erect a new relay station for the benefit of lonely settlers scattered over Rhodesia.

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TANGIER TO TELL THE WORLD.

The Moroccan Government will include 120,000 francs in their next Budget for the erection of a commercial wireless station in Tangier.

o o o o

B.B.C. PROGRAMMES IN BRAILLE.

As the result of the generous response to a recent appeal for funds, the National Institute for the Blind has completed arrangements for the publication almost immediately of *The Braille Radio Times*.

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STRANGE.

The experience of the Dorset farmer who was recently seized with an attack of "nerves" when confronting the microphone is a reminder that no similar malady appears ever to have overtaken a "pirate" when confronting the headphones.

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NO EXCUSE.

That the licence fee for his wireless set had been paid by the previous owner was the unsuccessful defence put forward by a defendant at the Bromsgrove Police Court last week.

For the prosecution it was proved that the licence had expired.

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WIRELESS AND THE PRESS.

Rates for the transmission by wireless telegraphy of Press news are regarded as too high by the Empire Press Union, according to the annual report just issued. It is stated that the newspapers are looking forward to wireless in the hope that the competition will force the hands of the cable interests.

ARE YOU GETTING ONE?

It is reported that the latest Paris creation for the seaside resorts is the sunbath costume with wireless set to match.

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HAVE YOU HEARD POSEN?

The new Polish broadcasting station at Posen gave its inaugural transmission last week. The wavelength is 270.3 metres.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 4th.

Institution of Electrical Engineers, Wireless Section. At 6 p.m. (light refreshments at 5.30). *At the Institution, Savoy Place, W.C.2. Three Papers:* (a) "The Holweck Demountable Type Valve," by Mr. C. F. Elwell; (b) "Silica Valves in Wireless Telegraphy," by Messrs. H. Morris-Airey, O.B.E., M.Sc., G. Shearing, B.Sc., and H. G. Hughes, M.Sc.; (c) "Cooled-Anode Valves, and Lives of Transmitting Valves," by Mr. W. J. Picken.

Muswell Hill and District Radio Society.—At 8 p.m. *At Tollington School, Tetherdown. Informal evening with the President* (Capt. H. J. Round, M.C., M.I.E.E.).

Tottenham Wireless Society.—At 8 p.m. *At the Institute, 10, Bruce Grove. Business meeting, followed by a discussion.*

THURSDAY, MAY 5th.

Institution of Electrical Engineers.—At 6 p.m. (light refreshments at 5.30). *Annual General Meeting (Corporate Members and Associates only).*

Golders Green and Hendon Radio Society.—At 8 p.m. *At the Club House, Willifield Way, N.W.11. Beginners' Difficulties, No. 2.—Components.*

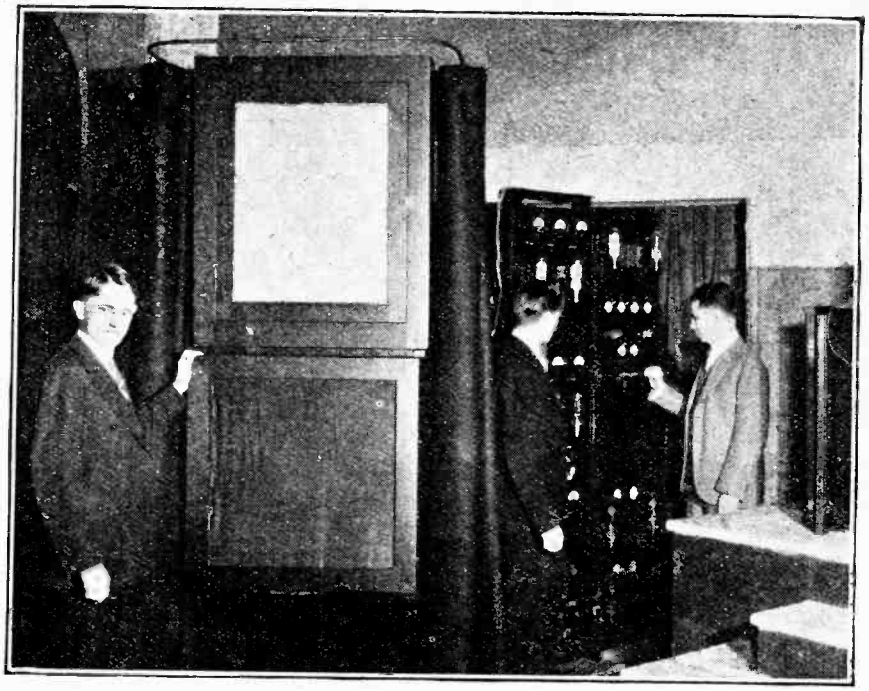
MONDAY, MAY 9th.

Croydon Wireless and Physical Society.—At 8 p.m. *At 128a, George Street. Informal evening for discussion and practical work.*

MORE LISTENERS IN NORTHERN IRELAND.

The number of receiving licences current in Northern Ireland on February 28th was 28,455, while in the Free State the figure on March 31st was 21,795.

"If the Free State Wireless Import Tax were removed," says *The Irish Radio Review*, "we have little doubt that the present grand total for all Ireland would, within twelve months or thereabouts, represent the number of active listeners in the Free State."



TELEVISION IN AMERICA. A form of television receiver now being experimented with in the Bell Telephone Laboratories, in New York, for reception from Washington by wire and from Whippany by wireless. The scene is projected on the frosted glass screen. Dr. Frank Gray, who is largely responsible for the tests, is standing on the left.

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NO WIRELESS FOR BRITISH TRAINS?

In the House of Commons last week Sir W. Mitchell-Thomson, Postmaster-General (Croydon, S.), replying to Mr. Day, said he was aware that broadcast receiving sets had been installed in long-distance trains in some countries. Experiments conducted some years ago in this country showed that it was possible to receive broadcast programmes on trains in motion, but no application had been received for a licence for the permanent installation of wireless receiving apparatus in trains.

STRAIGHT FROM THE SHOULDER.

Some rather frank advice to the U.S. Federal Radio Commission, now struggling with the American broadcasting problem, is contained in the current issue of *Radio Broadcast*, New York:—"Gentlemen of the Radio Commission, let but one voice rule you!" runs the exhortation. "The voice of the broadcast listener! Give him fair, efficient, and equitable service! Remember, not one of those who seek to broadcast has anything but a selfish purpose, however disguised, in seeking a place in the ether. Big and little, alike, have something to sell, whether it be a cause depending upon contributions for revenue or a commodity feeding its sales through goodwill."

IS TELEVISION IN SIGHT?

THERE is a good deal of misunderstanding in the public mind as to the actual progress made in television," said Mr. A. L. Rawlings, of the Admiralty Research Department, in an address before the members of the Windsor and Eton Scientific and Archæological Society. "The sounds of a whole orchestra can be reproduced by the vibration of a single telephone diaphragm, but there is very much more involved in television. To transmit an object, a person, or a scene, every separate bit must be faithfully reproduced by a single transmission."

An experiment was shown in which, by means of two valves and two mechanical relays, the current through selenium could be amplified about a million times, to light a lamp, when the selenium was illuminated. When pictures were transmitted by telegraph or wireless a scanning cell and lamp passed over photo paper moving in synchronism with another recording instrument which reproduced a picture. In ten or fifteen minutes a very good reproduction could be made. There were about 10,000 small dots in an ordinary Press portrait. The scanning cell had to travel all over the picture to take up these elements. It was considered that a face could be transmitted by 3,000 elements as a minimum. If they could transmit in this way a succession of instantaneous photographs much more quickly, we should be getting on to television. It was this rapidity of transmission that constituted the chief difficulty.

After demonstrating the transmission of one small detail, he said that, so far as he knew, they had seen in this experiment the most complete demonstration of television that had ever been made in public.

As a serious solution to television nothing we had as yet seemed of great promise. It could not be said to have reached success even in the hands of experts, and would require enormous development before it could come into practical operation. Television must be classed as one of the problems, like the nature, and cure of cancer, which, after baffling mankind for a generation, still eluded us. At the same time scientific experts were accumulating useful facts, and television might yet be realised.

Broadcast Receivers

The "DAVENSET" PORTABLE II

Dimensions,
12in. × 7¾in. × 4in.

Weight, 10 lb.

Price, 10 Guineas.

NOT many years ago the pocket wireless set enjoyed quite a vogue among journalists and writers of imaginative fiction. Topics of this nature go through a period of intensive cultivation. They become a fashion, and when this stage is reached no journalist can afford to ignore them. The subject of the moment is Television, and few papers go to press without a short paragraph commencing with an announcement of some newly discovered method and concluding with the usual prophecies. But this sort of thing cannot be kept up indefinitely, and the topic frequently has to be dropped before it is possible to publish news of actual achievement which would form a natural climax to what has gone before. When the thing is accomplished it is taken as a matter of course, for it has already become a commonplace in the imagination of the public.

Everyone will remember the portable wireless prophecies—aerials in umbrellas, receivers in top hats, etc.—but does anyone remember seeing a placard announcing the first portable set? Yet to-day the manufacture of portable sets is a most important branch of the wireless industry, and it is possible to purchase for ten guineas an instrument packed in a small attaché case which may be taken anywhere, and with which it is possible to receive even while walking along the road.

Such a set is reviewed in this article, and should prove of special interest to those lacking the transport facilities necessary for the larger and more powerful portables.

The design is based on a portable set described in these pages last summer,[1] but a low-frequency amplifier has been added to improve results.

[1] *The Wireless World*, July 21st, 1926.

Two frame aerials are wound round the inside of the case, each with a centre tapping in order that reaction may be introduced by the well-known Hartley method. A change-over switch is provided to select the wavelength range required. An aerial and earth may be used, if desired, and terminal plugs and sockets have been provided for this purpose. A small fixed condenser in series with the aerial terminal ensures that the wavelength range is not unduly raised by the addition of the aerial capacity.

The valves are of the 2-volt type, and their filaments are connected in series. They are supplied with filament current from a 4½-volt dry battery of the type used in hand inspection lamps. About 15 hours' service may be expected, and the cost of replacement is 1s. 9d. The H.T. voltage is rather low—22 volts—but the results seem to be quite satisfactory, and the saving in space and weight is considerable.

British Components.

The makers take pride in the use throughout of British components, which include an Ormond condenser with friction slow-motion control, Gambrell Neutrovernia for reaction control, Mullard P.M. valves, Tangent inter-valve transformer, Siemens headphones, Edison Bell plug and jack, Utility change-over switch, Ever-Ready batteries, Cosmos choke, and Glazite wire. The components are assembled in a rectangular framework, round the outside of which the pick-up coils are wound. The framework is sub-divided into battery and phone compartments, the latter being lined with plush. With the exception of this compartment the whole of the interior of the set is covered by a panel of Erinoid material of a pleasing blue colour, lined with gold. In this panel a slot is cut, through which the wavelength switch may be operated.

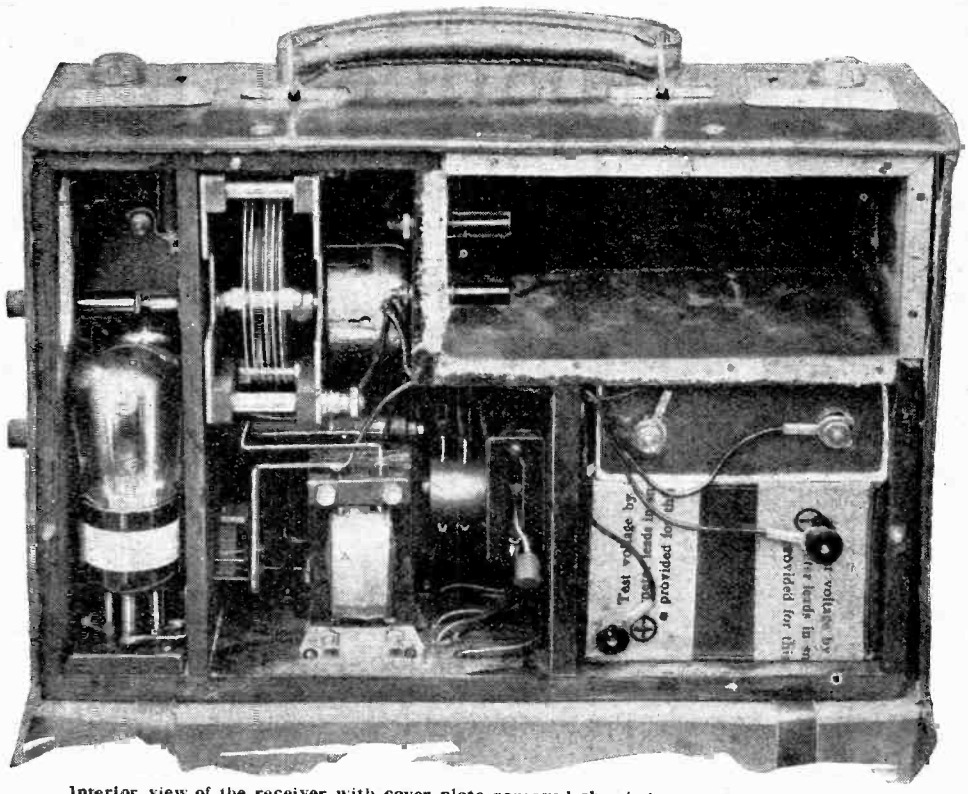
The tuning and reaction controls are ebonite rods knurled at the end, and just protrude through the side of the case. At the same end of the case below the

Broadcast Receivers.—

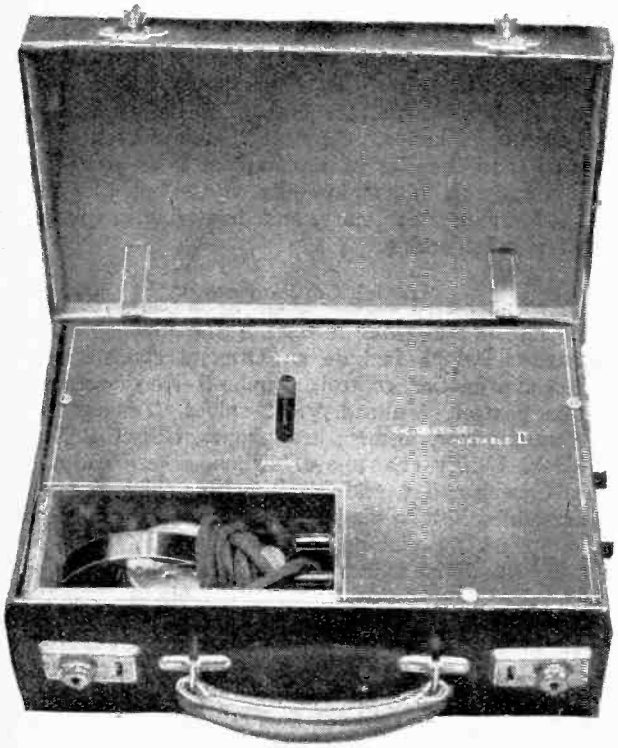
tuning controls will be seen the telephone jack. This is fitted with contacts by means of which the filament circuit is broken when the jack is removed, so that there is no possibility of the valves being left on when the set is packed up with the phones in their proper compartment.

The construction and wiring throughout bear evidence of conscientious workmanship, and the appearance and finish are excellent.

In testing the receiver it was decided to dispense entirely with external aerial and earth connections, as in our opinion the principal charm of the set is its essential portability. The absence of external wiring makes it possible to unpack, tune-in, and receive signals in 30 seconds—an important consideration when one is anxious to get the time signal and forgets all about it until the last minute.



Interior view of the receiver with cover plate removed showing separate compartments for components, batteries, and phones.



The interior appearance is in keeping with the neat exterior. The range switch is operated through the slot in the panel, while the tuning is effected by rotating the ebonite rods projecting from the right-hand side of the case.

In the London area signals from 2LO are, of course, "phones on table" strength, but Daventry (68 miles) can be received only with difficulty. On one occasion, however, the 10.30 a.m. time-signal and weather report from Daventry were urgently required, and by critically adjusting reaction it was possible to follow every word in a quiet room. Incidentally, the reaction control on the "Local" wave range is as smooth as any that has come to our notice, but on the "Daventry" range a certain amount of overlap or backlash causes instability when using critical reaction.

Ideal for Motor Cycling.

To test further the range and to demonstrate the portability of the set a solo motor cycle journey down the London-Coventry road was undertaken. The set was packed in a rucksack, as it was thought that excessive vibration on the carrier might cause damage. The weight of the set (10 lb.) was not noticed when carried in this way, and no fatigue was experienced, although the journey extended over 100 miles. The first stop was made five miles north of Barnet (2LO, 16 miles; 5XX, 52 miles). Here the transmission from the London station could be enjoyed in the open at comfortable strength with a strong wind blowing, but only the carrier wave of 5XX could be picked up. Thereafter stops were made at intervals of five miles until Dunstable was reached, where a halt was made for tea. This afforded an opportunity of testing the set indoors, and it was found that both stations were of equal strength and just sufficiently loud to be enjoyable. Outside, with a fairly

Broadcast Receivers.—

high wind blowing, a certain amount of concentration was required to follow speech. The distances at this point were: 2LO, 30 miles; 5XX, 38 miles. Pushing farther north tests were continued at regular intervals on Daventry, 2LO having been abandoned at Dunstable. At Stony Stratford (5XX, 20 miles) signals were sufficiently strong to be heard above the noise of the wind, which by this time had risen to half a gale.

Making due allowance for abnormal conditions, we would put the range of the set at 25 miles on 2LO and 30 miles on Daventry. The reader will at once notice that the two ranges are not proportional to the powers used by the two stations, but the discrepancy is easily accounted for by the size of the frame aerial, which is much smaller than the optimum size for 1,600 metres.

In passing, it should be mentioned that all tests were made in side turnings off the main road, several hundred yards from the main-route telegraph wires. Abnormal results are generally experienced on the main road itself in the immediate vicinity of the wires.

Regarding the quality of reproduction, one must not expect too much with only 22 volts H.T., but there appears to be sufficient straight on the amplifier valve characteristic to deal with signals of telephone strength. Curiously enough, better quality was obtained with strong than with weak signals.

Each set is sent out with working instructions, a test certificate, and a twelve months' guarantee. The price is £10 10s., which includes the Marconi royalty of 25s., and the set is made by Messrs. Partridge and Wilson, 217a, Loughborough Road, Leicester.

VALVES WE HAVE TESTED.

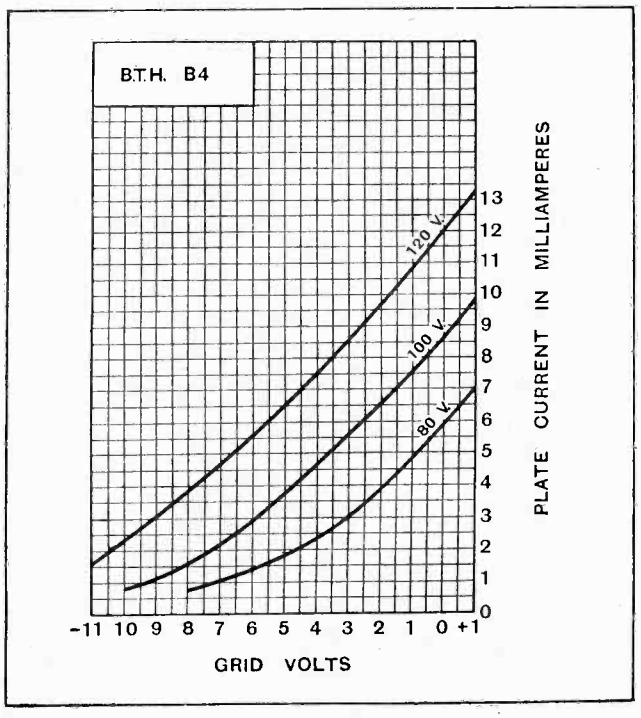
Six Valves of the B.T.H. Series.

WE have tested six valves of the B.T.H. range, manufactured by the British Thomson-Houston Co., Ltd. Two of the valves tested are of the 3-volt class with low filament current consumption, so as to be suitable for use with dry battery L.T.

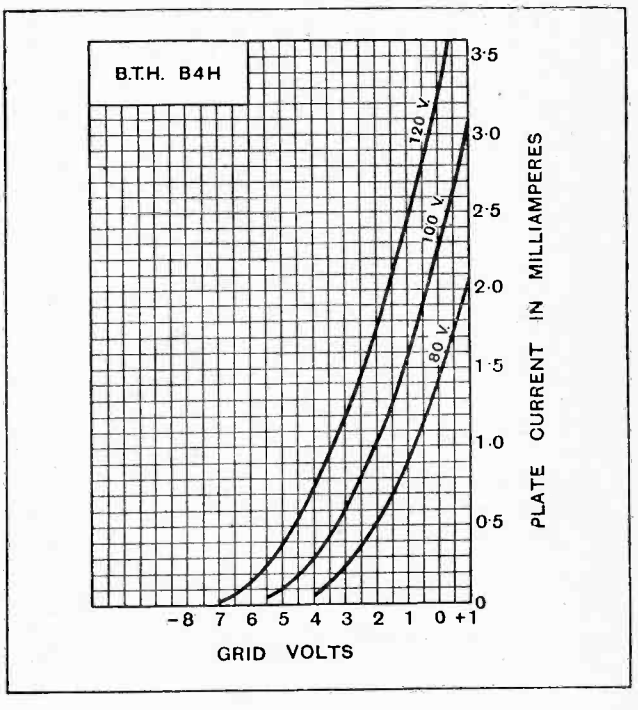
Taking the valves in order of their number, the B4 valve is in the 6-volt class, taking 0.25 ampere to heat the filament. This type of valve is quite suitable for giving good quality loud-speaker results with H.T. values of the order of 120 volts, and may be used as the last L.F. valve in the set. The measured valve constants for this valve are given below the curve.

The B4H valve has the same class of filament but a much higher amplification factor, which makes it suitable for H.F. amplification or for L.F. amplification with choke or resistance coupling. The filament current is rather on the high side for such a valve.

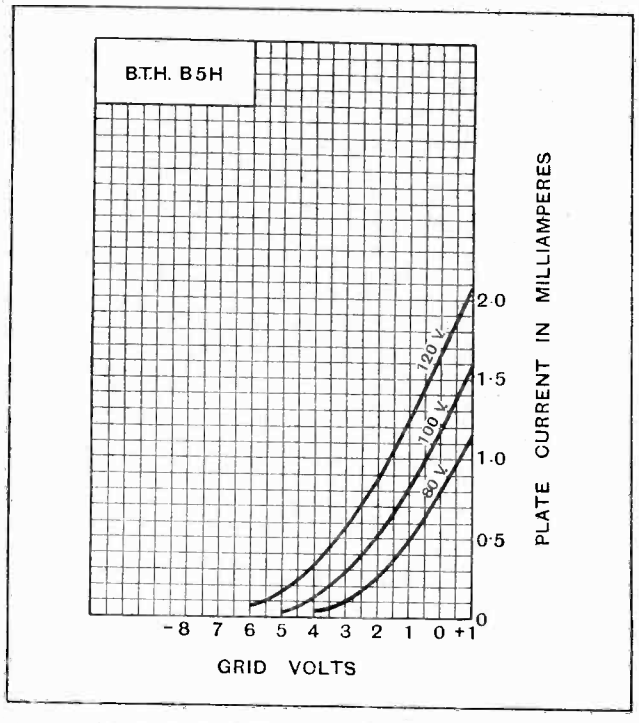
The next two valves are in the 3-volt class, the B5H



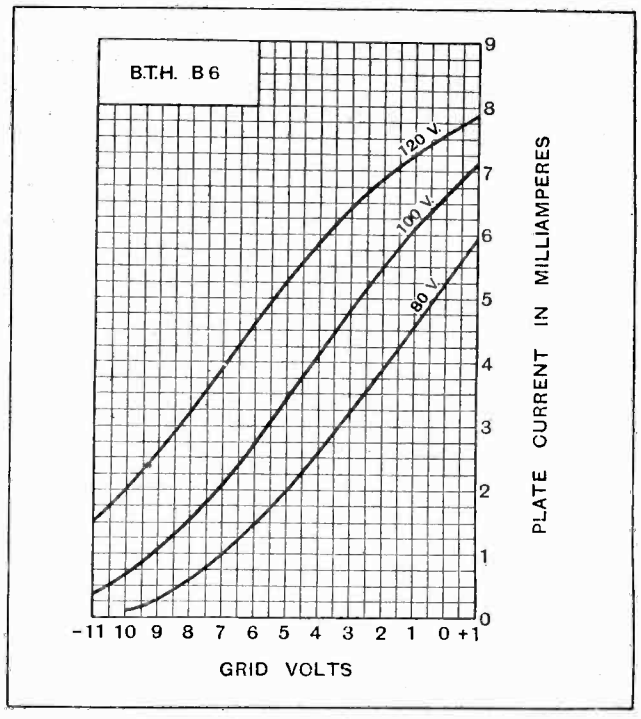
Amplification factor μ = 6.7.
A.C. resistance R_0 = 6,900 ohms.
Mutual conductance = 0.96 mA/volt.
Filament = 6 volts, 0.25 ampere.



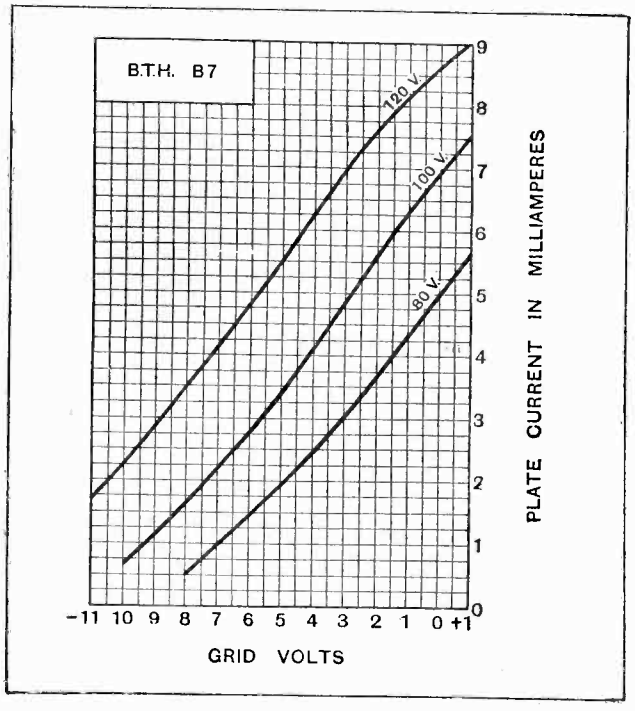
Amplification factor μ = 16.
A.C. resistance R_0 = 22,700 ohms.
Mutual conductance = 0.7 mA/volt.
Filament = 6 volts, 0.25 ampere.



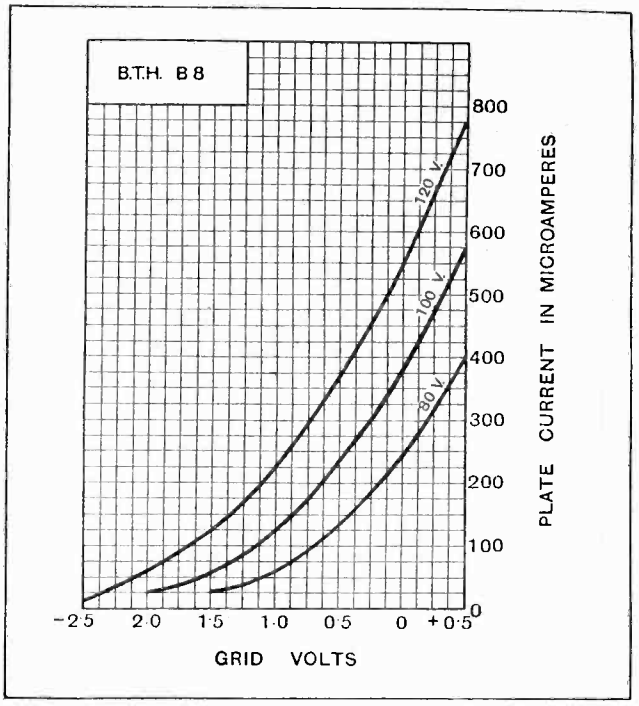
Amplification factor μ = 16.7.
A.C. resistance R_o = 45,000 ohms.
Mutual conductance = 0.36 mA/volt.
Filament = 2.8 volts, 0.06 ampere.



Amplification factor μ = 8.4.
A.C. resistance R_o = 13,300 ohms.
Mutual conductance = 0.63 mA/volt.
Filament = 2.8 volts, 0.12 ampere.



Amplification factor μ = 7.4.
A.C. resistance R_o = 11,700 ohms.
Mutual conductance = 0.63 mA/volt.
Filament = 6 volts, 0.06 ampere.



Amplification factor μ = 44.5.
A.C. resistance R_o = 170,000 ohms.
Mutual conductance = 0.38 mA/volt.
Filament = 2 volts, 0.12 ampere.

being suitable for H.F. or detector positions, and the B6 for L.F. work, although, as shown by the curves, much output must not be expected from this valve, as the H.T. value should not be too high.

The B_7 is intended for L.F. power amplification, with the advantage of having the very low filament consumption of 0.06 ampere, but, as will be seen from the curves, it is more suitable for first-stage L.F. than for power output, since it shows signs of saturation with plate potentials of over 100 volts.

The B.T.H. B4 and B5H valves and cartons.

The last valve tested is of the now fashionable resistance-capacity type, intended for use with very high plate circuit resistances.

The resistance of the B8 is taken for 80 to 100 volts on the *plate* of the valve, so that if high values of plate circuit resistance are used the H.T. voltage must be high if these figures are to be obtained.

When using about 120 volts H.T. with plate circuit resistances of 2 or 3 megohms the A.C. resistance of the valve itself will much exceed the figure of 170,000 ohms, since the voltage on the plate of the valve will be very low—this increase of resistance under these conditions, of course, applying to all valves of this class.

However, the B8 compares very favourably with other valves of similar filament voltage and amplification factor.

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.

Television.

Professor J. Denton, A.M.I.E.E., lectured to the Golders Green and Hendon Radio Society on April 21st, his subject being "The Principles and Prospects of Television." After describing the possibilities of television, Prof. Denton explained the spectrum and the relation of the light octave to the other waves in the scale, and he showed how it had been found possible to reduce the very bright light required by the television transmitter so that it was now possible to transmit in apparent darkness by utilising the lower rays.

The polarisation of light and the properties of the selenium cell revealed further steps towards the solution of the television problem, and the lecturer produced some spectacular effects with photo-electric cells and Thompson tubes. Lantern slides were shown of the apparatus of Rosing, Szczpanik, Belin, Holwick, and other experimenters. Jenkin's prismatic disc was illustrated, and the concluding slides dealt with the apparatus employed by Mr. Baird.

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Visitors.

At their last meeting members of the Golders Green and Hendon Radio Society were pleased to welcome representatives from the Hendon Traders' Association and also a number of visitors from other radio societies.

The hon. secretary of the Golders Green and Hendon Radio Society is Lt.-Col. H. A. Scarlett, D.S.O., 357a, Finchley Road, N.W.3, from whom particulars of membership can be obtained.

Measuring Instruments Compared.

"Electrical Measuring Instruments" was the title of a lecture given by Mr. E. H. Laister at the last meeting of the North Middlesex Wireless Club, held at Shaftesbury Hall, Bowes Park, N. The speaker dealt with the hot wire, chemical, moving iron and moving coil types of instrument. Mr. Laister mentioned the advantage of hot wire meters in that they can be used for direct or alternating current. Moving iron voltmeters and ammeters were cheap, but besides errors due to hysteresis and eddy currents in the iron, they suffered from the disadvantage that the deflection was not in proportion to the current. In moving coil instruments, however, none of these sources of error was present. Mr. Laister described how the permanent magnets employed are artificially "aged" so that the instruments do not alter after calibration. Many useful hints were given as to the use of measuring instruments in wireless work, and Mr. Laister has agreed to give a demonstration at an early date.

Hon. secretary: Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.

Two Valves and a Frame.

At the April meeting of the Kensington Radio Society, Mr. Hardy, of the Radi-Arc Electrical Co., Ltd., gave a paper on "What I Should Do with Two Valves." The speaker described a set suitable for a frame aerial—a two-valve reflex—the special feature of which was the H.F. transformer. This was wound so that the capacity coupling between primary and secondary was reduced to a minimum, and yet the magnetic coupling was light enough to avoid undue losses.

New members are cordially welcomed. The hon. secretary of the Society is Mr. G. T. Hoyes, 29, Upper Phillimore Place, W.8.

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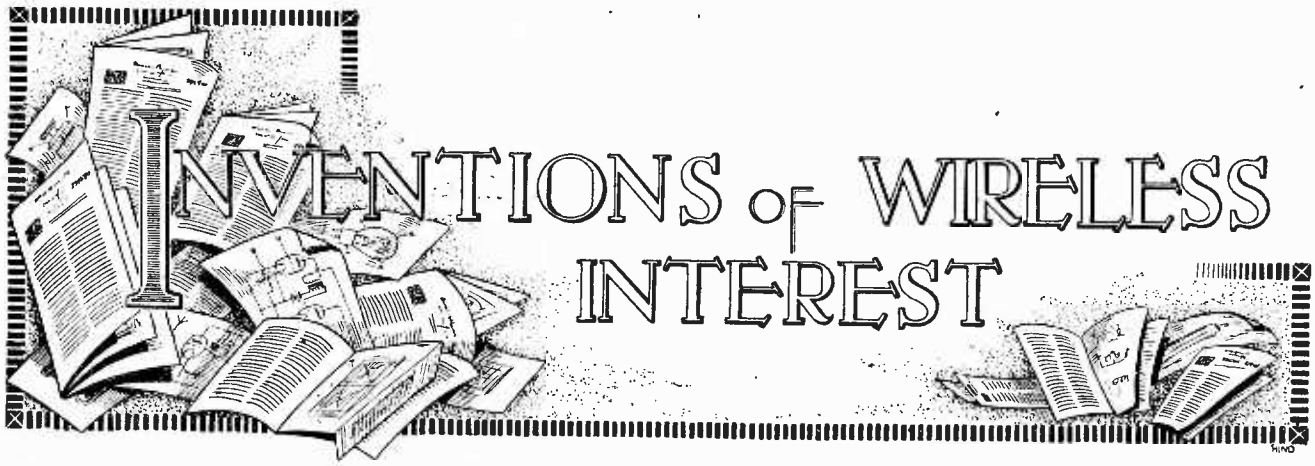
Facts About Quartz.

Mr. A. Hinderlich gave a lecture on "Quartz" at the last meeting of the Croydon Wireless and Physical Society. The lecturer referred to the care necessary in selecting specimens of quartz and the difficulties experienced in cutting. An interesting demonstration followed of crystal oscillation. Mr. Hinderlich explained that it had been found that quartz of one millimetre in thickness oscillates at a frequency which gives approximately 105 metres, and that various wavelengths could be obtained by grinding the quartz to different thicknesses. One specimen he had produced gave a wavelength of 33 metres.

Visitors are warmly welcomed at the meetings of the Society. Full particulars can be obtained from the hon. secretary, Mr. H. T. P. Gee, Staple House, 51 and 52, Chancery Lane, London, W.C.2.

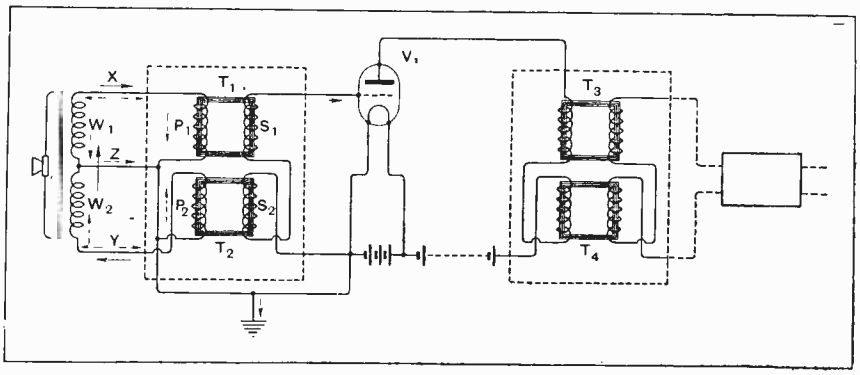


The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, Southampton Buildings, London, W.C.2, price 1s. each.

Microphone Amplifier Circuits.
(No. 266,029.)

Application date: Nov. 9th, 1925.

E. A. Graham and L. H. Paddle describe in the above British Patent Specification some microphone amplifier circuits incorporating a centre point earth system. The object of the invention, of course, is to prevent stray fields from affecting the amplifier, which may emanate from the output circuit of the amplifier, or from current carrying conductors in the vicinity. The particular arrangement shown in the illustration utilises two transformers in the input and output circuits, the two transformers being arranged so that the fields are in the same sense. A magnetophone type of microphone is illustrated, and is provided with two windings W_1 and W_2, the extremities of which are connected to the outers of the primaries of the two transformers T_1 and T_2. The secondaries S_1 and S_2 are joined and are connected between the grid and filament of the valve V_1. The centre point of the primaries and the centre point of the microphone winding are joined by a lead Z, which is then earthed and connected to the filament of the amplifier. The output circuit of the valve contains transformers T_3 and T_4 connected in series, but no centre tap is provided. It will be seen that should the leads X, Y, and Z, that is, the leads between the microphone and the input of the amplifier be cut by any stray fields, any currents induced will be balanced out in so far as secondary potentials across the two transformers T_1 and T_2 are concerned. In other words, no induced current will be amplified, and, therefore, the system will be stabilised, since the stray field from the output cannot cause any reaction effect with the input. Similarly, stray fields in conductors in the vicinity of the leads X, Y, and Z will not influence the amplifier. Microphone potentials, however, will not balance out, and will produce potentials across the secondaries of the input transformers. The specification also mentions that with long microphone leads earthed sheathed wires connected to the centre point should be used.



Microphone circuit independent of external electrical interference. (No. 266,029.)

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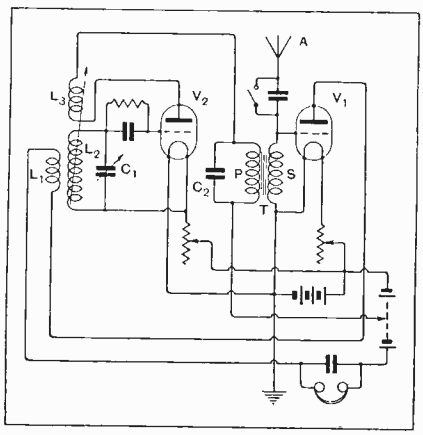
Preventing Radiation.
(No. 250,969.)

Convention date (U.S.A.): April 18th, 1925.

A circuit which tends to prevent radiation from a receiving aerial is described in the above British Patent by S. Y. White. The invention consists in connecting the aerial to the grid of a valve which acts partly as a low-frequency amplifier, and also as a means of transferring any energy received from the aerial to a detector valve. In one arrangement shown in the accompanying illustration an aerial A is connected to the grid of a valve V_2, the grid circuit of this valve containing the secondary winding S of an intervalve transformer T. Potentials communicated to the grid of this valve will cause high-frequency currents to be produced in the anode circuit of this valve, which contains an inductance L_1 coupled to a tuned



Non-radiating receiving circuit. (No. 250,969.)

circuit L_2 C_1, connected to the detector valve V_2. Reaction is obtained in this circuit from the anode circuit of the detector valve by means of a reaction coil L_3. The anode circuit of this valve also contains the primary winding P of the low-frequency transformer T, the primary winding, of course, being shunted by a condenser C_2 to by-pass any high-frequency component. Potentials transferred by the valve V_1 to the circuit L_2 C_1 will be rectified by the detector valve and low-frequency currents will be passed on by the transformer to the valve V_1, the anode circuit of which also contains the telephones T.

By Our Special Correspondent.

Making Us Laugh.—The Facts about "Daventry Junior."—The Great Event.—Birmingham's Summer Feature.—Koenigswusterhausen to Go.—The Music-hall Situation.

Community Laughing.

Not long ago I proffered a handshake to the B.B.C. for their commonsense in rejecting a proposal for "Community Laughing." The practice as fostered in America consisted of placing an ecstatic negro before the microphone and asking him to "laugh." The audience were supposed to respond until the whole American continent rocked with amusement.

Happily this is not the B.B.C. idea of a proper stimulant for "Community Laughing," and I shall not withdraw my proffered handshake, despite the fact that Savoy Hill has changed its mind and intends to have "Community Laughing" at an early date.

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The Stimuli.

Definite and tangible stimuli will be present in the studio when this unusual turn is attempted, and I understand that the equipment will include an exceptionally intelligent parrot and a number of irresistible gramophone records.

The gramophone records have already been tried on certain picked individuals who have never been known to smile at anything less than a reduction in the income tax. The results were distinctly promising.

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A Little Grand Opera.

"The Policeman's Serenade," a little grand opera from "Riverside Nights," will be broadcast on May 19th. The words are by A. P. Herbert.

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Stacy Aumonier Programme.

Mr. Stacy Aumonier, the well-known man of letters, is arranging a programme in the "My Programme" series, and his effort will be heard by listeners on May 9th.

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Caution at Daventry.

Although reports have appeared—not in *The Wireless World*—of test transmissions supposed to have been conducted already from "Daventry Junior," not a single signal has escaped the aerial.

The station is being built up slowly, the chief engineer and his staff being determined not to hurry matters. Each component is being tested separately before its inclusion in the plant, for it is realised that any serious failures during the test period may engender doubts in official quarters concerning the feasibility of the regional scheme as a whole.

If "Daventry Junior" were to prove a failure the regional scheme would undoubtedly be consigned to the limbo of things shelved.

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A Tentative Talk.

Meanwhile the long-wave experiments conducted between the parent station at Daventry in collaboration with the long-wave transmitters on the Continent have provided some valuable data and some indigestible food for thought.

Nearly thirty European stations are using the 1,000- to 4,000-metre wave-band, and several new candidates are waiting to plunge into the same congested channel.

During the present month the Bureau Internationale de Radiophonie will meet to discuss the position, but it is extremely unlikely that any new wavelength scheme will be formulated before the great event in September.

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Washington.

The great event is, of course, the Washington International Radio Conference—an event which, to the keen wireless man, has an importance exceeding that of a solar eclipse.

There has been only one international radio conference in the history of the world, and we shall be considerably older men and women before another is summoned. The first International Radio-telegraphic Convention took place in London in July, 1912, and was attended by

"WHITE MAGIC." Red Indians at the Fort Hall Reservation, Idaho, listening to Mr. Coolidge, known as the "White Father," broadcasting from the big wigwam at Washington. In Indian circles wireless is described as "the white magic."

plenipotentiaries of practically every Government. Their deliberations covered a wide field and yet, in comparison with the work facing the Powers next autumn, their task was a cheerful summer diversion.

I hear that the agenda for the Washington Conference, issued from Berne, occupies 800 typewritten pages!

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1912-1927.

Every phase of wireless endeavour will be taken in hand, investigated, turned inside out, and, quite possibly, set upon a new footing.

In 1912 the sole topic was wireless telegraphy, and the chief problems related to the organisation of land and ship stations, the collection of charges by different countries, time and meteorological signals, hours of service, and other matters of routine. In 1927 the new and uncharted realms of wireless telephony and broadcasting have to be explored.

The countless ramifications of broadcasting alone might be expected to turn many a man's hair grey, and I am not surprised that certain countries are becoming worried regarding the length of time which the conference is likely to occupy. A conservative estimate puts it at two months.

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A Conference with Power.

The Washington Conference will have an overwhelming advantage over every other form of wireless conference held in recent years. It will have legal power.

Although its recommendations have been laudably followed by a large number of countries, the Bureau Internationale de Radiophonie has no power in the legal sense of the word; indeed, unless I am very much mistaken, it has never received full recognition from any Government.

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Cricket at the Microphone.

Rev. F. H. Gillingham has agreed to broadcast a running commentary on the cricket match between Essex and New Zealand from the Essex County Club ground at Leyton on May 14th. On the previous Saturday, May 7th, Mr. P. F. Warner will give from the studio at 2LO an eye-witness account of that day's play in the Surrey v. Hampshire match at the Oval.

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A Happy Dissolution.

As a last concession, a negro convicted of murder at Sing Sing was allowed to listen to an entire programme broadcast from New York. After that the unfortunate fellow was probably very glad to die.—*Wireless Weekly*, Australia.

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Birmingham Summer Feature.

One of the regular features of the Birmingham station during the summer months will be the relays of concerts from the Pump Room and the Jephson Gardens, Leamington. It is hoped to take these every Saturday. In the afternoon the Pianoforte Trio, directed by Edna Willoughby, will be heard from the Pump Room, and in the evening concert parties and military bands from the Jephson Gardens. These should prove a most attractive addition to the programmes. The first programme from the Gardens by the "Society Six" Concert Party will be heard on May 25th.

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Koenigswusterhausen Superseded.

The German Posts and Telegraphs are erecting a new station at Zeesen, near Berlin, which will supersede the present "Deutschlandsender" of Köenigswusterhausen. The new station is the work of the well-known Telefunken Company of Berlin, and German authorities claim that it will be the most powerful European broadcasting station. They believe that it will surpass our Daventry, and also the Rhineland station of Langenberg.

The station at Zeesen will transmit on a wavelength of 1,250 metres, which is the present wavelength of Köenigswusterhausen. British listeners will await with interest the arrival of this new giant of broadcasting.

FUTURE FEATURES.

Sunday, May 8th.

LONDON.—Light Symphony Concert.
BOURNEMOUTH. — Programme of Classical Music.
CARDIFF. — Religious Service in Welsh.

Monday, May 9th.

LONDON.—Chamber Music by London Wind Quintet.
NEWCASTLE.—"The Art of Pleasing Nobody," by members of the Station Staff.
GLASGOW.—"The Monkey's Paw," in three scenes, by W. W. Jacobs.

Tuesday, May 10th.

LONDON.—"The Arcadians."
MANCHESTER. — Concert by the "Celebrity" Orchestra relayed from Hotel Majestic, St. Annes-on-the-Sea.
BELFAST.—"The House Agent," a Sketch by Gerald Grace.

Wednesday, May 11th.

LONDON.—"Down Memory Lane."
BIRMINGHAM.—"The May Queen," Cantata by Sterndale Bennett.

Thursday, May 12th.

LONDON.—Military Band Concert.
MANCHESTER.—A Massenet Concert.
NEWCASTLE.—"Five Birds in a Cage," in one act, by G. E. Jennings.

Friday, May 13th.

LONDON.—Ballet Music.
CARDIFF. — "His Rest Day." Comedy in one act played by Cotswold Players.
GLASGOW.—Choral and Orchestral Concert.
ABERDEEN.—Scottish Programme.

Saturday, May 14th.

LONDON.—B.B.C. Concert Party.
BELFAST.—"The Half Door," one-act play by F. K. Fahy.

A Famous Oratorio.

Mendelssohn's oratorio, "Elijah," will be broadcast from 2LO and other stations on May 15th. The Wireless Chorus and the Wireless Symphony Orchestra (leader, S. Kneale Kelly) will be conducted by Stanford Robinson. The soloists are Dora Labbette (soprano), Muriel Brunskill (contralto), Spencer Thomas (tenor), and Rex Palmer (baritone).

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Story of the Military Band.

The development of the military band from the earliest times will be told by Colonel J. C. Somerville in a broadcast on May 12th. Musical illustrations will be provided by the Wireless Military Band under the direction of Lieut. B. Walton O'Donnell, and some of the oldest forms of military band instruments will be used, *i.e.*, Serpent, Cornetto, Ophicleide, and Keyed Bugle. Colonel Somerville was formerly commandant at the Royal Military School of Music, Kneller Hall.

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The Music Halls.

Apropos the rumours and counter-rumours regarding the music halls and the B.B.C., I understand that the Entertainments Protection Association, of which Sir Oswald Stoll, Mr. Gulliver, and other music-hall proprietors are members, has decided to place proposals before the B.B.C. for some form of working agreement. The draft proposals will be discussed this week at a special meeting.

In the meantime it has to be remembered that the Entertainments Protection Association, Ltd., was one of the parties to the agreement entered into by the entertainment industry and the B.B.C. in 1925. One of the clauses of that agreement was that artists might be employed for ordinary broadcasting when such artists were not precluded by the conditions of any contract existing *at the time of the proposed broadcast*.

The italics are mine. To the ordinary onlooker it would appear that the terms of this agreement have not been adhered to.

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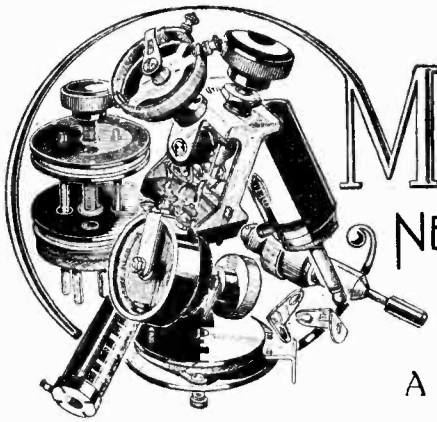
B.B.C. on Guard.

As I mentioned in these columns last week, the B.B.C. has not been directly approached by the music-hall interests, all the controversy having been conducted through the Press.

The position is being very carefully watched by the B.B.C., however, and from the attitude which is being preserved at Savoy Hill I gather that the music-hall interests will receive no hasty and extravagant concessions.

"Quite 90 per cent. of music-hall turns," said a B.B.C. official, "are useless for broadcasting purposes, and the B.B.C. is not prepared to pay large sums of listeners' money to secure an occasional claim on the services of the remaining 10 per cent."



MANUFACTURERS' NEW APPARATUS

A Review of the Latest Products of the Manufacturers.

THE LEION ELIMINATOR.

A novel feature has been introduced in the design of the new Leion battery eliminator manufactured by Productive British Grinders, Ltd., 10, Vyse Street, Birmingham. Not only is provision made for obtaining H.T. potentials from the D.C. supply mains, but a charging circuit is incorporated for the filament battery. Although it is common practice, where D.C. supply is available, to derive H.T. potentials from the public supply, there are few instruments available which provide for L.T. battery charging conveniently arranged so as to remove all trouble in regard to maintaining the L.T. battery in a working condition. As regards L.T. supply, the arrangement consists of a two-position switch, connecting with a pair of

The Leion battery eliminator, in which provision is made for L.T. battery charging.

batteries, and by means of a current-limiting lamp connected to the supply mains one battery is on charge while the other is connected through to the receiving set. On the H.T. side provision is made for two H.T. voltage outputs, both continuously variable, by means of series-connected resistances. This arrangement is rather unusual as compared with the potential dividing resistance so commonly adopted for supplying several voltage outputs. With this arrangement, in which the voltage is controlled by continuously adjustable high resistances, the potentials delivered depend, of course, on the amount of current passed in the plate circuits of the valve, but, being continuously variable, the right adjustment of H.T. potential can be readily obtained. The smoothing circuit, which comprises iron core inductances and bridging condensers, is liberal in the values of the chokes and condensers employed. The manufacturers test the eliminator under rather severe conditions, inasmuch as a 25-cycle mercury arc rectified A.C. supply is taken as a source of D.C. This instrument, therefore, should be suitable for use on practically any D.C. supply mains. The front ebonite panel measures, roughly, 6in. × 6in., and the depth of the unit is 7½in.

A lamp socket adaptor and a length of flexible cord is supplied, as well as a two-pin plug, so that in place of the charging lamp connection can be made to a lamp stand.

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A NEW CABINET.

The time has come when even the enthusiast who normally constructs receiving sets of various types according to the many circuit systems must possess at least one really first-class set. One no longer hesitates when considering the best circuit system to adopt, and several designs have been put forward which are likely to remain standard practice for some time to come. That well-finished sets are now being more generally built is indicated by the growing demand for attractive cabinets, and a wireless cabinet of interest has recently been produced by Messrs. G. G. Ambatielo and Co., Ltd., Ambatielo House, Farringdon Road, E.C.1, to house the home-constructed set and render it an attractive piece of furniture. To offer an attractive cabinet at a moderate price has been the aim, and although, perhaps, some criticism can be made as regards lightness of construction in this instance, the cabinet represents good value in view of the comparatively low price at which it is offered. Of Jacobean style, it is not only pleasing in design, and would not look out of place among high-grade furniture, but the general dimensions have been carefully considered to meet the requirements of set design. It is a two-section cabinet, the upper half accommodating the set with front doors hinged top and back, while the lower compartment is provided for the accumulators, high-tension and grid batteries, or battery eliminator. The model shown is nearly 3ft. in height and accommodates a panel approximately 8in.

An inexpensive Jacobean cabinet with accommodation suitable for housing [a multi-valve set, together with batteries or battery eliminator.

× 28in. The width of the top board is 15in., and the depth inside about 13in. This size is ample for accommodating the most elaborate of receiving apparatus, and the lower compartment will easily accommodate H.T. batteries of the large-capacity type.

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.

CERTIFICATES OF MERIT FOR COMPONENTS AND SETS.

Sir,—In the advertisement columns of all British radio periodicals are to be seen displayed advertisements of radio components which are, to say the least of it, somewhat extravagantly written.

We believe it would be highly advantageous, both to the trade and the public generally, and particularly instrumental in fostering that renewal of confidence on the part of the actual consumer of radio gear, which is so sadly needed by manufacturers to-day, if your paper, as the dominant journal of its kind in this country, and the "doyen" of British radio publications, would establish some form of "Certificate of Merit" Service

This has been done in the U.S.A., but, in that country, these certificates are given in rather an indiscriminate manner, and we suggest that certificates might be issued over here in, say, three classes and only after the most thorough examination. Products could be given "Certificates of Merit," grouped, say, as :—"Star" Class, First Class, Second Class.

It is suggested that the following might be the rough meaning of such grading :—

"Star" Class:—Products than which there is nothing superior to be found: not necessarily the *best*. Claims made by the manufacturer as regards quality of materials and workmanship, definite fulfilment of the exact purpose for which the instrument has been designed, perfection of finish, etc., must be beyond doubt. Merits judged irrespective of price.

First Class:—Price should enter into the question in this group and be considered along with the essential fulfilments suggested in the "Star" Class. Articles in this class should be deemed to be the best obtainable at the price.

Second Class:—This should include all products which are as claimed by the manufacturer: which in the judge's opinion offer excellent value for the cash demanded: products which have a reasonable good all-round performance.

Under no circumstances should certificates be granted where claims made by manufacturers are not met by a reasonably narrow permissible margin.

We are very sanguine that the introduction of such a system would considerably help to clear away confusion, and to disperse the present belief in the minds of a great percentage of purchasers of component parts and complete receivers that advertisement propaganda may easily be halved. That this impression is there and, moreover, is rapidly spreading, we have convincing proof; we also consider that in many instances such disbelief is somewhat justified, occasionally fully justified.

We are, further, equally sanguine that the introduction of such certificates would be highly beneficial to the establishment of a more healthy industry, and would ensure manufacturers being painfully aware that mere weight of advertisement would not suffice if they could not "deliver the goods." Advertisers should be permitted to place a distinguishing mark in their announcement such as, we suggest, a star (*) or the number 1 or 2 encircled.

No doubt the inauguration of such a joint service to public and manufacturers would entail expense, and we suggest that same could be met by a small fee for the preliminary laboratory testing. We would certainly support such a scheme and are eager to see same introduced.

Trusting you will find space in your valuable paper to insert this letter in your correspondence columns, together with your comments, and that you will invite the opinion of manufacturers and the public, and also the trade generally.

Liverpool. CLAUDE LYONS.

April 11th, 1927.

THE "EVERYMAN FOUR."

Sir,—I have noticed recently that several correspondents have given readers their experience of the use of various 6-volt valves in the wonderful set the "Everyman Four." As no doubt there are many who desire to use those of only 4-volt type, perhaps my experience of the new 4-volt Osram range may be of interest.

My set is to specification and I used the valves originally mentioned until a couple of days before Easter, when I tried a DEH410 as a detector. The result was excellent, so much so that I completed the change over, with the result that I get a few more stations, much greater volume, purity better than I have heard before, and, at the same time, I have reduced my current consumption by nearly half, and that at four instead of six volts.

A number of stations can be usually received during daylight, and after nightfall the volume of such stations as Birmingham, Langenberg, Hamburg, Stuttgart (to mention only one or two) is such that I am considering installing some form of further control. One evening last week at about 11.20 p.m., when all British stations were closed down except Daventry, I counted 29 stations on the speaker, no 'phones being used.

For valves one and two I use DEH410 with a voltage of about 135 and 90. A higher voltage on valve one only appears to cause noise and bring in mush. Valve three is DEL410, and four DEP410 with 150 on the plate, and G.B. of six and twelve respectively. The 15-ohm resister is left in, the other shorted.

Aerial used 60ft. long, and 30ft. to 20ft. high (running down), copper tube earth.

A friend of mine who was not impressed by the performance with the original valves is now constructing, especially as he favours 4-volt accumulators.

Before closing, I should again like to express my appreciation of the many straightforward and inexpensive circuits that you publish from time to time; circuits of the kind an amateur requires, as they do not call for special and very often expensive components that are useless afterwards.

London, N.7. F. EGERTON PARKER.

April 25th, 1927.

FLUID SAC LECLANCHÉ BATTERIES.

Sir,—It will be of interest to those contemplating the installation of a wet Leclanché battery to know that the use of earthenware jars will not give satisfactory results, due to the porosity of the material and leakage of electrolyte. Good quality glass jars are essential for satisfactory results.

Installation tests recently carried out on a number of earthenware pots show that with a difference of 60 volts between a fluid inside and outside an earthenware jar, a current of from 3 to 1,000 milliamps will pass accordingly to the quality of the glazing. They are therefore obviously unsuitable.

London, W.C.1. M. E. WATES.
April 14th, 1927. THE WET H.T. BATTERY CO.

WIRELESS IN WESTERN AUSTRALIA.

Sir,—I must congratulate you on the excellent articles which appear from time to time in your journal, of which I am a regular reader.

A few lines about broadcasting out here may be of interest to your readers.

We have only one broadcast station in Western Australia at the present time and it operates on a wavelength of 1,250 metres. This is somewhat unsatisfactory, as neither English nor American sets will work to the best advantage on the local station. However, we manage fairly well on locally made sets. Our nearest station, barring the local, is Adelaide, 1,500 miles away, so one has to go some distance for a change of programme.

I saw a lot of letters in your paper *re* amateur transmitters being so plentiful that they were interfering with broadcast reception—well, what about sending a few of them out this way?

And say, when are the Englishmen going to broadcast on the short waves? We get some fine music from 2XAF on 32.79 metres, when they relay WGY's programme. The speech and music are very good on two valves, and a loud-speaker can be used on a detector and 2 L.F. most times when they are on. I have also heard some very nice music from PGJJ in Holland, but the only telephony I have heard from England was from G2NM, Gerald Marcuse, who was testing with some place in India when I listened at 4 a.m. one morning. We should like to hear the Westminster chimes, St. Paul's, etc., when the B.B.C. or controlling officials find out that short waves will get to Australia.

I consider myself that the idea of 1,500 metres was on the wrong track for the broadcast of high-power telephony, but of course I do not live in England and cannot even guess the conditions there.

Best wishes to the gang over there.

Subiaco, Western Australia. HENRY T. SIMMONS. (Radio A6KX).

INSUFFICIENT H.T.

Sir,—I was rather pleased to read Mr. P. K. Turner's remarks in the valve issue of *The Wireless World* (April 6th, 1927) on the evil of insufficient H.T.

His estimate of the number of culprits is certainly very modest. The distortion brought about by this practice is very noticeable on cone loud-speakers, and in many cases is responsible for the belief that cone speakers cannot handle power. At the same time, I admit that some cone speakers have this fault. I have often heard it remarked that cone speakers have a booming sound. While I cannot claim to have tested all makes of cone loud-speakers, I can say that in every case of this kind I have investigated the fault has been incorrect biassing of the grids or unsuitable H.T.

The reason that distortion through these courses is more noticeable on a good cone speaker than on a speaker of the short horn variety is, I suppose, fairly obvious.

I certainly think that to avoid the possibility of *noticeable distortion* by making a cone of very stiff material is a retrograde step, and in any case it only brings us back to reproduction comparable to that of the short horn speakers.

The above remark applies only to a stiff diaphragm clamped rigidly at its outer edge (such as a double cone), unless, of course, it is of abnormal size.

Finally, if anyone doubts the amount of distortion possible through a badly operated amplifier let him use a "coil drive free edge cone" and juggle about with the operating amplifier.

Ilford. R. CUSTERSON.
April 21st, 1927.

Calls Heard.

Extracts from Readers' Logs.

Belfast.

Austria :—Ö GP. Czecho-Slovakia :—CS 2UN, 2YD, OK1. Tripoli :—DA 1CW. Porto Rico :—PR 4SA. Färoe Islands :—D 7JO. Madeira :—P 3FZ. Portugal :—P 1AE, 1AK, 1AF. Chile :—CH 2AS. Argentine :—R BA1. Panama Canal Zone :—CZ1. Spain :—EAR 6, 19, 24, 26, 41, EAC A5, Revista Radio Sport. Egypt :—SUC. Italy :—I 1AU. 1ER, 1BD, 1UVZ. Germany :—K I2, W3, W9, 4ABG, 4UAI, 4VO, 4YA, 4YAB, 4YAE. Poland :—TPAI, TPAV. Sweden :—SMT, SMXV, SMVG, SMWU. Portable :—GX 6MU, XU 2RV. Miscellaneous :—OCNG, OCNY, PCMM, SP1, SGC, SGL, FL, BAR.

Leslie Marshall ((2BNR).

On 45 metres.

Bangor, Northern Ireland.

(February 3rd to March 6th.)

Great Britain :—G 2AG, 2AY, 2GY, 2VR, 2XY, 2WJ, 5AD, 5BY, 5DC*, 5NK, 5MQ, 5YM, 5QV, 5UP, 5UW*, 6DR*, 6UZ*, 6LR, 6UG, 6JS, 6IA, 6JS, 2SR. Northern Ireland :—GI 2IT, 5WD, 5MO, 5NJ*, 5ZY*, 6JA, 6AI, 6MU*, 6WG, 6YW. Irish Free State :—GW 11B, 14B, 18B, 3NZ. France :—EF 8JJ, 8BO, 8UD, 8KU, 8WI, 8GER, 8KM, 8FO, 8KP, 8WD, 8RG, 8XE, 8RLD, 8CD, 8XU, 8XUV. Italy :—EI 1A3, 1CE, 1CN, 1CY, 1DR, 1AY, 1GW, 1UU. Belgium :—EB V33, N33, Z33, 4QQ, W1, 4CO, 4CB, 4WW, 6K, 4AI, 4ZZ, 4YZ. Holland :—EN, 0PM, 0FK, 0ST, PCMM, PCRR. Spain :—EE AR18, AR28, AR42, AR44, ARA. Austria :—EA JZ, AK, GP. Germany :—EK 4ABF, 4UA, 4GD. U.S.A. :—NU 1BZO, 1DIO, 1ANQ, 1RD, 1BHM, 1AUR, 2AGN, 2AGO, 2CVJ, 2RS, 2PS, 2BAA, 2BGI, 2CNS, 2AFF, 2UO, 2AZK, 2UM, 2VM, 2BM, 2BK, 2AGS, 2AKV, 3FD, 3BN, 3BH, 3TR, 4LA, 4OVU, 4TU, 7EB, 7BCQ, 8BH, 8AFQ, WIZ, KDKA, 2XD, 2XAF. Miscellaneous :—D 7BJ, EP IAE, IAW, EL IT1B, NM 1AYS, SD 2AR, X 4GJL, FE 1BM, ET 8BR, PAI, EJ 7WW, ES 1UU, SMST, SMSH, IRCL, LA 1R, O 1YD, NC 1AD, FM 8AY. * Indicates telephony.

(0-v-1 Reinartz.)

C. B. Cleeland (2AXO).

Birmingham.

Canada :—C 1AC, 1AM, 1AR, 1CQ, 1DQ, 2BC, 2BE, 2DO, 2HV, 2ZC, 3KP. U.S.A. :—U 5AMT, 5FR, 6DN, 7EK, 7VH, 7WU. Mexico :—M 1N, 9A. Panama :—CZ 1LA, 68X. Cuba :—Q 8KP Porto Rico :—PR 4JA, 4SA. Argentine :—R AF1, CB8, DB2, DX8, DZ9, HA2, HB5, NA2. Chile :—CH 2AB, 2AS, 2BL, 2LD. Uruguay :—Y 1BP, 1BU, 1CD, 1CG, 2AK, 2AP. Brazil :—BZ 1AA, 1AC, 1AD, 1AF, 1AI, 1AJ, 1AK, 1AM, 1AN, 1AO, 1AP, 1AQ, 1AR, 1AU, 1AV, 1AW, 1AX, 1AY, 1BD, 1BG, 1BH, 1BI, 1BK, 1BL, 1BR, 1IB, 1IC, 1IV, 1QA, 2AB, 2AF, 2AG, 2AJ, 2AK, 2AL, 2AM, 2AR, 2AS, 2ID, 5AA, 5AB, 5AD, 6QA, 6QB, SNF, SPM, SQI, SQ4, SQIX, RG. Australia :—A 2BK, 2IJ, 2TM, 2YI, 7CW, 7HL. New Zealand :—Z 2AC, 2AE, 2NA, 3AI, 3AK, 3AR, 3XB, 4AA, 4AC, 4AM. Philippine Islands :—PI 1AU, 1BD, 1HR Straits Settlements :—SS 2SE, 8MAX. South Africa :—O A3B, A4L, A4Z, A5X, A6N. Miscellaneous :—G XAN, M 1DH, KEL, DNSC, IC AG1, KC Z4, TL 1Z, LIT 1B, CB F2, KTC, La 1CW, TJ CRJ, J 3XP, BXY, FI 1ACG, JM 2PZ, WXP, VOQ.

(0-v-1) Lawrence L. Parry

READERS' PROBLEMS ANSWERED

"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each separate question must be accompanied by a stamped addressed envelope for postal reply.

A Minor Trouble.

I am building the "Wireless World Five," but find difficulty in obtaining the special "Can't-Cross" connectors which you use for battery connection, my local dealer being unable to supply them. Can you inform me where I can obtain these? K. L. R.

We advise you in the circumstances to apply direct to the manufacturers of this device: Messrs J. and W. Barton, 22a, Virginia Street, Southport, Lancs.

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Eliminating Interference from Tramways.

I have lately moved to a new locality, and find that I am greatly troubled by noises caused by the electric tramway system, which runs in proximity to my house. Can you suggest any method of curing this trouble? M. D. G.

Usually it will be found that the best method of all is to use an efficient counterpoise consisting of an arrangement of wires carefully insulated and run a few feet from the ground parallel to the aerial, and, if possible, slightly longer. But each case must be judged on its merits, and many cases can be cured without such an arrangement, whilst at the same time we realise that it is comparatively seldom that space permits of such a counterpoise being erected. In general, one should avoid reflex circuits in cases like this, and should earth the cores of the L.F. transformers, or earth their shrouds if they are of the enclosed type. It is often recommended that a large fixed condenser be used in the earth lead, and also that the aerial should be stretched at right angles to (or at any rate at as great an angle as possible up to 90°) the tramway lines, but this again is not always possible under the circumstances. One of the most successful methods of curing the trouble in cases of those readers who from one cause or another are not able to use a normal counterpoise, is to use a rough counterpoise consisting of 30ft. or so of rubber-covered wire attached to the earth terminal of the set and led away anywhere, such as round the skirting board of the room, the far end of course being "free," and not connected to anything. Experiments should be made with regard to the length of wire, and its position; it may be run under the carpet if desired. When this method effects a cure, one may usually infer that the trouble was caused by earth currents. It is within our experience that a particularly flagrant case of tramway interference was completely cured in this manner.

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Receiving Long-distance Stations Satisfactorily.

I have a 4-valve receiver consisting of an H.F., detector, and two resistance-coupled L.F. stages. I find that this gives me excellent loud-speaker results on even quite distant stations. Some of the exceptionally distant stations which I receive, however, give me quite satisfactory results, but, presumably, owing to the fact that both stages are resistance-coupled, volume is not quite adequate, and I should like, if possible to use a good transformer in the last L.F. stage instead of a resistance-coupled stage. I enclose a rough sketch of this portion of my receiver, which I wish to alter, and shall be glad if you will explain the best method of procedure. S. M.

We reproduce in Fig. 1 (a) the sketch which you send us, whilst in Fig. 1 (b) we show the alterations which you desire to make. You will notice that the transformer primary merely takes the place of the grid leak, whilst at the same time the small coupling condenser between plate of third valve and grid of final valve is eliminated. You should not use a cheap transformer, but obtain one of low ratio, which in the case of a reputable firm will mean that the primary inductance is fairly high.

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Series or Parallel?

I have recently purchased a loud-speaker of foreign manufacture, which I find is of 1,000 ohms resistance. I wish to run this together with my existing loud-speaker which is of 2,000 ohms. Should I connect the instruments in parallel or series? I wish to be able to control the volume of each loud-speaker individually. L. D. W.

Under the circumstances, you are advised to connect the two instruments in series. You could then, of course, shunt each loud-speaker with a modern type of volume control such as the "Pye" obtainable from Messrs. W. G. Pye, Ltd., Granta Works, Montague Road, Cambridge, or any other similar instrument by other makers. This would then enable you to control the volume of each loud-speaker individually. We would point out that the arrangement we have given holds good irrespective of whether the loud-speakers are connected directly in the plate circuit of the last valve, or whether a choke filter output circuit is used.

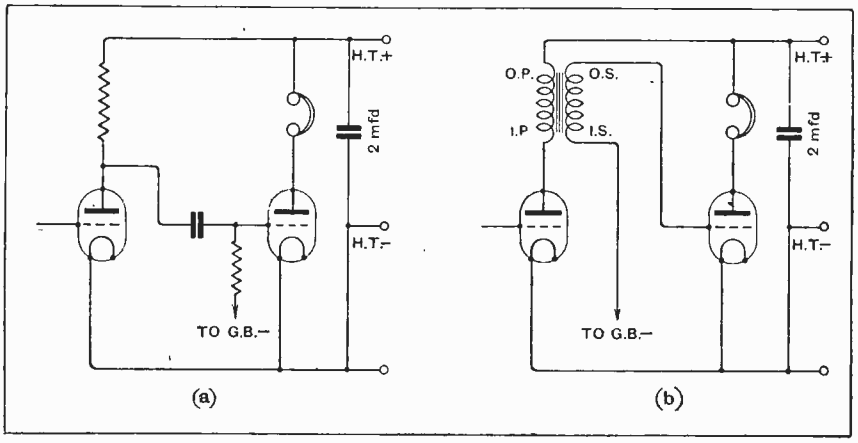

Fig. 1.—Circuit alterations for changing from resistance to transformer coupling.

Is a Separate H.T. Switch Necessary?

I have a plain "On and Off" switch which breaks one lead of my L.T. battery when desiring to switch off the receiver after a period of listening. Can you tell me whether it is advisable for me to use a similar switch for switching off the H.T. battery? In other words, is the H.T. battery wasting away during the periods when the valves are switched off? R. L. S.

No, there is no need to incorporate this extra switch, because when you turn off your valve filaments the valve emission ceases, and the H.T. battery then is definitely on "open circuit," or, in other words, it is "off," there being no complete circuit joining any of the H.T.+ terminals to H.T.−. If, however, you have valve holders of very poor insulating qualities, then there will be a continuous current flowing from the H.T. battery through the faulty valve holder, or, again, if the insulation of your terminal strip is poor, there will be a current flowing between H.T.+ and H.T.− across the leaky ebonite. In any case, however, the current would be small, and if the insulation of these components were so bad that any leakage did take place, then you are not getting anywhere near the best results out of your receiver. The remedy, therefore, would seem to be not to purchase a separate switch, but to purchase new valve holders, etc., of reliable insulating properties if necessary. You should not, however, switch off and then proceed to "juggle" with the valves or wiring in the set, as you must remember that you might, in the course of your experimenting, accidentally short-circuit the H.T. battery inside the set, or do some other damage. Even this does not, however, call for a switch, because on the comparatively rare occasions which you will wish to alter any of the wiring of the set you will naturally disconnect the H.T. battery.

o o o o

"R_8" or "Phones on the Table."

When searching for distant stations I often find that I receive a large number with varied strength. I understand that there is an official scale of signal strength by which one is able to record in a log book the strength of a signal received. If this is so I shall be glad if you will give me full particulars. W. H. M.

The scale of signal strength measurement to which you are referring is probably the "R" scale, and we reproduce the scale herewith for your benefit.

R_1 = Signals unreadable.
R_2 = Signals readable with difficulty.
R_3 = Weak but readable.
R_4 = Readable.
R_5 = Easily readable.
R_6 = Fairly strong.
R_7 = Strong.
R_8 = Very strong
R_9 = Loud-speaker strength.

It will be noticed that R_1 indicates that signals are unreadable. This should, of course, be interpreted as meaning that the signals received, whether they be Morse code signals or telephonic speech, can be faintly heard in the headphones, but too faintly for more than a letter or two or the Morse code to be distinguished, with perhaps a word or two of speech. R_2 indicates that one can, in the case of either Morse code signals or telephony, receive several words, and probably enough to indicate by the context the meaning of the message. The meaning of the other symbols is absolutely straightforward. We would point out that several interpretations of the various "R" symbols have appeared from time to time, but the one which we reproduce is the generally accepted scale. Possibly R_9 would be the signal strength often referred to by amateurs as "phones on the table" strength.

o o o o

A Long-distance Headphone Receiver.

I have built a receiver for long-distance headphone work consisting of the "Everyman Four" set minus the two L.F. stages, my phones being connected in the plate circuit of the detector valve instead of the anode resistance, but results are very poor indeed. Can you tell me where I have gone wrong? P. R. O.

It is quite impossible for you to get good results from the arrangement you mention for a number of reasons. In the first place, the valve is of much too high an impedance to utilise anything but a very high resistance in its anode circuit, and in any other manner scarcely any worth while results will be obtainable. It is of little use connecting an anode resistance of high value in series with the telephones, because then, apart from other things, the volts dropped across the telephones would be a very small percentage of the total voltage drop across the whole impedance in the anode circuit. The only way to solve the problem is to add another L.F. stage in accordance with the diagram which we give in Fig. 2. If you will follow our advice and make this alteration you will then find that you have a very efficient long-distance headphone receiver.

o o o o

A Sulphurous Question.

I intend building a multi-valve receiver in a large cabinet, and wish to know if any harm would be done in including my H.T. and L.T. accumulators in the same cabinet as the receiver. T. F. C.

You should definitely *not* include these batteries in the same compartment as the wiring of the receiver, or trouble will very speedily arise. We presume from your question, however, that you intend building a very large type of cabinet containing a separate compartment for the batteries. This, of course, will be quite in order. It is advisable, however, to paint the inside of the compartment with anti-sulphuric paint and to provide vents for the escape of gas given off by the batteries.

o o o o

Volume Control.

I notice that in your description of the "Neutralised Tuned Anode" receiver, published in your October 20th issue last year, you refer to the fact that the volume control used is similar to that made use of in the four-valve receiver published in your July 28th, 1926, issue under the title of "Everymon-Four." Can you tell me what exactly was this method of volume control? D. F. B.

The method of volume control used was a perfectly simple one, namely, the control of the H.F. filament temperature by means of a rheostat, dimming the filament causing, of course, a great increase of valve impedance, and, therefore, a loss of volume. In no circumstances, however, should this method of volume control be used in conjunction with an L.F. valve, or great distortion will naturally result.

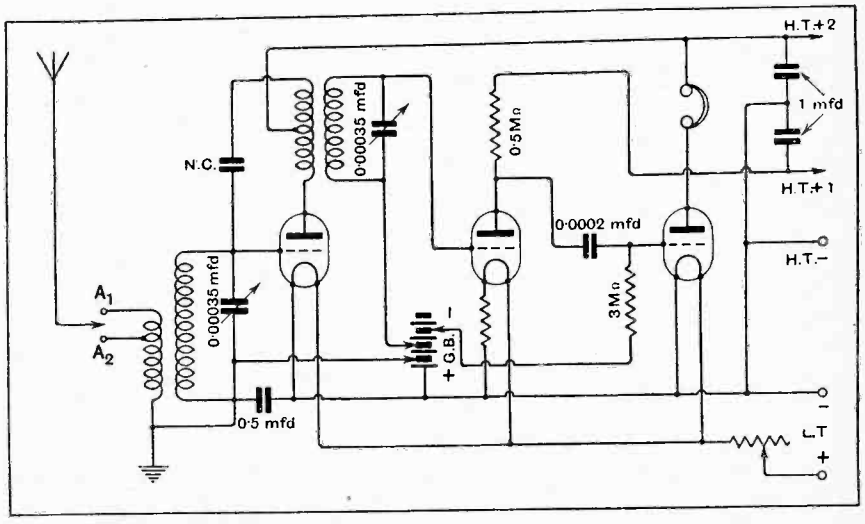

Fig 2.—The "Everyman Four" modified for headphone reception.

Using Four-volt Valves.

I am building the "Everyman Four" receiver, and am intending to use 4-volt valves throughout. Are there any alterations that it is necessary for me to make to the receiver for this?

W. L. S.

We would refer you to the reply given to A. L. C. on page 473 of our April 13th issue, in which full instructions are given for using 2-volt valves throughout. Exactly the same advice applies in the case of using 4-volt valves.

○○○○

A Mathematical Miasma.

I find it rather puzzling how to calculate the capacity given by connecting up fixed condensers in series, by connecting them in parallel, or by connecting them in series-parallel arrangement, and I shall be glad if you will assist me in my difficulties. Does the same rule hold good as in the case of series-parallel arrangements of resistances and inductances? P. R. E.

The problem is not at all difficult, as you suppose. In the case of condensers connected in a parallel arrangement, the resultant capacity is equal to the sum of all the individual capacities. The calculation of the resultant capacity of several condensers in series is no more difficult, although it might appear so. In brief, the resultant capacity yielded by connecting fixed condensers in series is equal to the reciprocal of the sum of the reciprocals of each individual capacity. Thus, take the case of three imaginary condensers of 0.0005 mfd., 0.001 mfd., and 0.0015 mfd. connected in parallel. The answer will simply be 0.0005+0.001+0.0015=0.0075 mfd. If, on the contrary, we connect these same three condensers in series, we must first proceed to turn them upside down, that is, taking the reciprocals of them, which gives us $\frac{1}{0.0005}$, $\frac{1}{0.001}$, $\frac{1}{0.0015}$. We must add these together, as it is the sum of these reciprocals we want, and the result is $\frac{11000}{3}$. This is the sum of the reciprocals, and we now take the reciprocal of it, which is 0.00027 mfd., and this gives us the answer. In complicated banks of condensers in series-parallel arrangements it is best first to work out the resultant capacity of each little bank of paralleled capacities, which is a simple matter, as it is merely the sum of each individual capacity composing the paralleled bank.

Thus, in Fig. 3 (a), for instance, the first thing we do is to work out the result of the two paralleled capacities of 0.0005 mfd. and 0.001 mfd., which, it will be noticed, are in series with two fixed condensers of 0.001 mfd. and 0.01 mfd. This leaves us with three series capacities in the top line, which, being worked out by the rule given above, gives us one single capacity in the top line, which is shown in Fig. 3 (b) as 0.00056 mfd. The top line of Fig. 3 (b) merely represents the resultant capacity of the top line of Fig. 3 (a). Taking the second line down of Fig. 3 (a), we have a solitary

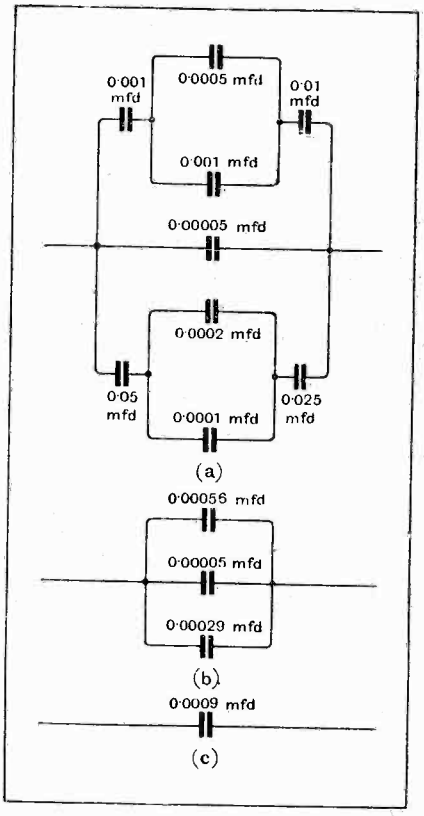

Fig. 3.—Calculation of complicated capacity combinations.

capacity of 0.00005 mfd., and so without more ado we know that this will form the same capacity in the second line from the top in Fig. 3 (b). The bottom line of Fig. 3 (a) is worked out in exactly the same manner as was the top line, and we get the resultant capacity of this bottom line of Fig. 3 (b) in the bottom line of Fig. 3 (b).

In Fig. 3 (b), therefore, we are left with three capacities in parallel. The solution is now easy, as we need only add these three capacities together, which gives us the solitary capacity in Fig. 3 (c). The capacity in Fig. 3 (c) is, therefore, equal to the capacity resulting from the apparently complicated looking multiplicity of condensers in Fig. 3 (a).

Many people are apt to confuse the method of working out complicated series parallel arrangements of condensers with complicated series parallel arrangements of resistances. In the case of resistances the opposite holds good, namely, the resultant resistance of several resistances in series is equal to the sum of the individual resistances, whilst the resultant resistance of several resistances in parallel is equal to the reciprocal of the sum of the reciprocals of each individual resistance. It should be noted that in the case of capacities in parallel, the result will always be greater than of any of the individual capacities, whilst obviously in the case of resistances in parallel the result will always be less than any of the individual resistances. A capacity of 5 mfd. in series with one of 0.0001 mfd. will, therefore, always be less than 0.0001 mfd., and the resultant resistance of a 10,000 ohm resistance and a 1 ohm resistance in parallel will always be less than 1 ohm.

If desiring to calculate the inductance of various chokes, whether air or iron cored, connected in series or parallel, the same rule follows as in the case of resistances, except that it only holds good if there is no mutual inductance between the various chokes, that is to say, if they are sufficiently separated from each other to avoid any magnetic interaction between any two or more chokes.

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A Reaction Riddle.

I wish to build a receiver consisting of H.F., detector, and two L.F. valves, using a stage of resistance coupling in the first L.F. stage, a transformer being used in the second stage. I propose to use a 1 megohm anode resistance, a 0.002 mfd. coupling condenser, and a 3 megohm grid leak. Will this be in order? I also, of course, wish to react on to the tuned anode, which form of coupling I have found very successful.

L. H. V.

Unfortunately if you are going to use a 1 megohm anode resistance it will be quite impossible for you to obtain normal reaction effects in the usual manner by connecting a reaction coil in series with your anode coil. You must, if you wish to use reaction, make use instead of a comparatively low value of anode resistance, which should be wire wound. In brief, you must make use of what some people are apt to term the "old-fashioned" method of resistance coupling. We would suggest a 150,000 ohm anode resistance used in conjunction with a valve like the Marconi D.E.5B or the Mullard P.M.5X. Indeed, such an arrangement was described with full constructional details in our issue of March 31st, 1926.

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VALVES AND VALVE PRICES.

IN this issue, under Correspondence, we publish a letter from the British Radio Valve Manufacturers' Association which constitutes a reply, written at our invitation, to letters sent to us in criticism of the Association's policy with regard to valve prices. The Association has dealt with the principal points raised by our correspondents, whose communications have not been published in *The Wireless World* because space would not permit of the inclusion of so many letters.

No doubt our readers have been anxiously awaiting a further reference to this important subject, and we regret the period of delay which has unavoidably occurred before we obtained the letter which we now publish.

We feel that this letter from the Association gives an explanation which, for the time being, should satisfy our readers, and, in particular, we would draw attention to the statement that reduction in prices should be made at the right time simultaneously by various manufacturers, as otherwise the prices of valves might vary almost from week to week and complications of distribution of valves amongst retailers under such conditions would be too great to contemplate.

We are satisfied that it is essential for the Association to adopt this attitude, but at the same time we sincerely trust that when the right time comes—and we hope it will be soon—the manufacturers will reward us adequately for our patience.

CONTENTS.

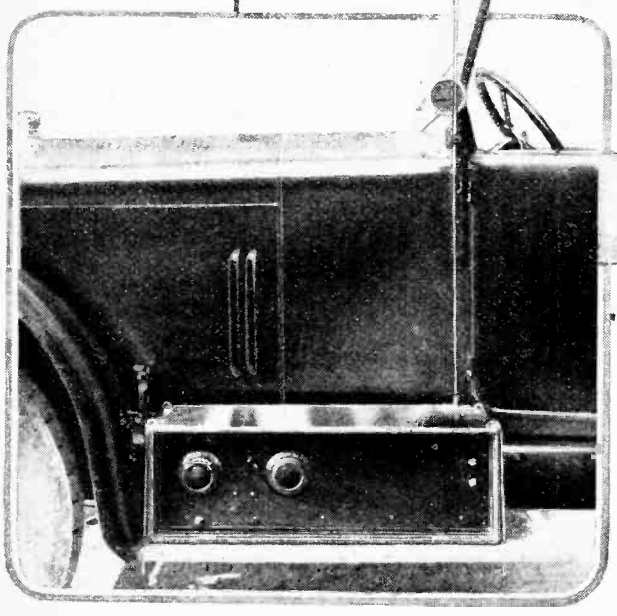
THE NATIONAL BROADCASTING COMPANY.

AN interesting article published in this issue describes the work of the National Broadcasting Co. of America, which has been formed with the object of obtaining co-operation amongst the principal broadcasting stations and raising the standard of the programmes. In America there is a far larger proportion of stations serving the more thickly populated districts than in any other part of the world, but as many of these stations are owned by comparatively small concerns the programmes have not, on the whole, maintained a high standard, although from time to time excellent performances have been put out when these have been externally organised for the purpose of either direct or indirect advertising.

One of the aims of the National Broadcasting Co. will be to extend the advertising side so as to provide the necessary funds for really first-class programmes. In this country we have steadfastly set our faces against the introduction of advertising into the broadcast programmes, and fortunately the annual licence fee has provided ample funds for broadcasting requirements. Had broadcasting here been left to private enterprise instead of being a Government-controlled system it is probable that it would soon have been found necessary to resort to advertising, but we can congratulate ourselves that our system has made it unnecessary to depend upon an expedient which, whilst it may be acceptable in America, would find little favour with us.

The Motorists' Portable

Four Valve Mobile Receiver



By F. H. HAYNES.

THE owner-driver has probably devoted most of his spare time, recently, to an overhaul of his car, and this wave of enthusiasm may have carried him along to the consideration of fitting some new and useful accessory. It is more than likely that if the car owner is also an enthusiastic listener, being desirous of carrying his interest with him on the road, he will reflect on the design to adopt for building a portable set embodying the many points of progress which have been made during the past winter. Comparatively few can afford to construct duplicate sets for home and portable use, and although the set on the car must be in every way a portable, specially designed for the conditions of the road, it must be none the less suited to satisfying the requirements of the enthusiast as a home receiver.

The Aerial Question.

Although it has several times been demonstrated that reception is possible whilst travelling along the road, few sets have been specifically designed for this purpose. Practically all commercial portables are fitted with frame aerials, and although when placed aboard a car they give satisfactory reception, the directional properties of the frame give rise to fluctuations in signal strength. A frame aerial does not always point in the direction of the transmitting station when used on a mobile receiver, and the strongest signals are obtained apparently from various directions as the car passes any vertical conductor capable of acting as a collector, and therefore a radiator of the broadcast transmission. An exposed frame on a car is, moreover, conspicuous and unsightly, must be capable of being rotated in any direction, and will probably suffer damage owing to its considerable wind resistance.

The form of aerial put forward here is a vertical rod, no higher than the top of the car, and secured to the case in which the set is housed on the running board.

Circuit Considerations.

It has been observed, particularly during the past winter, that a well-constructed set embodying a high-frequency amplifying stage will, as a rule, without aerial or earth connections, give good reception on telephone receivers up to distances of ten miles from a main station, and at much greater distances when connected to a short piece of wire, as an earth, and a few feet of aerial wire.

The circuit system adopted, therefore, is a four-valve arrangement, consisting of a tuned input circuit to be excited, when used as a portable, by a short vertical conductor, an efficient high-frequency amplifying stage, neutralised and screened, and a valve detector followed by two resistance-coupled valves with a choke feed output circuit to keep the H.T. battery voltage away from the telephones or loud-speaker.

Non-microphonic Valve Mounts.

The design of the components has been modified to meet the special requirements particularly in regard to the method of supporting the valves. A few preliminary tests at once revealed the need for entirely insulating the valves from mechanical vibration. No form of spring valve holder was found to adequately guard against the setting up of microphonic noise in the valves, although providing some protection against damage by mechanical shock. The valve holders used were developed in another connection, their purpose being to entirely screen the valves to prevent that form of distortion which occurs by mechanical reaction between valves and loud-speaker when the latter is used in the same room as the receiving set. Everyone is well acquainted with that form of low-frequency howl which is set up when a loud-speaker is operated near a microphonic valve, but it must not be overlooked that serious distortion occurs long before the mechanical reaction between valves and loud-speaker arises, and it would appear desirable in the construction of future sets to adopt some form of non-rigid non-metallic mounting on the baseboard, at the same time

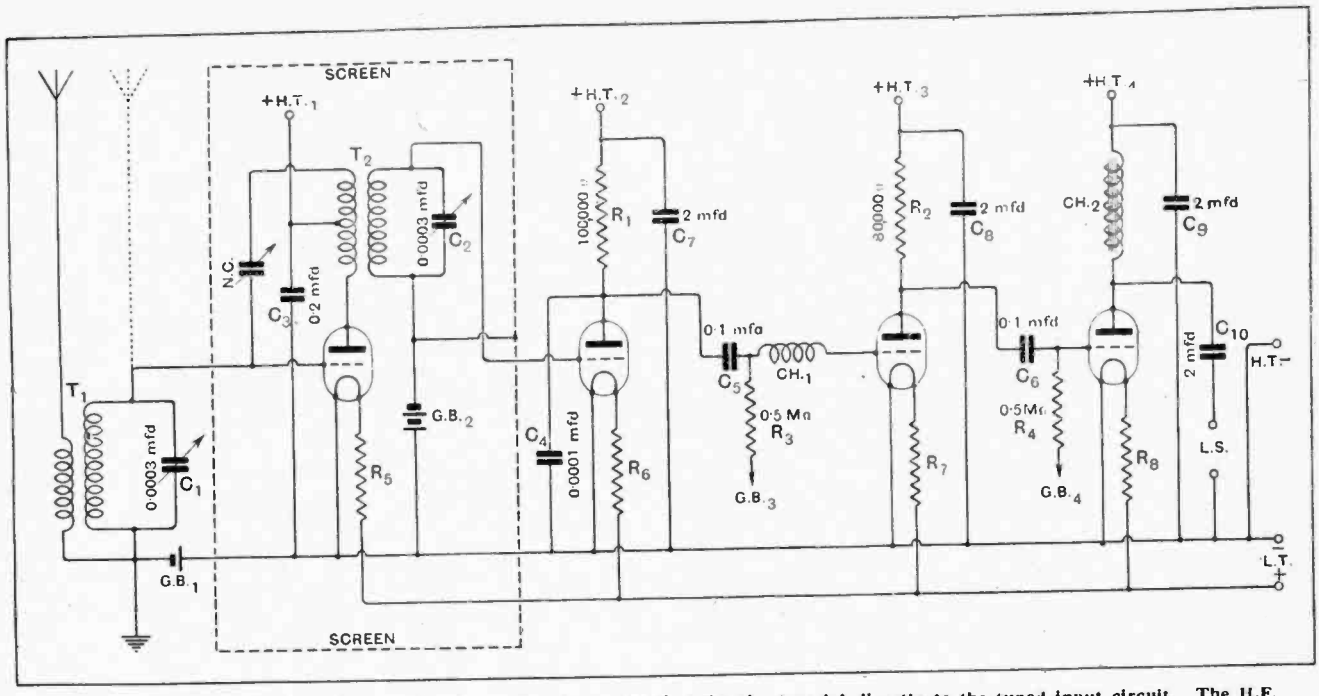


Fig. 1.—Provision is made in the circuit arrangement for connecting the short aerial directly to the tuned input circuit. The H.F. unit is in a screening box and is followed by an anode bend detector and two resistance-coupled L.F. stages.

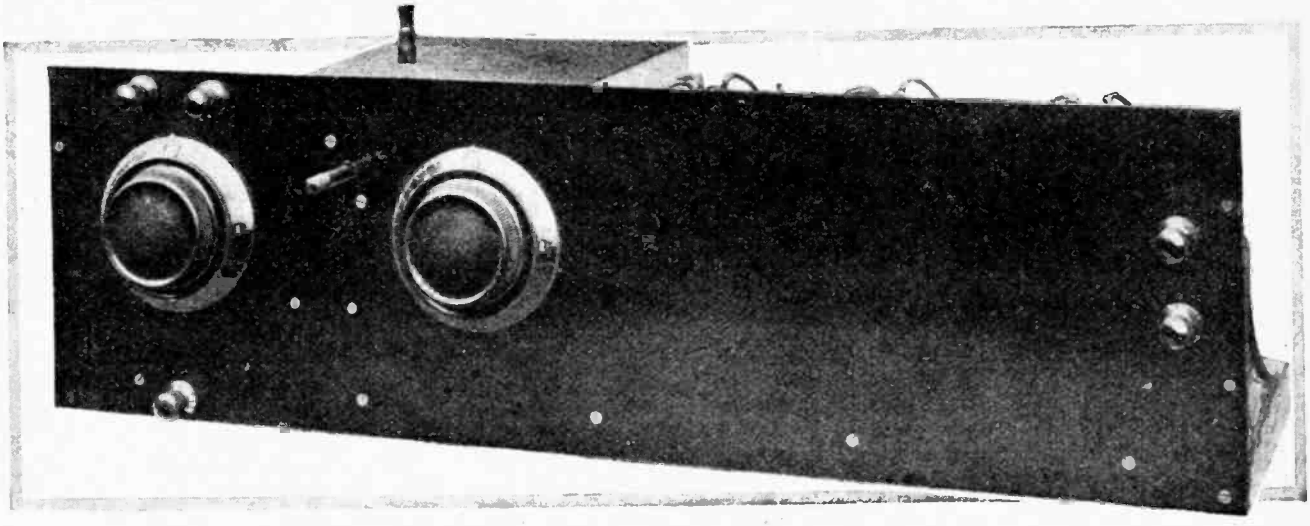
covering the entire valve to prevent sound waves impinging upon it.

The form of valve mounts adopted serve other useful purposes. There is first the entire elimination of stray external capacities introduced by the usual form of valve holders, for the connections are made by short flexibles arranged around the top of the thin walled "Sorbo" lined tube which supports and protects the valve. In the leads to the valve may be a tuned winding, a filament resistance, an anode resistance, or a grid leak, and these being interposed in the straight lead passing up from the baseboard very much simplifies the wiring, the actual holding down screws connecting to the battery leads. Leaks and resistances elevated in this way are protected against stray capacity leakage, and in this connection advantage is gained in a screened high-frequency stage

The tuning coil within the screen should be supported almost centrally between the metal faces which lie at right angles to its axis, whilst both sides of the neutralising condenser, being points of H.F. potential, cannot be secured to the metal base of the screening box. Both of these components are, therefore, mounted on to the walls of the container of the associated valve and connected in circuit by short leads.

Constructional Details.

Turning now to the actual process of construction, one should, after having obtained all the necessary parts, carefully peruse the several working drawings. The panel may be purchased exactly cut to size, and can be ordered with the cabinet. It is ¼in. in thickness, and its highly polished faces prevent the adhesion of dust. A metal



The Motorists' Portable.—

panel cannot very well be used in this instance owing to the several bushings which would be required. When the panel has been made a loose fit in the cabinet, the positions for the holes may be set out with the point of a pair of dividers, centre punched and drilled. The large holes for the condenser bushes may be filed to size to a small circle scribed on the panel in the absence of a large drill. Apart from the countersinking, which may be done with a larger drill or rose bit, the sharp edges of all holes should be removed.

The baseboard is of ½in. oak clamped and elevated by ½in. battens. This board, if not obtained with the cabinet, should be purchased already planed to thickness and adjusted to size with a small tennon saw and medium file. It is as well to attach the brackets at this stage, but before fitting them they should be tested for squareness by placing the right angles side by side and examining the edges, which now fall in line, with a straight edge. Adjustment to a true right angle is essential, or difficulty will be experienced when clamping the copper screening box hard up against panel and baseboard.

Making the Valve Containers.

The preparation of the ebonite tubes should next be undertaken. The pieces are carefully sawn off to length, working all the time to a line scribed right round the tube and finished off by rubbing on a sheet of emery or carborundum paper laid flat on the bench. There are five tubes, each 4in. in length, for the aerial inductance, and four valve containers, and a fourth piece for the H.F. transformer secondary winding, 2½in. in length. The diameter of the special thin-walled ebonite tube is in each case 2½in. internal, and the thickness is less than 3/32in. 6B.A. screws and nuts, ¼in. in length and countersunk, are used for securing the tags connecting to the flexible wires as well as for holding the brackets which support the resistances and are used for attaching to the baseboard.

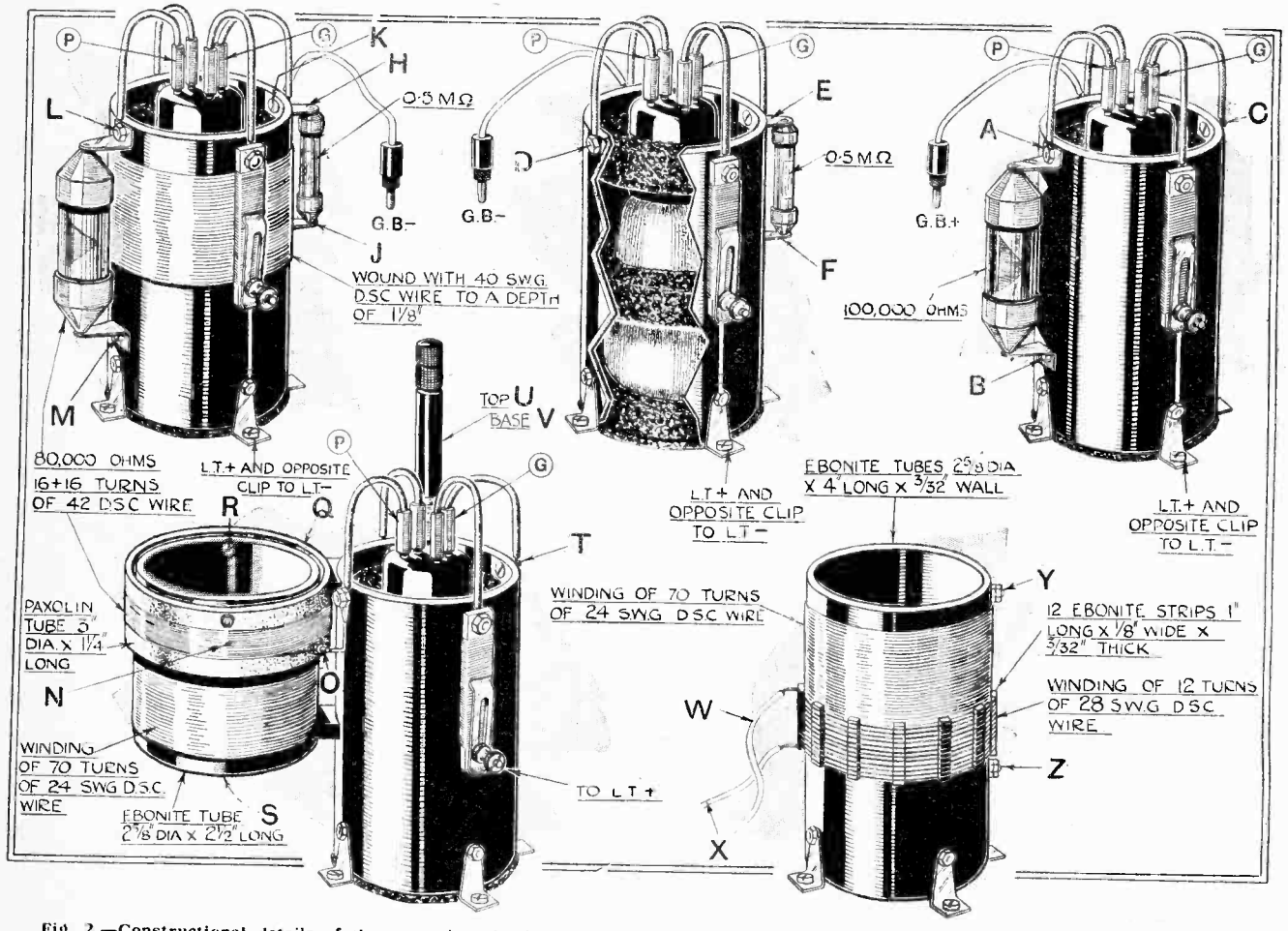


Fig. 2.—Constructional details of the non-microphonic valve containers and the H.F. transformers showing the points to which connections are made. A, on the detector valve container, connects to the mica coupling condenser (C_5 also C_4). B, to the H.T. battery terminal (+H.T.$_2$ also C_7). C, to the lower end of the secondary of the H.F. transformer (T_2 also C_2). Next, on the output valve container, D connects to the low-frequency choke (CH_2 also C_{10}). E, to the mica coupling condenser (C_6). F, to the grid bias plug (G.B.$_4$) shown on the opposite side of the cylinder. Next on the left is the container associated with the fourth valve. H connects to the grid bias lead (G.B.$_3$). J, to the high-frequency choke coil (CH_1) and the mica coupling condenser (C_3). K, to the valve grid lead and the H.F. choke (CH_1). L, to the coupling condenser (C_6). M, to the H.T. terminal (+H.T.$_3$). Q, to the top of the neutralising condenser. R, to tuning condenser (C_2 and grid bias battery G.B.$_2$). S, to the tuning condenser (C_2 and the grid denser (N.C.). W, to the aerial terminal. X and Z, to the earth terminal. Y, to the grid of the detector valve. The reference letters of the components are given in the theoretical circuit diagram. Anode resistances and grid leaks are lightly soldered to the brackets.

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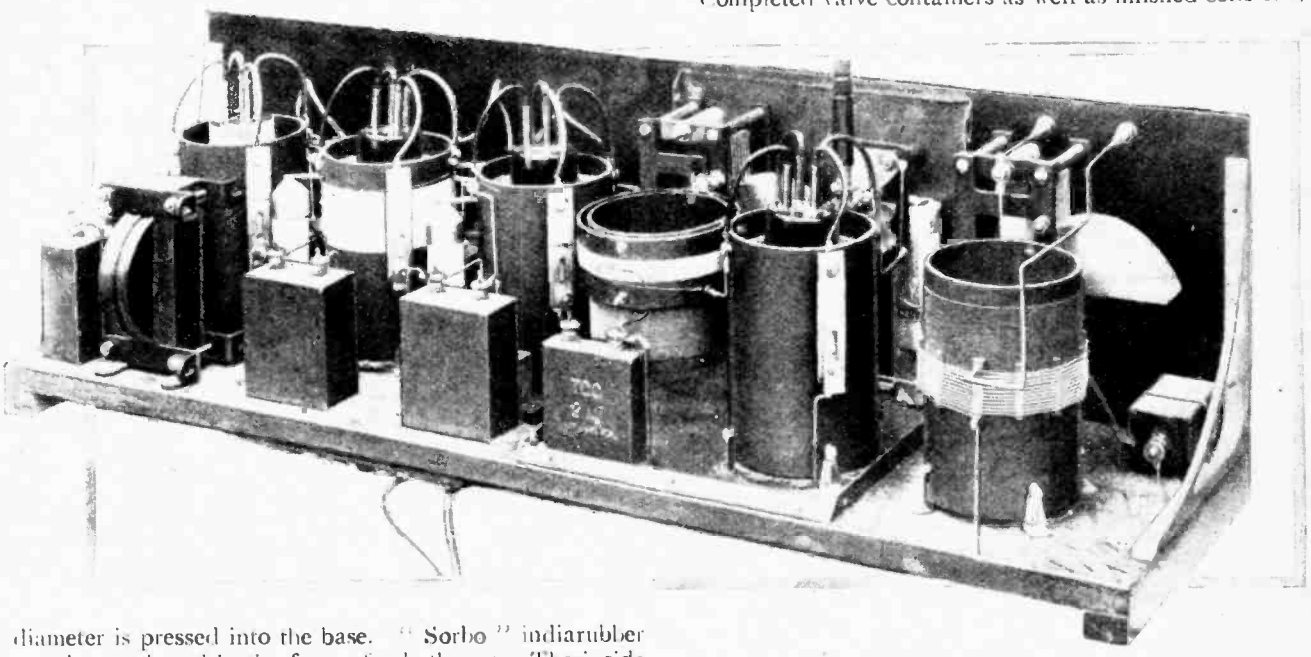
To screen the valves from mechanical vibration two rings of "Sorbo" rubber are attached to the inside walls of the cylinders, and a pad just slightly larger than the inside sockets. No difficulty should be experienced in making the coils and valve containers; there are no tapped holes, and it is merely a question of accurately setting up the positions for the brackets.

Completed valve containers as well as finished coils can,



diameter is pressed into the base. "Sorbo" indiarubber may be purchased in the form of a bath mat. The inside walls of the tube should be cleaned with glass paper and a little petrol, and indiarubber solution should be applied to both the "Sorbo" and the cylinder and allowed to nearly dry before sticking the rings in place. The bottom discs are held down by slightly protruding around the rim at the bottom. The valve legs are connected across to the tags by several strands of fine wire forming flexible leads and covered with insulating tubing. To avoid the danger of the plate socket coming into contact with the others and thus burning out the filaments of the valves, it may be thought advisable to slip pieces of rubber tubing over all however, be obtained made up in accordance with the details given here. The outer surfaces of all tubes should be finished smooth by rubbing down with emery or carborundum cloth. A winding space of just over $1\frac{3}{4}$in. is occupied by the closed circuit inductance of the aerial circuit transformer. Actual direction of winding is immaterial, though the overwound primary is in the same direction. The ends of the winding are soldered to home-made double-ended tags cut from tinned copper foil or thin tin plate.

The aerial winding, which, by the way, is only provided so that the set can be used for long-range reception on an

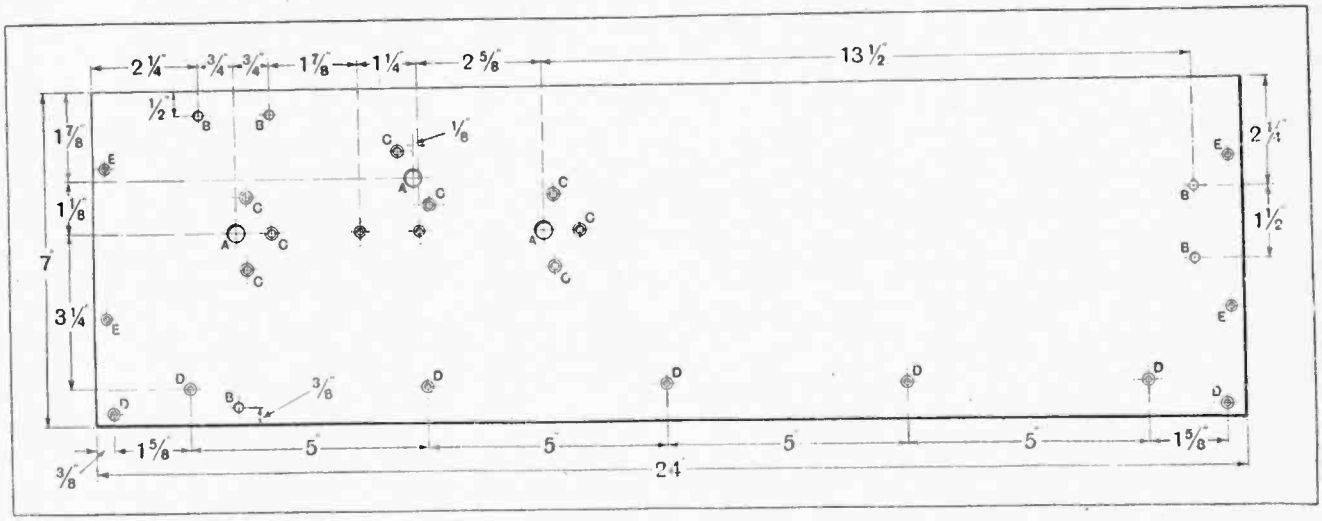


Fig. 3.—Drilling details of the front panel. Sizes of holes: A, 3/8in. B, 7/32in. C, 5/32in. countersunk for No. 4B.A. screws. D, 1/8in. countersunk for No. 4 wood screws. E, 1/8in. countersunk for No. 6B.A. screws. The condenser holes are carefully set out with the aid of the template supplied.

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elevated aerial, is carried on twelve plain or grooved spacers of wood or ebonite. A rubber band round the spacers holds them in position while winding, and the ends are terminated on two ½in. 8B.A. screws with recessed heads nutted in position at the end of one of the spacers. The terminating points may be at the back of the coil or on the side remote from the H.F. stage. Alternatively, a piece of "Paxolin" tube similar to that used in the intervalve H.F. transformer may be secured by three 6B.A. screws and nuts at the lower end of the closed circuit winding to give support to the turns forming the aerial circuit. If this is done the winding should consist of 12 turns of No. 26 D.S.C. wire, turns touching.

The H.F. Transformer.

The sketch should be carefully referred to when constructing the H.F. intervalve transformer with regard to the positions of the screws upon which the windings are terminated. The secondary winding is wound on the ebonite tube, and then the "Paxolin" tube is placed in position. It is secured at three points, in one place by the terminating screw of the secondary, with a small nut as a spacer, by the screw which holds the coils to the valve container, using shaped ebonite spacers, and by another screw and ebonite spacer.

Having first set the "Paxolin" tube in position it is removed and wound with 32 turns of No. 42 D.S.C. wire with a tapping point at the centre turn made by twisting up the wire and tinning it. In removing the insulation care must be taken to avoid damaging the wire, and in using "Fluxite" as an aid to soldering any excess must be removed before continuing to wind. The ends are wound round the terminating screws and then soldered.

Little need be said as regards the making up of the remaining valve containers, all constructional information being gleaned from the drawings. The clips holding the anode resistances and leaks should be tinned where they engage, and subsequently soldered to the ends of the leaks and anode resistances.

Assembling the Components.

With all components to hand the process of assembly can now be commenced. First the 15-volt grid battery is clamped hard against the back of the panel by means of two "H.A.H." battery clips, one side of each clip having been broken off. The screening box is next secured in position by being clamped down under the fixing screws of the variable and fine adjustment variable condenser. The holes for attaching the metal strap which grips the 3-volt biassing battery should be marked off so that this part of the box can be removed and completely drilled. Eight holes are drilled in the base for screwing down to the board, the hole in one of the corners being slightly displaced to hold the H.T. bridging condenser. Another hole is required for screwing down the bridging condenser, as well as another pair of holes adjoining the bridging condenser terminals through which sleeving-covered No. 18 leads can freely pass. Four holes are necessary for clamping down the valve container with ⅝in. cheese-headed 6B.A. screws, as well as two more holes for the sleeving-covered leads to the filament.

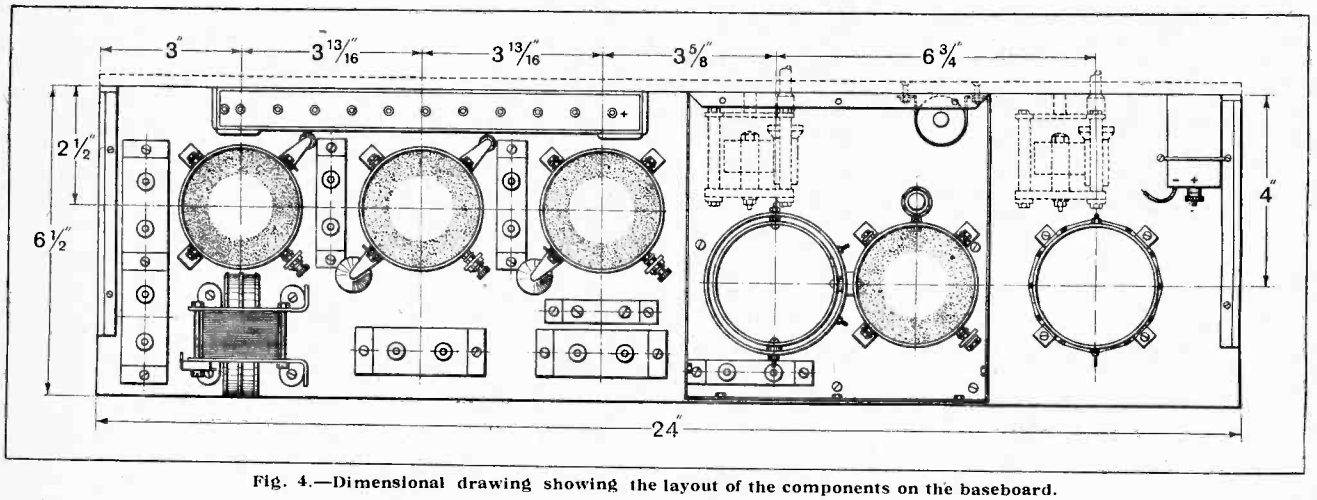


Fig. 4.—Dimensional drawing showing the layout of the components on the baseboard.

Make sure that the two sides of copper box bed well down against the panel and baseboard, and see that they do not become distorted when screwed in position. The moving plates of the tuning condenser must swing well clear of the neutralising condensers and the grid battery. Two 1in. × ⅜in. diameter ebonite spacers are required for attaching the panel mounted fine control neutralising condenser. These should be drilled for ⅜in. at each end so that 4B.A. × ½in. countersunk headed screws can be forced into the holes. The positions for holes required in the ebonite plate of the condenser are obtained by marking through, using the front panel as a template. Before attaching the 3-volt grid battery, the two cells should be pushed out of their wrapper and a short flexible wire soldered across between the centre cap of the lower cell and the zinc container of the one above. Mind that the metal strap does not cut through the wrapper of this battery, or one of the cells will become short-circuited. A piece of wire is also soldered to the underside of the lower cell joining to the copper box, or alternatively a thin strip of springy brass can be attached to the base by the holding down screw in the corner near by.

A connecting wire is clamped under the nut of the panel mounted neutralising condenser and brought round to a convenient position near the top of the Gambrell condenser

The Motorists' Portable.—

before placing the coils in position, also, a connecting tag is secured to the frame connection of the tuning condenser as well as a long double-ended tag or wire to the lower condenser terminal to provide ready connection to the tuning inductance.

With this done and the valve unit previously wired up as much as possible, the assembly of the H.F. stage can be completed. To prevent breaking the fine wire primary winding the lead which connects to the terminal of the H.T. condenser should be curved and of about No. 28 gauge.

Every care must be taken in finding the correct location for the hole in the box through which the handle of the neutralising condenser protrudes. The position should be determined by measurement from several edges, and at this stage a hole can also be drilled through the top of the containing cabinet.

The aerial tuning equipment should next be fitted up, and the connection between the lower end of the winding and the frame of the condenser is made by a long, narrow tag clamped down under the corner bolt prior to fixing the coil in position. The lead which connects on the lower side of the fixed plates to the grid and neutralising condenser of the H.F. unit should also be run before securing the coil. As the L.F. equipment is somewhat cramped the 15-volt grid battery should be left in position while marking out the positions for the holes.

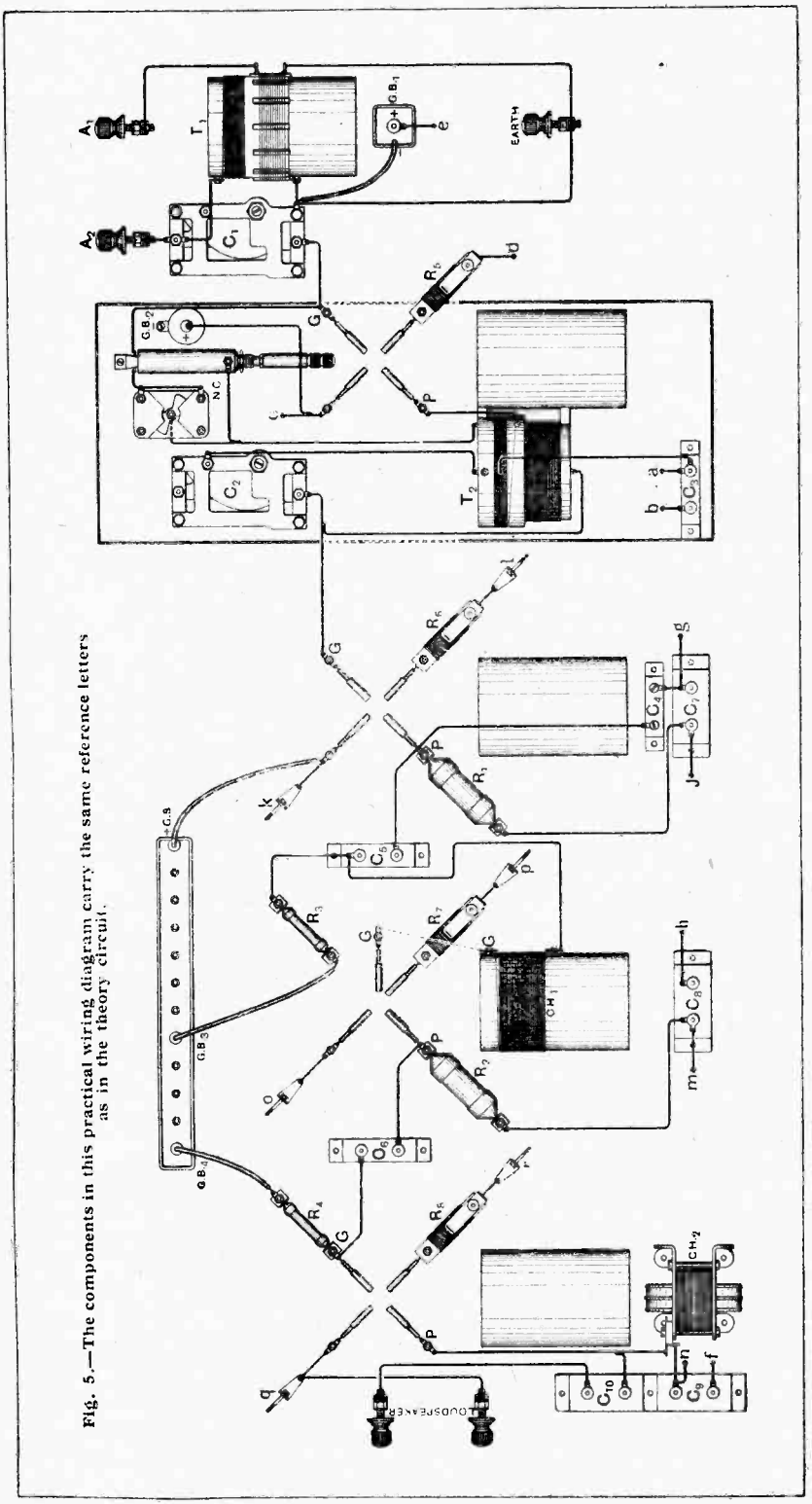


Fig. 5.—The components in this practical wiring diagram carry the same reference letters as in the theory circuit.

Wiring Details.

Before the wiring up can be done a seven-tag terminal strip must be made up from a piece of $\frac{3}{16}$in. ebonite, $5\frac{1}{4}$in. × $\frac{3}{4}$in., and attached a short way in on the underside of the base. The filament wiring is carried out entirely beneath the baseboard by joining together the tags and the holding-down screws of the valve containers. The H.T. wires also run on sleeving directly to the bridging condensers. Interstage wiring is effected by short bare leads, using the practical wiring diagram as a guide. Three battery plugs connected to short flexibles are required for connecting the L.F. valves to the grid battery. With the wiring completed and checked the leads should be connected up to the filament battery and next to the high-tension battery, and the set tested on the usual aerial.

Testing Out.

The H.F. valve is a P.M.5X, detector P.M.5B, first L.F. P.M.5, and second L.F. P.M.256. With both neutralising condensers at zero setting self-oscillation should occur when the

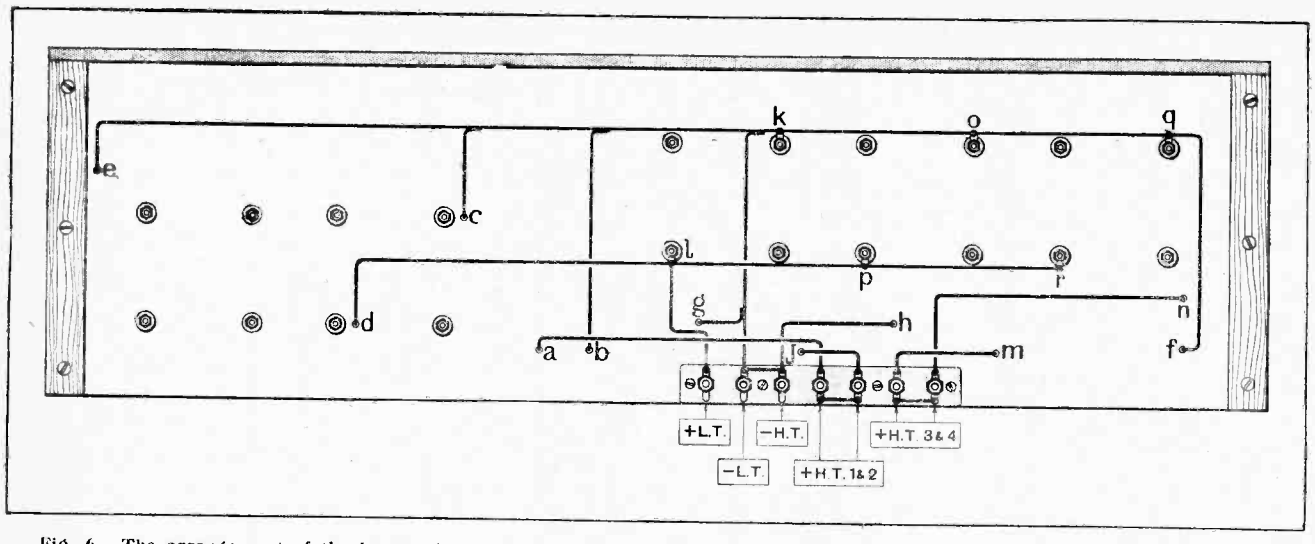


Fig. 6.—The arrangement of the battery leads under the baseboard. Reference letters have been added to show the continuation of the leads above the board.

two tuning circuits are adjusted to approximately the same wavelength. The potential applied to the H.F. valve during test should be about 80, to the detector 100, a somewhat critical valve being required for maximum signal strength, and 150 to the two L.F. valves with bias of 6 and 15 volts.

Tune in to the local station and screw down the neutralising condenser just to the point where heterodyning ceases, and this position should approximately correspond to that obtained when adjusting for the elimination of the local signal with one of the filament pins of the H.F. valve disconnected. The Gambrell condenser should be taken to the point where self-oscillation just maintains when the tuning condensers are set to positions near in the middle of the scales, fine adjustment being obtained from the neutralising condenser on the front panel.

For obtaining uniform stability over the entire tuning range the primary and neutralising windings must be identical in their inductance and capacity values, and as these values change with the setting of the tuning condenser across the secondary it follows that they should be equally influenced. In the modern Hazeltine neutrodyne arrangement a two-start winding is employed, though constructional difficulties are encountered in adopting this arrangement for amateur use. In this instance the windings being of fine wire occupy limited space and are very tightly coupled.

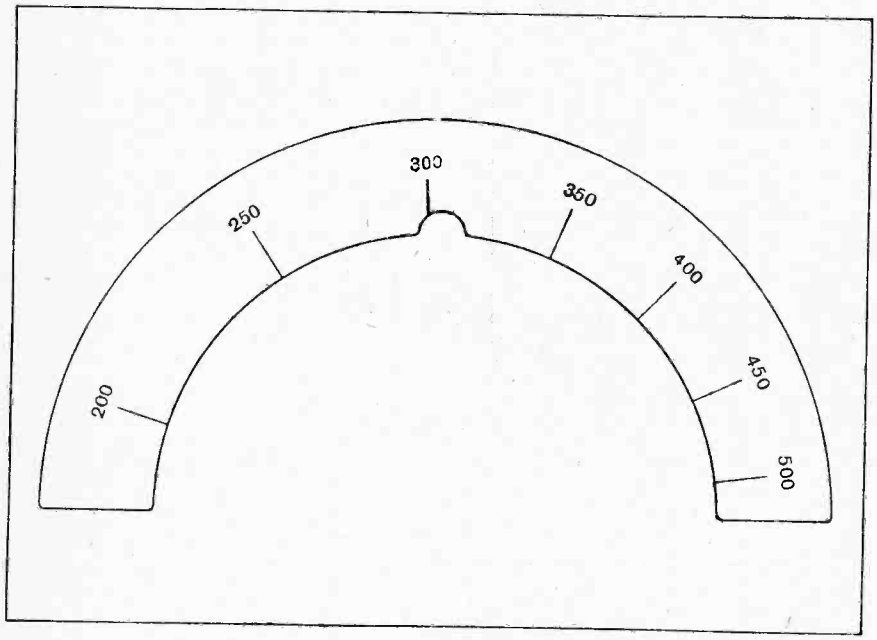


Fig. 7.—Calibration of the H.F. tuning condenser. The scale can be copied or cut out and slipped behind the dial. As the condenser follows a logarithmic law, this calibration holds good irrespective of the size of the coil. It is only necessary to correctly set it as to wavelength when tuning to the local station when the other markings will be found to be correct

The aims in H.F. transformer design which have been fulfilled in this instance are that resistance losses in primary and tuned circuit have been kept as low as possible by the use of a good secondary coil and tuning condenser. The primary is of fine wire to produce a compact low-capacity winding, its actual high frequency resistance being of small account compared with the resistance of the valve with which it is series connected. Next, that the tuned winding is as large as possible, consistent with covering the required tuning range. Thirdly, that the primary to secondary turns ratio has been adjusted to suit the impedance of the valve, limiting, as far as possible, stray capacities which might serve as a leak to the radio-frequency potentials, keeping the primary winding near the filament connected end of the secondary.

LIST OF PARTS

2 ft. Ebonite tube, 2¼in. internal dia., 3/32in. wall (Britannia Rubber and Kamptulicon Co., Ltd.).
1 Copper screening box (Wright & Weaire 740, High Road, Tottenham, N.17).
1 Cabinet, 7×24×8⅛in., with fittings (W. E. Matson Ltd., Windus Works, Windus Road, Stamford Hill).
1 Ebonite panel, 7×24×¼in.
1 Baseboard, 6½×24in.
1 Paxolin tube, 3in. dia.×1in. long.
4 Peerless 5-ohm fixed resistors (Bedford Electrical Co.).
1 Neutrovernia (Gambrell).
1 Neutrodyne micro-condenser (Ormond Engineering Co.).
4 Fixed condensers, 2 mfd. (T.C.C.).
1 Fixed condenser, 0.2 mfd. (T.C.C.).
2 Fixed condensers, 0.1 mica (T.C.C.).
1 Fixed condenser, 0.0001 mfd. No. 620 (Dubilier).
2 Grid leaks, Dumetohm, 0.5 meg.
1 32-henry choke (Pye).
1 Anode resistance, 80,000 ohms (Varley Magnet Co., Ltd.).
1 Anode resistance, 100,000 ohms (Varley Magnet Co., Ltd.).
2 Cyldon condensers, 0.0003 mfd. log mid line (Sydney S. Bird & Sons).
2 Ethovernia dials (Burndept).
16 Valve pins.
1 pair Brackets, 5½×5½in. (A. J. Dew).
1 Ever-Ready 1½ V-type "O" cell (Portable Elec. Light Co.).
1 Ever-Ready, 3 V-type, No. 1839 cell.
1 Ever-Ready, 15 V. G.B. battery.
5 Terminals (Igranic Elec. Co., Ltd.).
¼ lb. 24 D.S.C. green wire.
3 doz. small stiff vertical grid leak clips.
Battery leads.
Screws, nuts, brass rod.
Sorbo rubber sponge.
Wander plugs, etc.

Approximate cost of complete equipment .. £14 . 10s. 0d.

Having proved the connections of the set by local reception, distant stations can be tuned in by carefully rotating the dials together, finally controlling any tendency to self-oscillate by the critical neutralising adjustment at the front of the panel.

As the tuning condensers follow a logarithmic law it is possible to give the tuning scale of the second dial irrespective of the actual size of the tuning coil. The scale shown can be fitted behind the H.F. tuning condenser and adjusted to read correctly on signals from the local station. This calibration will be found to be closely correct for other settings. The calibration is practically unaffected by adjustments of the neutralising condenser, which does, of course, slightly alter the tuning position of the aerial condenser.

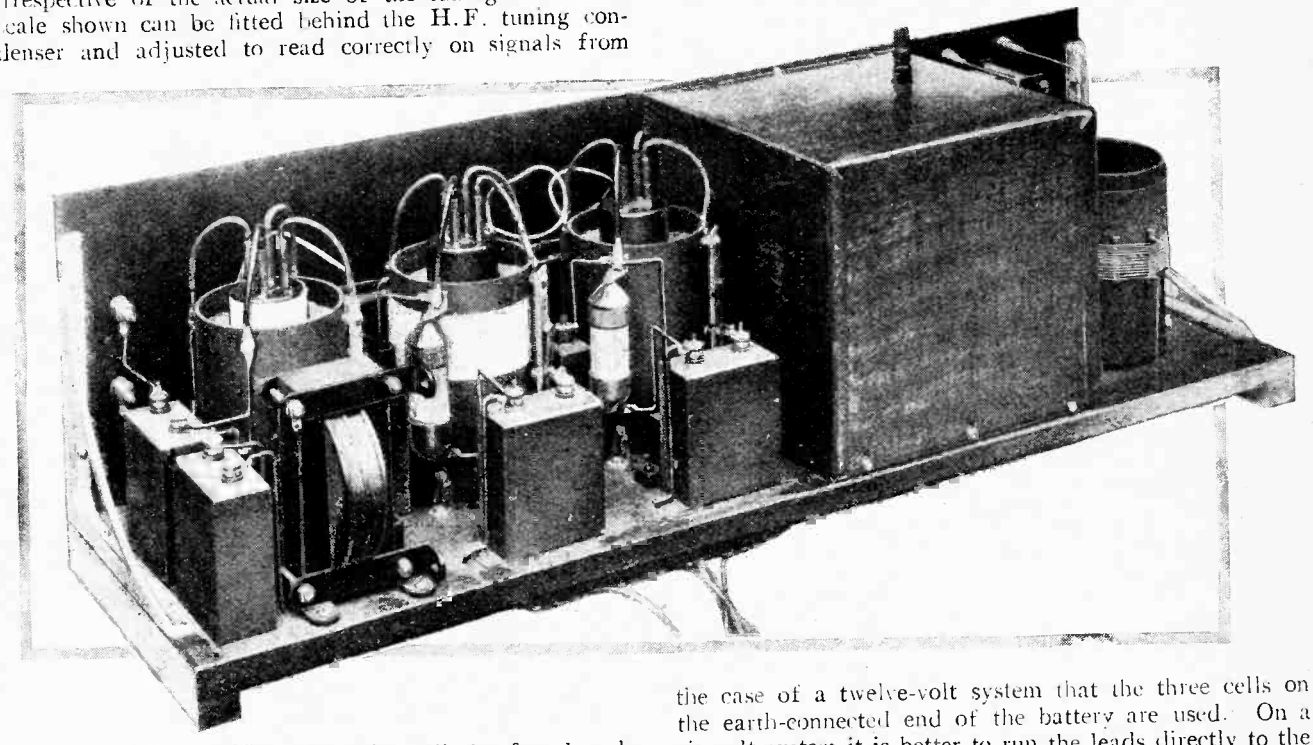
Test can next be made for local station reception, using an earth wire and a short indoor lead connected to A_2.

The actual aerial on the car was set up by obtaining two pieces of brass tube exactly fitting one in the other 4ft. and 3ft. in length. When stationary the aerial may be extended, giving improved signal strength.

Ignition Noise.

Earth connection is actually picked up by deriving the filament current from the car accumulator, making sure in the case of a twelve-volt system that the three cells on the earth-connected end of the battery are used. On a six-volt system it is better to run the leads directly to the battery rather than to pick up connection at the switch box, so as to avoid ripple and induction effects.

The three 50-volt H.T. batteries can be probably accommodated near the car accumulator, a five-wire cable, well wrapped with insulating tape and passing through a hole at the lower edge of the back of the cabinet, being



The Motorists' Portable.—

used for the purpose. Connection to the aerial rod is made by a thin lead passing across the top of the cabinet.

The magneto, sparking plugs and ignition leads may be found to give rise to considerable noise when attempting to obtain reception with the car in motion. This interference is not due to sparking at the points of the contact breaker on the magneto, neither does it arise from the sparking at the plugs, for with the engine running at 1,500 r.p.m. 50 sparks occur a second, producing a constant low-pitched buzz. Interference, if experienced at all, will be found to

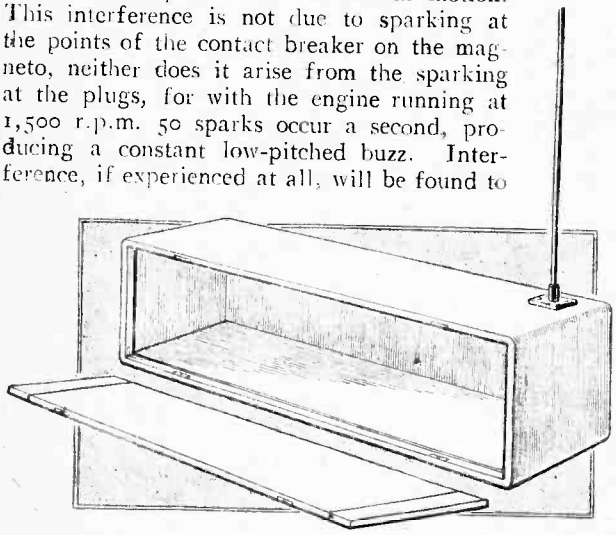


Fig. 8.—Constructional details of the cabinet and the aerial fixing. An ebonite bracket, as shown in the photograph at the beginning of this article, should be fitted to hold the aerial steady, though holding only loosely to allow for differences in the vibration of the body of the car and the running board.

be intermittent and is principally caused by brushing and feeble sparking taking place through weak points in the insulation of the leads to the plugs. Rather than wrapping the leads with lead foil or braiding it is better to renew them to ensure perfect insulation.

Tests on the Road.

The containing cabinet is built from $\frac{5}{8}$in. mahogany with a completely removable cover and finished a polished black, as is usual in the case of car fittings. Holding-down clamps are made from $\frac{1}{4}$in. brass rod hooked at one end and threaded to take $\frac{1}{4}$in. Whitworth wing nuts at the other. Recesses in the top of the cabinet locate the hooked ends. These should be nickel-plated and are quite inexpensive to buy.

Many interesting observations will be made journeying through a suburban area and listening to the local station with telephone receivers. Signal strength will be found to vary considerably, and from tests made it is obvious that reception is greatly improved when passing near to an aerial to which an oscillating valve set is connected and tuned to the local station. As the set is not used in an oscillating condition, a heterodyne beat note will not be set up, evidencing that it is essentially the oscillating set which is interfered with by other oscillators. When, however, a receiving set was adjusted to create a heterodyne note, that same note was picked up quite strongly by the car receiver.

Vibration may cause the dials to slip away from the correct tuning position unless clamped up to give a somewhat stiff movement.

There is little point in going to the trouble and expense of building any set that is not in some way better than previous sets. In this instance the writer takes the results given by the Special Demonstration Receiver[1] as to its ability to bring in distant transmissions as a standard for comparison. In building this set each of the parts were interchanged with the equipment of the Demonstration Receiver and tested for comparative performance before adopting them.

[1] Described in the issue of February 16th, 1927.

Calls Heard.

Extracts from Readers' Logs.

Hackbridge, Surrey.

March 18th to 24th.

Brazil :—SB 1AD, 1AL, 1AR, 1AV, 1AD, 1AW, 1AY, 1AJ, 1BR, 1BQ, 1BI, 1BL, 1IC, 1ID, 2AB, 2AG, 2AR, 2AV, 2AK, 2AX, 7AA. Chile :—SC 2AB, 2AS, 2BL, 3IJ. Argentine :—SA AF1, CB8, DE3, DW4, EN8, GA2, HA2, HA3, HD4, HE1. Uruguay :—SU 1OA, 1CD, 2AH, 2AK.

H. E. Smith (2BZW).

(0-v-1 Schnell) on 30-36 metres.

Bristol.

(March 20th to April 20th.)

Argentina :—SA BA1, BR7, DB2, DE3, DH5, DR4, DW4, EN8, FC6, HA2, HA3, HB1, HE1, HD4, HG1. Australia :—OA 2AY, 2GW, 2MS, 2SA, 2SH, 2TM, 2WB, 2YI, 3AM, 3BQ, 3DC, 3ES, 3XO, 4BD, 5AX, 5BG, 5HG, 5KN, 5LF, 5WH, 6MU, 7CW, 7HL. Belgian Congo :—CBF2. Brazil :—SB 1AF, 1AJ, 1AN, 1AO, 1AR, 1AW, 1BA, 1BR, 1BK, 1BL, 1BO, 1BU, 1BW, 1BY, 1CA, 1CB, 1CK, 1IB, 1IC, 1ID, 2AA, 2AG, 2AJ, 2AL, 2AR, 2AU, 2AV, 2AX, 2EG, 2IB, 2IG, 3AC, 5AA, 7AA, 7AB, AUX. Canada :—NC 1AD, 1BR, 2AX, 2BE, 2DO, 2FG, 3BT, 3FC, 3NJ, 3WAB, 3XQ. Chile :—SC 2AH, 2AR, 2AS, 2BL, 3AG. Costa Rica :—NR CTO. Cuba :—NQ 5BY, 8KP. Dutch West Indies :—NL 1P. Egypt :—1HF. French Africa.—FQ P.M. French Indo-China :—AF HVA, 1B. Haiti :—NT DCZ. India :—AI 2KW, 2KX. Italian Libya :—FI 1CW. Jamajca :—NJ 2PZ. Mexico :—NM, 1J, 5B. Nicaragua :—NN M3Y. New Zealand :—OZ 2AE, 2BG, 2BR, 2BX, 2GA, 3AI, 4AA, 4AE, 4AC. South Africa :—FO A3B, A3W, A4X, A5Z, A3X, A6N, 3SR. Syria :—AR 8LHA. Uruguay :—SU 1AM, 1BU, 1CD, 1CG, 1CX, 1NA, 1OA, 2AK, 2BC. U.S.A. :—NU 3ABL, 3ACM, 3ADL, 3AHP, 3AJH, 3AKS, 3AUV, 3BCD, 3BQZ, 3CBV, 3CDS, 3CE, 3CJN, 3CP, 3DQ, 3EF, 3FZ, 3GP, 3IU, 3LD, 3LQ, 3LU, 3OW, 3QF, 3QL, 3QW, 3RE, 3SK, 3SH, 3SJ, 3TI, 3VF, 4BK, 4BN, 4CB, 4CK, 4DB, 4EF, 4HZ, 4IF, 4IT, 4IZ, 4JR, 4JS, 4LL, 4OC, 4OM, 4RW, 4RY, 4ST, 4TE, 4TI, 4WI, 5AAF, 5AKY, 5EK, 5JY, 5OA, 9AFX, 9AKK, 9CAJ, 9CPM, 9DHI, 9DOL, 9SV, 9VZ, 9XI. Varions :—AQE, ARDI, KEM, KDO, KTC, KUMT, NE8JC, NE8AF. The following heard on 20 metres :—Brazil :—SB 5AB. Canada :—NC 1AR, 1CO, 1DJ. U.S.A. :—NU 3AKG, 3BWT, 3CCH, 3PS, 4BL, 4DV, 4JR, 4QY, 4SI, 7EK, 9AFB, 9AWB, 9AXB, 9BAS, 9BPM, 9CCA, 9CP, 9CXX, 9DPM, 9ES, 9KV, 9ML. (0-v-1).

C. R. Ponting.

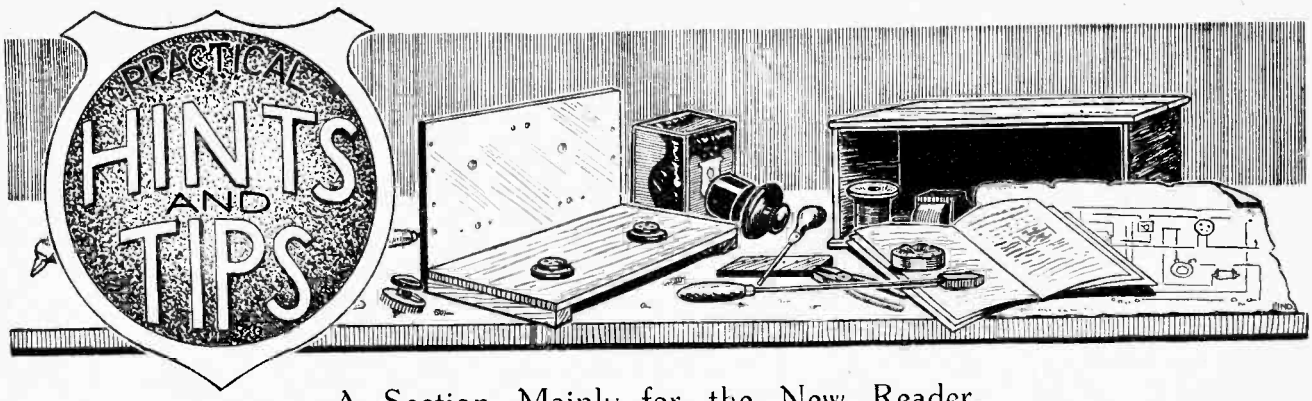
Acock's Green, Birmingham.

(February 4th to April 4th.)

U.S.A. :—NU 3AHL, 3AFW, 3BW, 9AX, 9CN, 9SJ, 9BZ. Brazil :—SB 1AA, 1AB, 1AK, 1AO, 1AW, 1IB, 1BR, 2AG, 2AR, 2AX. South Africa :—FO A3W, A3B, A6N. Morrocco :—FM 8MB, 8RGS, 8PMR, 8VX, OCRB. Argentina :—SA CW4, HD4. Russia :—EU 05RA, 08RA, 09RA, 1VZ, 1UK. Canada :—NC 1BR, 1AD, 3JM. India :—AI DCR. Uruguay :—SU 2AK. Syria :—AR 8LHA. Australia :—OA 3DC, 5WH. New Zealand :—OZ 2AC, 2BX, 3AC, 4AM. Jamaica :—NJ 2PZ. Abyssinia :—FA FA1, FA2. Tripoli :—FI 1CW, 1TA. Iraq :—AQ 1DH.

(0-v-1 Reinartz.)

L. Davis, Jun.



A Section Mainly for the New Reader.

NEUTRALISING.

The mistaken idea that the balancing or neutralising of a receiver having a single H.F. amplifying valve is a difficult matter seems to be still prevalent. While special precautions have to be taken when setting up a two-stage amplifier, the balancing of a single stage calls for no elaborate procedure.

To carry out the operation, the neutralising condenser is set at minimum capacity, and the tuning condensers are rotated until the circuits come into resonance. If everything is in order, the H.F. valve will now oscillate violently, as will be indicated by the production of a rushing noise in the telephones, or a heterodyne whistle if the set happens to be tuned to a station. The balancing condenser should now be rotated until this oscillation ceases. The next step is to readjust both tuning capacities and then to re-balance if necessary.

The above procedure may be repeated again if the set is not perfectly stable. It is, of course, easiest to adjust when listening to signals, as under these conditions the presence of oscillation is more easily detected.

It is as well to carry out the operation of balancing a receiver with the H.F. condenser set at approximately half its maximum capacity; an adjustment made in this way should hold good over the whole tuning range provided the set is correctly designed.

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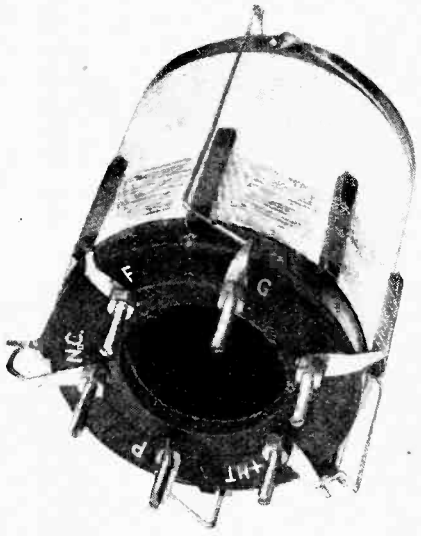
"ALL-WAVE FOUR" TRANSFORMERS.

The amateur who has access to a lathe may prefer to make his own formers for the coils used in the "All-Wave Four" receiver.[1] The method of construction shown in the accompanying diagram results in transformers as effective as the originals. While they are easier to wind by mechanical means, no other advantages are suggested.

A Paxolin cylinder, 3½in. long and 3in. in diameter, is fitted with an ebonite ring having an external diameter suitable for insertion into one end, and an internal diameter of 1⅞in. Six pins, with soldering tags (one is "dead"), are spaced equally on a diameter of 2⅛in. An ebonite cross-bar, which serves as a convenient handle when changing coils, should be fitted to the other end.



An interchangeable H.F. transformer.

A suitable ebonite base, carrying six plug sockets, must, of course, be provided. It should be remembered that perfect contacts are essential in an H.F. transformer, so both pins and sockets should be very carefully chosen; the so-called "banana" plugs, with spring sides, may be found to be better than the more common split pins.

In the illustration the lettering against each pin indicates the ultimate connections of the corresponding sockets.

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MECHANICAL VIBRATION.

When trouble is experienced with L.F. instability the cause may sometimes be traced to the transmission of mechanical vibrations from the loud-speaker to the receiver. This is particularly likely to be the case when both instruments are on the same table, and, of course, the remedy is obvious. The effect is comparable to that form of howling which is produced by the action of sound waves from the loud-speaker on the valves.

o o o c

THE SELECTIVITY OF AN H.F. AMPLIFIER.

One of the most certain and easiest methods of improving the selectivity of a receiver with the modern type of high-frequency transformer with "Litz" secondary and air-spaced primary and neutralising windings is to use an H.F. amplifier, a valve having a higher impedance than that for which the transformer is designed. Generally speaking, an impedance greatly in excess of 50,000 or 60,000 ohms is not recommended, but it should be pointed out that the published figures of 70,000 or 80,000 ohms relating to a number of valves at present on the market may be brought down considerably by in-

[1] *The Wireless World*, April 27th, 1927.

creasing the H.T. voltage applied to slightly more than the usual 120 volts. The valve should have a high magnification factor, of some 30 or 40; a number of suitable patterns, which are usually sold for resistance coupling, are on the market.

Great care must be taken not to apply an excessive grid-bias to these high impedance valves; certain types have a special electrode construction giving a "delayed" grid current, and their makers' instructions to the effect that no grid bias is required should be observed.

oooo

ACCUMULATOR CHARGE DURATION.

It is an easy matter to ascertain the length of time which a given accumulator should last on a single charge, provided the current consumed by the valve filaments and the capacity of the battery is known. To obtain the working life per charge, it is merely necessary to divide the ampere-hour capacity of the battery by the total current consumed. The result will be in hours.

Certain batteries are rated in "ignition ampere-hours"; in this case the result as given by the above calculation must be divided by two. Fortunately, this misleading method of rating (as far as wireless purposes are concerned) is now almost obsolete.

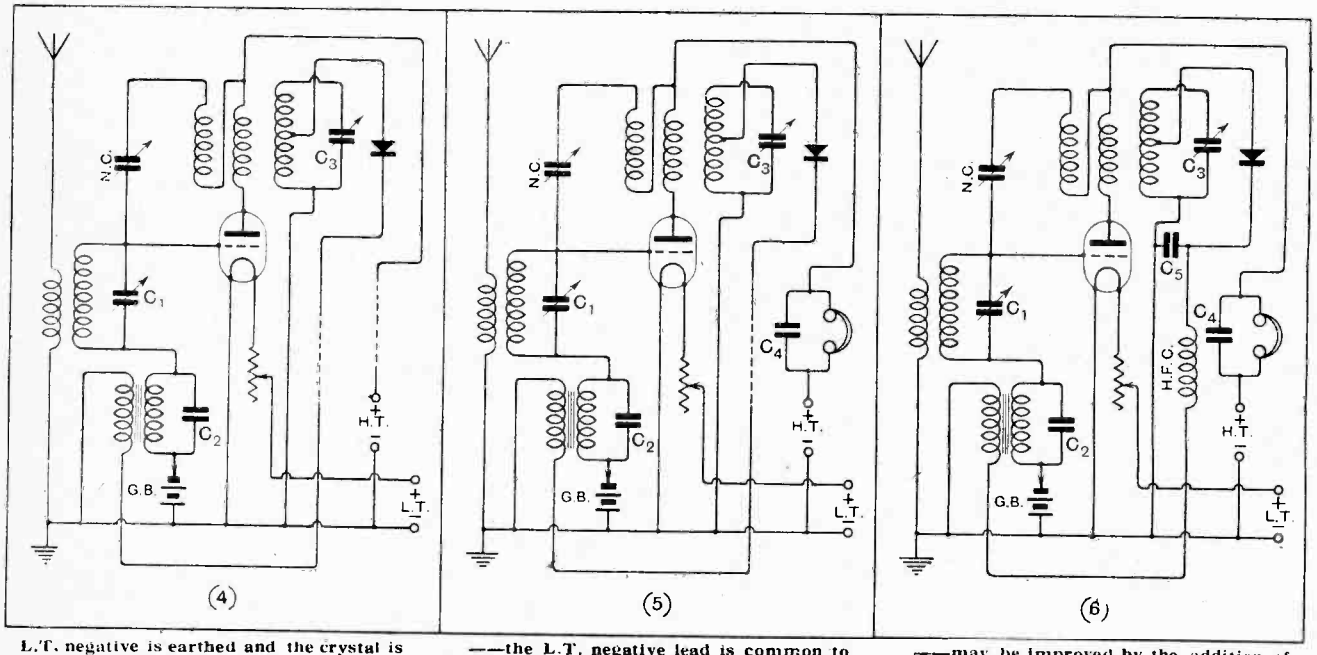
DISSECTED DIAGRAMS.

Practical Points in Design and Construction.

No. 70 (a).—A Single-valve and Crystal Reflex.

(Concluded from last week's issue.)

The present series of diagrams is intended to show progressively, and in an easily understandable manner, the various points to which special attention should be paid in the design of typical wireless receivers, and at the same time to assist the beginner in mastering the art of reading circuit diagrams. If components and values are carefully chosen, the single-valve reflex receiver shown below is capable of operating a loud-speaker. The data given apply to the normal broadcast waveband, on which all reflex receivers work at their best.



L.T. negative is earthed and the crystal is connected across a part of the H.F. transformer secondary. The rectified output is passed through the primary of the L.F. transformer. Note that——

——the L.T. negative lead is common to part of this circuit, and is at the low-potential end. The insertion of telephones, with an H.F. by-pass condenser, completes the receiver, which, however——

——may be improved by the addition of an H.F. choke and a by-pass condenser C_5 as shown above. While not essential, this modification generally makes for easier and more stable operation.

THE connection of the crystal to the transformer secondary is a matter of great importance in a receiver of this description; unfortunately, however, it is impossible to lay down hard-and-fast rules, as everything depends on the effective resistance of the crystal. The lower this resistance the fewer should be the number of turns across which it is connected. A low-resistance specimen of galena may be joined to perhaps the twentieth turn above the earthed end of the secondary, while a perikon combination is often tapped to the centre point. In practice, a number of temporary tappings should be made and the final connection decided upon as the result of an actual trial.

It will be noticed that the lower end of the H.F. transformer secondary is joined to L.T. negative; this means that the low-potential part of the H.F. circuit is definitely "tied down" to earth potential, with a considerable improvement in the stability of the receiver.

A capacity of 0.001 mfd. is suitable for the by-pass condenser C_4.

The H.F. stroke may be of a commercial pattern, with an inductance of some 40,000 or 50,000 microhenries; it must be kept clear of the other H.F. coils, and should be of small diameter. The condenser C_5, which is, in effect, across the L.F. transformer primary, should be chosen in accordance with the recommendation made by the makers of the latter component; a capacity of from 0.0003 to 0.001 is generally suitable.

The NATIONAL BROADCASTING COMPANY of America.

How Unified Control is Rapidly Raising the Quality of American Broadcasting.

By A. DINSDALE.

ON November 15th, 1926, the National Broadcasting Company made its formal bow over the air to the great radio audience of the United States. The formation of the company marks a logical step in the evolution of broadcasting in the country of origin of the art as we know it to-day.

The objects of the company are to provide a truly national broadcasting service which will bring within easy range of every inhabitant of the United States, wherever situated, the very best programmes it is possible to produce.

Owen D. Young, a member of the National Broadcasting Company's Advisory Council, said recently: "It is quite apparent that to a large degree broadcasting must be national in scope in order to give listeners the kind of service they should have. If the National Broadcasting Company can provide the highest quality of programmes which exists in the United States, no matter where the point of origin may be, and can disseminate it completely throughout the country so that everyone can hear it, no matter where he may be, and if it can do this without charge upon the listener and without unfair discrimination between those fairly entitled to use the facilities, it will, in my judgment, have rendered a great service to the American people."

Merlin Hall Aylesworth, President of the National Broadcasting Company, put it in another way in his opening remarks at the company's inaugural programme. He said: "The National Broadcasting Company owns only one station, and that is WEAF in New York City. It will manage stations WJZ in New York and WRC in Washington. Using stations WEAF and WJZ as centres of distribution, we are able to provide at least two networks of associated stations throughout the United States and so ensure a wide diversification of programmes. Our object is to provide these stations with programmes of national scope and to distribute them to such other broadcasting stations as may wish to take them. We shall, however, endeavour to avoid duplication of programmes in the same territory."

The writer was privileged to meet Mr. Aylesworth recently while travelling on the same boat, and was fortunate in being able to discuss matters at first hand and in securing the special message to *The Wireless World* readers printed on this page.

Mr. Aylesworth further described the National Broadcasting Company's position by explaining that, from a broadcasting point of view, the N.B.C. is to the local broadcasting station what the Associated Press is to the local newspaper, from a news distribution point of view.

The company has also made arrangements with the leading electrical firms to prosecute still further their researches into radio problems so that they may be able to make use of the latest technical developments.

A Special Message from MERLIN H. AYLESWORTH, President of the National Broadcasting Company, to British Broadcast Listeners.

British broadcast listeners are already very familiar with our American broadcasting, as broadcast through Stations WEAF, WJZ, WGY, and KDKA. These are the four high-powered stations in the networks of the National Broadcasting Company that are the most often heard by British listeners.

Sir John Reith has accepted our invitation to come over to New York to attend the inauguration of our new building and studios, and I hope then to have an opportunity to discuss with Sir John ways and means whereby the National Broadcasting Company and the British Broadcasting Corporation may proceed to an interchange of programmes.

If this can be arranged, and the engineers of both institutions can overcome the technical difficulties involved, we hope to make British Broadcasting as familiar to American listeners throughout the country, by means of our networks, as American broadcasting is to British listeners.

There would seem to be no reason why some message of great importance, either from America or from Great Britain, which would be of interest to the people of both countries, should not be freely exchanged through the medium of the facilities offered by both broadcasting organisations.

M. H. Aylesworth
N. B. C.

Radio Advertising—the American Attitude.

And how is this ideal system to be paid for? Who will provide the super-excellent programmes, since there is to be no tax or other obligation upon the listener?

The answer lies in indirect advertising. In America, as is well known, advertising has become an exact science—almost an art. Commercial and business interests will eagerly seize upon every possible medium which can be used to make known to the public their name and line of business. The American public is used to this, and does not mind the inclusion of broadcasting as still another medium, especially when it gets something in return—a fine programme.

The advertisers, on their side, have discovered that broadcasting offers an unrivalled medium for reaching,

The National Broadcasting Company.—

in America, some six million homes, in a manner that no other medium could possibly do. For this reason Frank A. Arnold, Director of Development of the National Broadcasting Co., says that "commercial broadcasting is the fourth dimension of advertising," the other three dimensions being the newspapers, magazines and posters, signs, etc.

To-day, therefore, an American advertiser who wishes to use the broadcasting medium engages artists and a suitable broadcasting station and broadcasts what is known as the "sponsored programme." His name (and sometimes that of his goods) will be mentioned as being responsible for giving the radio audience an opportunity to hear so-and-so.

When this plan was first tried out there was considerable outcry against it, for the obviousness and sometimes the blatancy of the announcement was unpalatable to the listeners. To-day such announcements are made with much greater unobtrusiveness and create no offence. As Mr. Arnold puts it, "No one thinks less of Grand Opera because it has its guarantors."

Extending the Networks.

Over $2,000,000 will be expended for broadcasting talent alone in 1927 by commercial and business interests sponsoring programmes over the National Broadcasting Company's networks.

Before the formation of the N.B.C., Station WEAF, New York, was owned and operated by the American Telephone and Telegraph Co., and WJZ was owned and operated by the Radio Corporation of America. Both these stations were linked up with a limited number of stations in other States, and these networks were known as the Red and Blue chains.

In taking over the two New York stations the N.B.C. retained the Red and Blue chains, and these have formed the nucleus from which has grown a nation-wide network of "S.B." on a gigantic scale, with alternative programmes available almost throughout. By that is meant that an alternative programme of the highest quality, but of different character, is available. There are also available to most listeners, of course, the lesser low-powered stations, providing more or less inferior programmes.

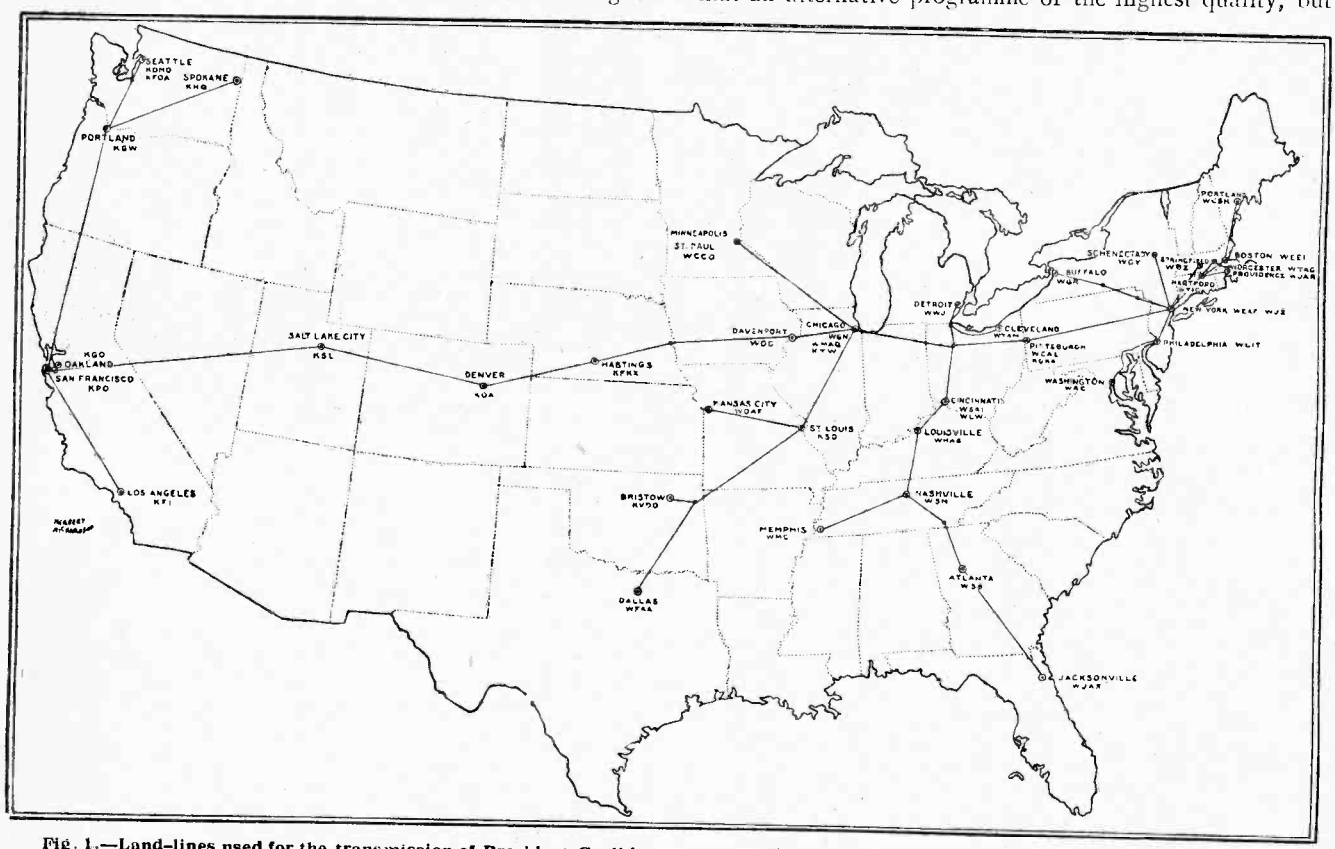


Fig. 1.—Land-lines used for the transmission of President Coolidge's address, Washington's Birthday, February 22nd, 1927, broadcast by the National Broadcasting Company through its 42 associated stations.

When this plan was first tried out there was considerable outcry against it, for the obviousness and sometimes the blatancy of the announcement was unpalatable to the listeners. To-day such announcements are made with much greater unobtrusiveness and create no offence. As Mr. Arnold puts it, "No one thinks less of Grand Opera because it has its guarantors."

The N.B.C. do not in any way desire to usurp a monopoly of broadcasting. They do not desire to eliminate the small broadcaster. On the contrary they invite competition. The small broadcaster has his place. He cannot afford to supply a high-grade programme, but there are thousands of listeners who desire to listen to the class of matter he has to purvey. The N.B.C. do not wish to broadcast such matter, so that the two interests cannot clash, and both may live without there being any question of a monopoly.

It would scarcely be possible for one organisation to hold a monopoly of broadcasting in a country so vast as America, which has twice the area of Europe. The

The National Broadcasting Company.—

distance from New York to San Francisco is about equal to that between the west coast of Ireland and Moscow.

It was at first anticipated that the task of widely extending the Red and Blue chains would take many months, but the country-wide demand for the opportunity to hear the very best artists in every sphere speeded up the process considerably. To date, over 100 stations have applied for the network service, which, starting from New York, extends north to the Canadian border, south to Florida and Texas, and west to the Pacific coast from Seattle in the north to Los Angeles in the south.

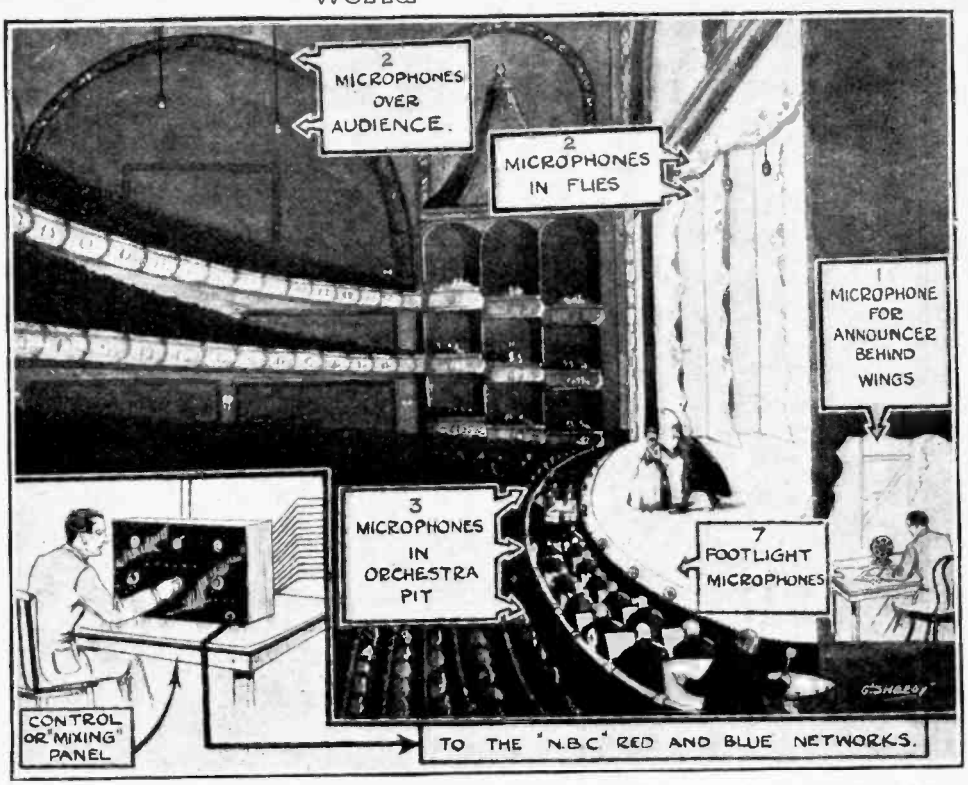
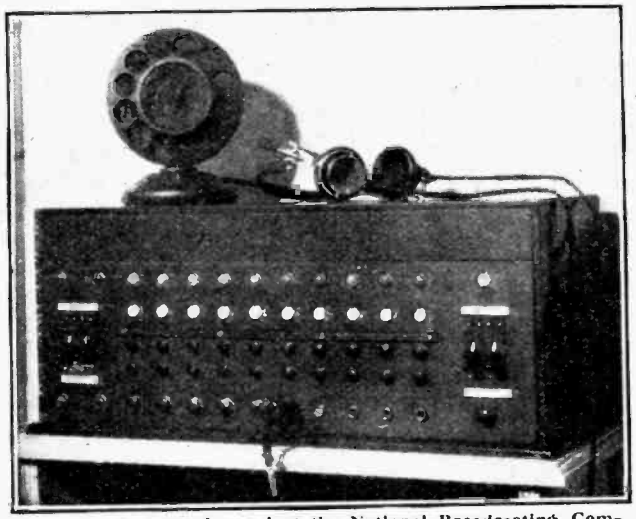


Fig. 2.—Arrangement of microphones for broadcasting a performance of "Faust" from the Chicago Civic Opera House.

How the Chains are Operated.

To explain the operation of the chains, let us consider the Red chain, which uses Station WEAF as the key station. The complete network is shown in Fig. 1, and covers a total line distance of some 10,000 miles. The stations are, of course, linked up by telephone lines, and when the entire chain is in operation 400 engineers are required to operate it. Half of this number are telephone engineers and half radio engineers.

Connecting up the special circuits, testing them and making sure that they are kept free from noise and in constant connection with each other occupies the attention of the telephone engineers. The term "special circuit" should not be confused with the ordinary telephone circuit. True, these "special circuits" which are used for linking up the broadcasting stations are telephone circuits, but they have been cleared of all other traffic and specially prepared to carry the wide range of frequencies involved in broadcasting.



Announcer's control panel at the National Broadcasting Company's Station, WEAF. This instrument is situated in the studio itself.

The ordinary American long-distance telephone circuit may carry at the same time four or five telephone messages, besides numerous telegraph messages. Each of these is transmitted on a special frequency so that it cannot interfere with any of the others, but a special circuit between broadcasting stations can carry only the broadcast transmissions.

It must be equipped with special repeaters or valve amplifiers, since the ordinary repeaters used in telephone communication are not designed to cover at one time such a wide range of frequencies. The cut-off of the ordinary long-distance telephone line and its associated repeaters is at about 2,500 or 3,000 cycles, whereas a circuit for broadcasting must carry frequencies up to about 8,000 cycles.

Starting from the studio of WEAF, programmes are first carried by special telephone circuits to the Bell System Building, at 24, Walker Street, New York, where the central exchange is situated. At the same time they are also sent by wire to the Bell Telephone Laboratory, at 463, West Street, on top of which building WEAF's aerial is suspended.

From Walker Street a huge network of lines radiates, covering the entire country, and the outgoing programmes are put on to the special lines of the Red chain. The ramifications of these lines can best be followed by reference to the map in Fig. 1.

The National Broadcasting Company.—

At junction points where two or more circuits join, and at other positions along the line, valve amplifiers are used to amplify the signals travelling over the circuits, in order to make sure that practically the same signal strength is delivered to each of the stations which are broadcasting the programme.

In addition to the special telephone circuits on which the programme is carried, another circuit paralleling the first is used to keep all stations in the chain in constant communication with each other by telegraph. In this manner, the condition of the various circuits is checked at regular intervals to make sure that every word and every note of the programme which is originating at WEAF is reaching all of the stations in the chain with good volume and without extraneous noise.

Programme Material.

Turning now to the programme side of the National Broadcasting Company's activities, a review of the programmes presented during the few short months of the company's existence reveals a surprisingly large number of outstanding features.

Commencing with the company's inaugural programme, we find such internationally known features as the New York Symphony Orchestra; Harold Bauer, the distinguished concert pianist; Mary Garden, the opera star; and the inimitable Will Rogers. A remarkable feature of this broadcast is that Mary Garden's voice was "picked up" from Chicago, and Will Rogers spoke from Independence, Kansas, and yet the entire programme went through without a hitch, perfectly timed.

On New Year's Day listeners in the north-eastern section of the country, in the grip of the intense cold of midwinter, were treated to a detailed report of a football match being played in California, where the announcer sat in the open in his shirt sleeves.

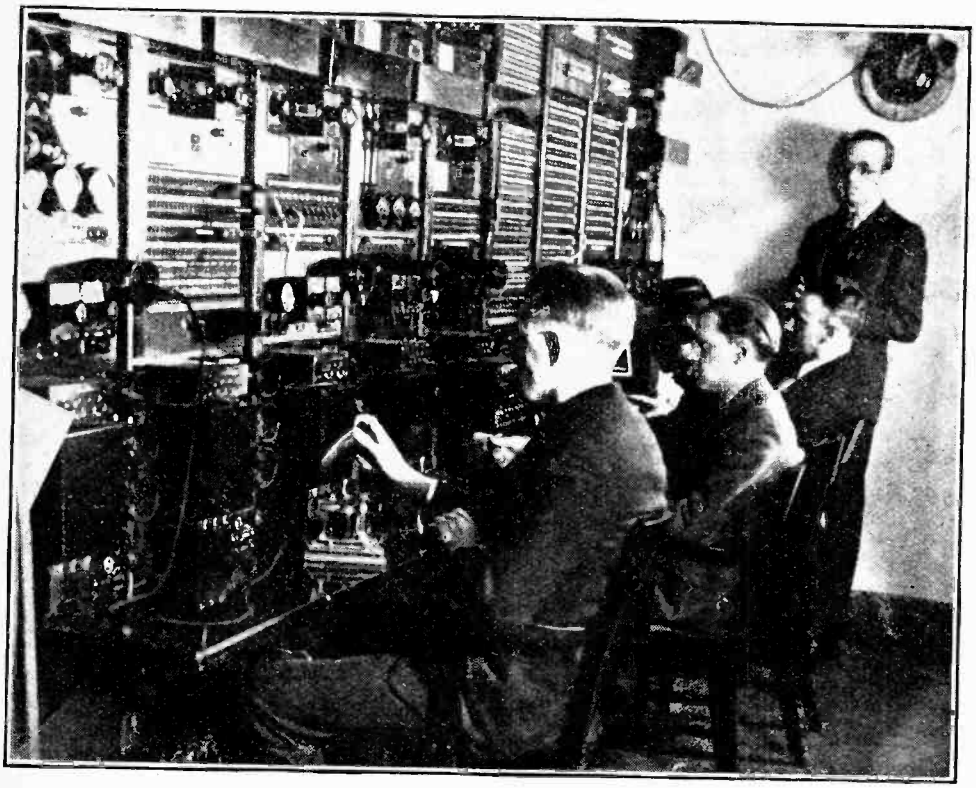
Grand Opera.

The first nation-wide transmission of Grand Opera from the stage was accomplished by the N.B.C. on January 21st of this year in a manner which attracted the attention of the whole country, not only as an artistic achievement but as a technical achievement as well. On this occasion there came to millions of homes, for the first time, not only the arias of a great opera, but the actual feel and atmosphere of the Civic Auditorium in Chicago, where a distinguished audience sat enraptured at a performance of "Faust." Of this, more anon.

On February 22nd forty-two stations, as shown on the map, broadcast President Coolidge's address on the occasion of Washington's birthday. It is estimated that in the United States alone twenty-five million people heard this address, which was also picked up on the short wave and rebroadcast by the B.B.C.

Besides this list of leading features, there is a list made up of 14 famous operatic stars, 15 great concert stars, four leading orchestras, nine stage stars, and many others who have broadcast.

Amongst the material broadcast are 14 recitals and tabloid operatic performances, seven light operas, and four dramatic performances. Three of America's leading bands and six of her leading religious lights have also appeared before the microphones of the Red and Blue chains. Other matter includes labour discussions, addresses on governmental and political education, general education, discussions on current events, outstanding sporting events, agricultural courses and information, and popular orchestral music, all broadcast by persons who are acknowledged leaders in their particular sphere.



Input control board at station WEAF, 195, Broadway, New York. The telegraph sounder in the foreground is for maintaining communication with other stations in the N.B.C. chain.

How "Faust" was Broadcast.

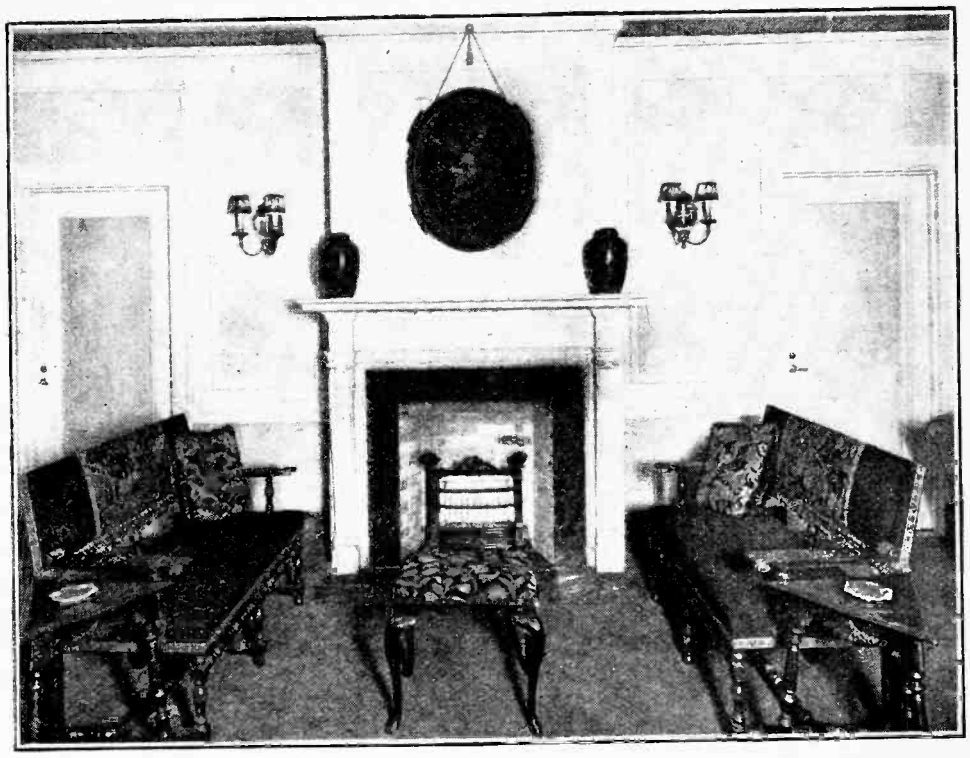
The broadcasting of "Faust" from Chicago Civic Opera House was an outstanding technical achievement in itself, for as many as fifteen microphones in parallel had to be used. Such a large number had never been handled before, and some clever work had to be done to arrive at the correct positions and also in connection with the controls, or "mixing

The National Broadcasting Company.—

panels" as they are called.

For a week before the performance engineers were busily engaged installing their apparatus and making trials during the rehearsals. To pick up the sounds from the stage two microphones were placed in the flies, and seven along the footlights. Three microphones in the orchestra pit picked up the orchestra, whilst two more, hung high up over the audience, served to pick up the incidental noises amongst the audience which go to make up the "feel" and atmosphere of a great auditorium.

These same two microphones also served to provide an echo effect by picking up sounds from the stage a fraction of a second later than the footlights microphones.



Reception room at one of the N.B.C. Stations.

The arrangement is shown diagrammatically in Fig. 2.

During the initial trials to find the best positions for the microphones, trained musicians joined the engineers in listening, by means of a monitoring system, to the results, and they offered expert advice on the musical side of the effects.

Musicians also helped with the problem of linking microphones into groups and in their proper control at the "mixing panel." This panel served as the central control point for all the groups of microphones, and it was here that all the microphone outputs were added together and sent out over the line as the complete broadcast.

Obviously, careful handling was necessary, or certain instruments in the orchestra, or parts of the performance, could easily have been over-accentuated. That a perfect balance was obtained throughout, to the complete satisfaction, and even amazement, of musical critics listening all over the country, speaks well for the careful and expert work of the controlling engineers and musicians.

On the occasion of this broadcast, only twenty-six stations had been linked up in the N.B.C.'s network. It was not until the occasion of President Coolidge's address that the chain was extended to forty-two stations, as shown in Fig. 1.

The Latest in Studio Design.

The N.B.C.'s engineers recently had an opportunity to make use of all their accumulated knowledge of studio design when they were called in to design one for New York's latest picture house, the Roxy Theatre. This theatre is the largest in the world, and superlative in every degree in everything appertaining to it.

In the building of it a large space was left empty for broadcasting purposes, and the N.B.C. engineers were given a free hand to fill it.

Besides giving a moving picture entertainment, the Roxy Theatre provides variety turns, and every Monday night a variety entertainment from the theatre is broadcast through WJZ.

For this purpose the studio was constructed on the fifth floor of the building, far enough above street level to ensure that no interference should be experienced from street noises. A unique feature is the visitors' gallery. It is sound-proof, and shut off from the studio by a glass window through which visitors can watch the performance in the studio below whilst listening to it as reproduced by a loud-speaker.

Having been given an entirely free hand the engineers, working in conjunction with the architects, were able to design a studio with as nearly perfect acoustical properties as modern experimentation in the study of sound and echoes can at the present time produce, and a system of control apparatus for relaying the programme to the broadcasting station which is a model of convenience and efficiency.

The studio is constructed without pillars or breaks in the wall surfaces which might destroy its acoustical properties, and every corner of the room, including those between the side walls and the ceiling, is exactly a 90-degree angle.

The National Broadcasting Company.—

Through the middle of the ceiling a square shaft runs to the organ loft, which contains a specially designed organ used for broadcasting only. Above the surface of the ceiling, in the loft, the four walls of this shaft consist of shutters, any of which can be opened to any degree, controlling the volume of the organ music which can enter the studio and reach the microphone, as well as allowing emphasis to be placed upon any desired portion of the music. The organ is played from a manual in the studio directly below the loft.

At regular intervals round the walls of the studio are microphone outlets connected to the control board. Since many different kinds of music are to be broadcast from the studio, including the work of a large chorus, many more microphone outlets have been provided than in most remote-control studios.

Special lighting arrangements have been made, with a view to illuminating every portion of the studio without producing any objectionable glare. Special attention has also been bestowed upon the question of ventilation, a point overlooked in a great many studios.

From his place at the control panel the control engineer can see the whole of the studio through a glass panel, and a complete system of signal lights enables him to communicate with the artists. Also seated in the control room with the engineer will be one of the assistant conductors of the theatre, who will assist the engineer in his control work so as to ensure a correct musical balance.

Future Plans of the N.B.C.

Amongst the future plans of the National Broadcasting Company, perhaps one of the most important is the building of a new WEAF. This decision was made when the station was sold by the American Telephone and Telegraph Company to the N.B.C., the reason given being that the station, as at present located, interferes with research work being carried on at the Bell Telephone Laboratories, on top of which WEAF is situated.

The new station is to be built outside the city limits, on Long Island, and it will have a power of 50 kW. It is expected to be ready some time this autumn, and it will incorporate all the latest principles of construction and equipment. Some of America's foremost engineers are engaged upon the work.

By placing the station out in the country the screening effect of tall steel-framed buildings will be eliminated, and this, coupled with the great increase in power over that at present employed, will give the station a vastly increased range.

About June 1st next the N.B.C. expect to move into their new office building, which is at present under construction at 711, Fifth Avenue, New York. This building, besides housing the executive and engineering staffs, will also contain all the studios.

In connection with these new studios an interesting experiment is to be tried. It has been argued by many that a temperamental artist cannot be expected to give of his or her best under conditions which are not harmonious to the artist's particular temperament. Bearing this in mind, therefore, the N.B.C. are going to unheard-of lengths in the decoration and lighting effects of their new studios.

The gaudily decorated and brilliantly, even garishly, lighted studio may be expected to suit some artists; others may prefer a quiet drawing-room effect; whilst still another type of artist may prefer a sombrely decorated, dimly lit library.

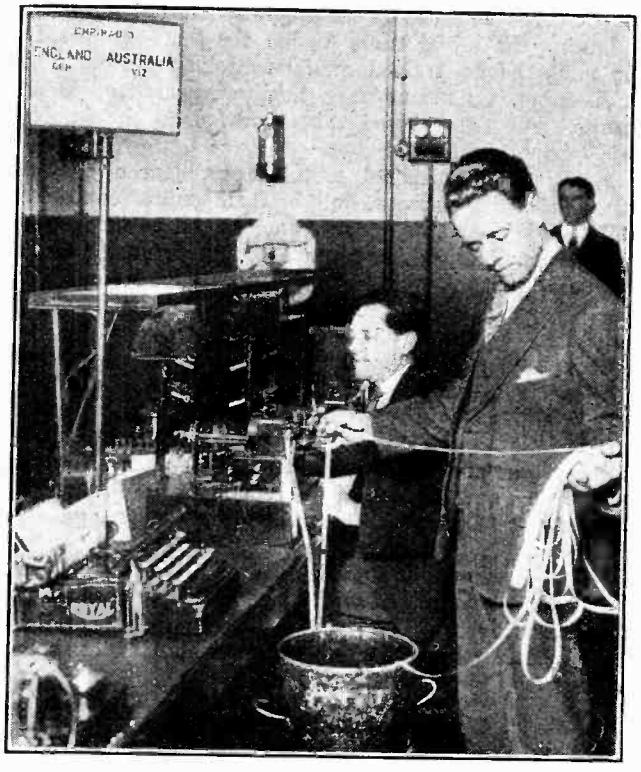
These, it is understood, are the general lines upon which the N.B.C. are working, and the fruition of their plans, and the results of their execution, will be awaited with interest. When further particulars become available, the writer hopes to give a detailed description of these studios, and the results obtained by their use.

Educational Features.

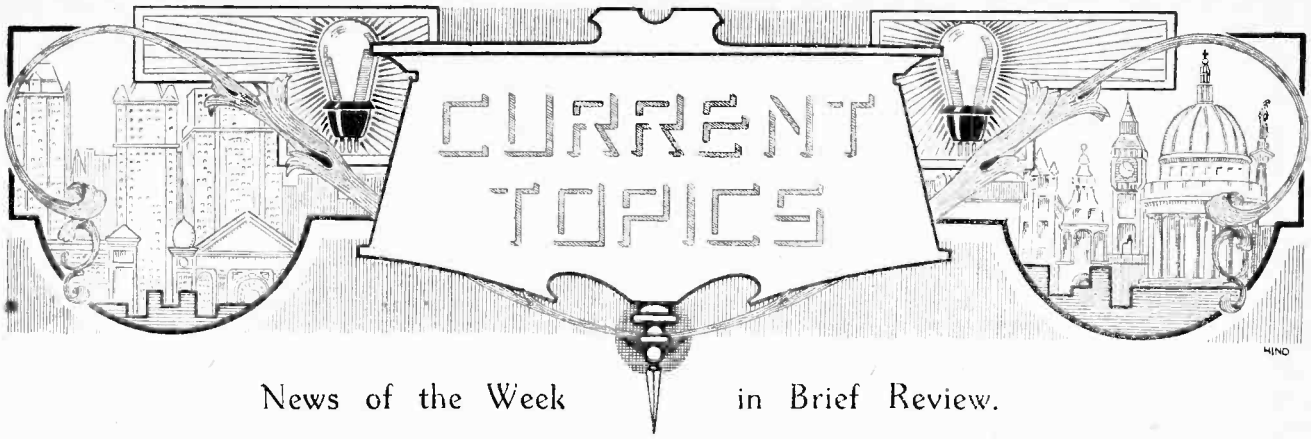
Another plan under consideration has to do with adult education. Just as now, under the present system of broadcast entertainment in America, that entertainment is virtually endowed, so the N.B.C. hope soon to establish an endowed "University of the Air."

This plan is based on the idea that it should be just as easy for philanthropically inclined individuals or institutions to endow a "University of the Air" as it is to endow an ordinary university or other institution of learning.

Many people may be somewhat dubious as to the outcome of such an experiment, but at least the results will be awaited with considerable interest by both "highbrows" and "lowbrows."



AUSTRALIAN BEAM SERVICE. Telegraphic instruments at the Central Radio Office, London, through which messages are sent to the beam transmitter at Grimsby and received from the corresponding station at Skegness.



News of the Week in Brief Review.

BOOMING WIRELESS IN ITALY.

To "popularise" wireless reception, the Italian Government proposes to exact a small radio tax from all householders, whether they listen or not.

Signor Mussolini is reported to have planned an Italian "Daventry."

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LIFEBOAT INSTITUTION'S WIRELESS EXPERIMENT.

The new motor lifeboat provided for Rosslare Harbour, County Wexford, by the Royal National Lifeboat Institution, is the first of the Institution's boats to be provided with a wireless transmitter and receiver.

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RADIOTELEPHONY AT R.A.F. DISPLAY.

At the eighth Royal Air Force Display, to be held at Hendon on Saturday, July 2nd, air drill by radiotelephony will again occupy a prominent place on the programme. It is understood that the wireless manœuvres will be conducted by No. 41 fighter squadron in place of No. 25 squadron, which has performed the task for the last two years.

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1,000-METRE FOG BEACON.

The wireless beacon fog signal at Round Island Lighthouse, in the Isles of Scilly, will be brought into operation on May 20th. In foggy weather it will transmit the call sign "GGG" repeatedly for 48 seconds with intervals of three minutes, using a wavelength of 1,000 metres.

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"RED RUFUS."

Unpleasantness arising out of an "oscillation" problem had a sequel at the Bradford Police Court last week, when Mr. W. Marsden was summoned by his neighbour, Mr. S. Brown, for threats.

Mr. Brown complained that on Easter Monday the defendant had banged at his door shouting: "I will ram this knife in your back, you oscillating ——. I will swing for you." The defendant's wife admitted banging on the wall and demanding that "Red Rufus" (as she had nicknamed the complainant) should "give over oscillating."

Marsden was bound over for six months and ordered to pay 4s. costs.

MORE RECEIVING LICENCES.

The receiving licences issued at the end of March numbered 2,253,845, as compared with 2,235,000 at the end of February. A year ago the licence figure had just passed the two million mark.

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AERIALS IN THE FATHERLAND.

In Germany, according to a Court ruling, a tenant is not necessarily entitled to erect a wireless aerial against his landlord's wishes. The question must depend upon the terms of the lease.

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MARCONI'S AS BOLIVIAN G.P.O.

Under a contract with the Bolivian Government, Marconi's Wireless Telegraph Co., Ltd., has taken over the control and operation of the entire postal, telegraph and wireless services of Bolivia for a period of 20 years.

The Marconi Company entered into a similar arrangement with the Peruvian Government in 1921 with highly satisfactory results.

TOC H WIRELESS SET.

A wireless installation subscribed for by the public through the Wood Green Group of Toc H has been handed over to the North Middlesex Hospital, Edmonton, by Sir Arthur Stanley.

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ACADEMY PORTRAIT OF DR. FLEMING.

A portrait of Dr. J. A. Fleming, F.R.S., by Sir William Orpen, R.A., is exhibited at the Royal Academy in Room XI. This portrait was commissioned by friends and the old students of Dr. Fleming for presentation to University College, London, as a memorial of his 42 years' tenure of the Chair of Electrical Engineering in the College. It is considered to be an excellent likeness.

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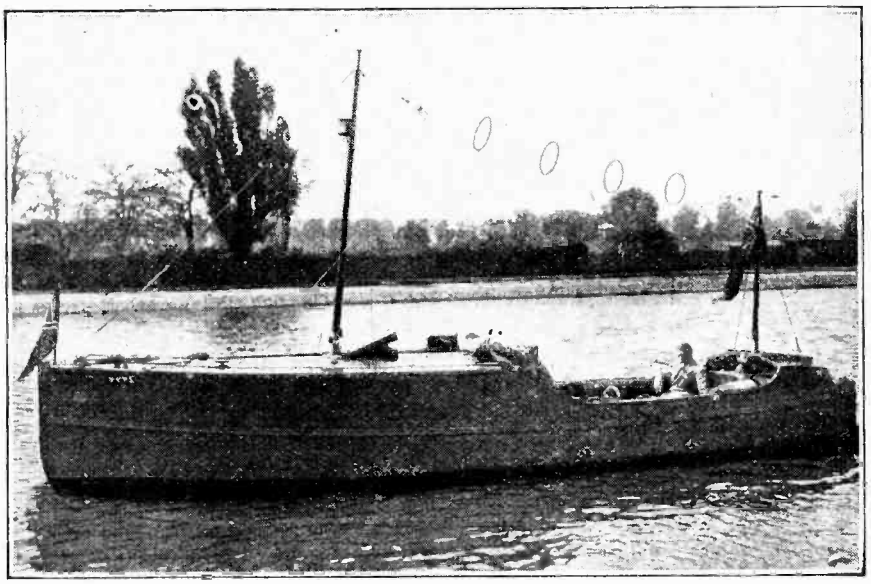
P.M.G. ON TRAMCAR INTERFERENCE.

Sound technical advice regarding the elimination of interference from tramcars is contained in a letter sent by Sir W. Mitchell-Thomson, M.P., the Post-



HOW TO MEET A HEAT WAVE.—A suitably equipped motor-boat, with wireless receiver and cage aerial, photographed last week on the Thames near Kingston.

master-General, to Mr. W. J. Baker, M.P. for East Bristol, in response to an appeal by Bristol listeners who are troubled by this form of annoyance. The P.M.G. recommends the modification of sets to improve their selectivity and, alternatively, the fitting of suitable chokes and condensers in connection with a counterpoise earth instead of the usual direct earth.

With regard to suggestions that the interference should be combated by substituting carbon rollers for the metal rollers in the trolley arms and by fitting condensers of 30 microfarads capacity across the overhead and earth contacts, Sir William states that considerable experimental work would be necessary before these remedies could be adopted.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 11th.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove. Demonstration of "Neutrosonic-Seven" Receiver, by Messrs. The Igranic Electric Co., Ltd.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration: "The Uses of the Wavemeter," by Mr. C. Jordan (G6JD).

North Middlesex Wireless Club.—At 8 p.m. At Shaftesbury Hall, Bowes Park. Lecture: "High Frequency Amplification," by Mr. W. Gartland.

SUNDAY, MAY 15th.

Tottenham Wireless Society.—Field Day on the River Lea at Broxbourne, with transmission between various experimental stations.

MONDAY, MAY 16th.

Croydon Wireless and Physical Society.—At 8 p.m. At 128a, George Street. Talk on "Methods of Amplification and Reproduction," by Mr. W. E. Ansell.

WEDNESDAY, MAY 18th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. At the Institution, Savoy Place, W.C.2. Lecture: "A Wireless Works Laboratory," by Mr. P. K. Turner.

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AIRCRAFT WIRELESS.

At the opening session of the International Commission of Air Navigation, held in London last week, it was recommended that all passenger airplanes should carry a wireless operator competent to transmit by wireless telegraphy.

LISTEN FOR KHABAROVSK.

The Russian wireless station at Khabarovsk, which is one of a chain of about a dozen stations in Eastern Siberia, is being completely modernised by the Westinghouse Electric and Manufacturing Company of America, which is supplying new valve equipment in place of the existing spark apparatus.

The Wireless World understands that Mr. Carl J. Madsen, the company's engineer, who is installing the plant, is a short-wave enthusiast, and has taken with him his short-wave transmitter. On or about July 19th Mr. Madsen will attempt to communicate with KDKA, transmitting on 63 metres.

NEWS FROM THE TRADE.

The Hart "Purse."

A useful advertisement novelty has been issued by the Hart Accumulator Co., Ltd., Stratford, London, E.15, in the form of a colourable imitation of an imitation crocodile leather purse containing a folder giving details of Hart batteries for all wireless circuits.

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A Battery Deal.

The General Radio Company, Ltd., 235, Regent Street, W.1, has purchased Radiobats, Ltd., securing control of that company's high-tension factory, which has an output of 7,500 cells per week.

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Wireless in Southend Charity Effort.

In connection with an endeavour to raise £10,000 for the addition of a children's wing to the Southend New General Hospital, an enterprising effort to gain publicity for the scheme was recently made by the local wireless firm of S. H. Davis and Son. A public address system was installed on the front by the firm's engineers and a mayoral speech was broadcast in addition to numerous musical items from Daventry. A sum of £200 was collected.

The Osram Bulletin.

The April number of the Osram G.E.C. Bulletin, just received, contains an interesting article on the three new Osram 4-volt "steep slope" valves besides pages devoted to the K.L.1 valve and the Gecophone power transformer specially designed for feeding current at the correct voltage from the mains to the heater element.

LOUD-SPEAKERS ON THE FRONT. In connection with an appeal for the local hospital, a Southend wireless firm installed its own broadcast and public address system on the promenade.

Supplying Fifty Loud-speakers.

One of the largest hospital receiving sets in existence is on view at Messrs. Holdron's, Ltd., of Rye Lane, Peckham, S.E. Built for installation in St. Giles' Hospital, Camberwell, under *The Daily News* scheme, the set contains 12 valves, and will feed 1,100 pairs of headphones and fifty loud-speakers.

EMPIRE BROADCASTING.

The need for the establishment of a short-wave broadcasting service to the Dominions has been frequently emphasised in THE WIRELESS WORLD, and formed the topic of discussion in our Editorials of April 27th and May 4th. Readers may be interested in the following extract from a London evening paper, in which our proposals are strongly supported.

THE topic of Empire broadcasting, that is, transmitting direct from the Mother Country to the Dominions and the Colonies, has again been made the subject of discussion, and the B.B.C. are being urged to make some effort in this direction.

So far the best achievements have been made on the ultra-short waves round about 20-30 metres, and the majority of the successful communications have been carried out by amateurs. There is no doubt, however, that listeners, both here and overseas, are intensely keen about the possibility of such a development.

Perhaps one of the best performances, which gives much weight to the arguments of the advocates of an Empire service, was that recently accomplished by a Dutch station, which had its programme received at Sydney and re-broadcast to Australian listeners.

If a foreign station can successfully transmit to the Antipodes on a wavelength of 30 metres, there seems to be no logical reason why our own Corporation should not begin to delve a little deeper into the possibilities.

High-power stations are the fashion at the moment, but, so we are assured, will work on the broadcast wave band of about 400 metres, if and when erected.

Would it be too much to expect a little experimenting on the lower band, so that Britishers all over the world could listen?

If Australia will relay a transmission from a Dutch station, writes our wireless correspondent, what would she give for the opportunity of dealing with a programme from England?—*Evening Standard*, May 5th, 1927.

HOME PORTABLE LOUD-SPEAKER SET.

Using Four-electrode Valves with 40 Volts H.T.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

THE idea of making a complete, self-contained, portable receiver, with aerial, batteries and loud-speaker all in the one case, is by no means a new one, but in most cases portable sets are designed from the point of view of obtaining a very low weight, even at the expense of efficiency.

The average portable set for loud-speaker work, using ultra-lightweight batteries, will not give distortionless results for very many hours, owing to the load on the small-capacity H.T. battery, and also will not run for very long on one charge of its L.T. supply, even though valves having a very low consumption may be fitted.

The set to be described in this article, as its name implies, is not intended to be taken on a walking tour or carried to picnics, except in a car, but is intended primarily for use at home or in the garden. Its batteries are sufficient to give a month's average use with one charge of the L.T., and good quality is ensured by the use of H.T. accumulators, while the loud-speaker reception is restricted to the local station. This set is eminently suitable for those people who wish to receive the local station but who do not want to be bothered with "wires all over the place," and who object to an outside aerial as being either unsightly or inconvenient to erect, or both—and quite a large number of listeners come into this category.

The Question of Weight.

It might be objected that a self-contained receiver using accumulators for high-tension as well as low-tension supplies is not going to be very light in weight, and thus could hardly be called a portable set. However, this trouble is not nearly so bad as would be expected, since the H.T. accumulators complete actually weigh less than the L.T. accumulators, and the weight of the whole set is only 38lb., of which the batteries contribute 15 lb.

This comparatively light weight for the long time of running on one charge is made possible by the use of four-electrode valves.

The writer has recently described [1] two receivers using four-electrode valves for L.F. amplification, where H.T. voltages of the order of only 40 volts were used and really good loud-speaker volume and reproduction obtained. The advantages of the use of large capacity H.T. batteries have several times been discussed in this journal, but in view of the fact that accumulator H.T. is provided for in the Home Portable Set, these advantages will now briefly be shown again.

An ideal valve amplifier should be supplied with constant H.T. voltage—which implies a source of high-tension of negligible resistance—as otherwise the output current in the plate circuit of the valves will not vary exactly in accordance with the input voltage to the grids, *i.e.*, distortionless amplification will not be obtained. Now when a dry battery gets old and exhausted its resistance increases enormously—the resistance of an average 60-volt battery, for example, may become many thousands of ohms—and in a two-stage L.F. amplifier this resistance, in the absence of a shunting condenser, is usually quite enough to couple the low-frequency valves together and make them "howl," giving a high pitched note in the loud-speaker. A condenser of one microfarad (or more) capacity used in parallel with the battery will have the effect of stopping the howl, since its impedance (or effective resistance) is only a hundred ohms or so at a frequency corresponding to the howling note, and thus the total effective resistance of the battery supply will be reduced to the order of a hundred ohms, which will not give sufficient coupling for the valves to oscillate, *but*—and this is a point which cannot be too strongly emphasised, as it is often forgotten—the actual resistance of the H.T.

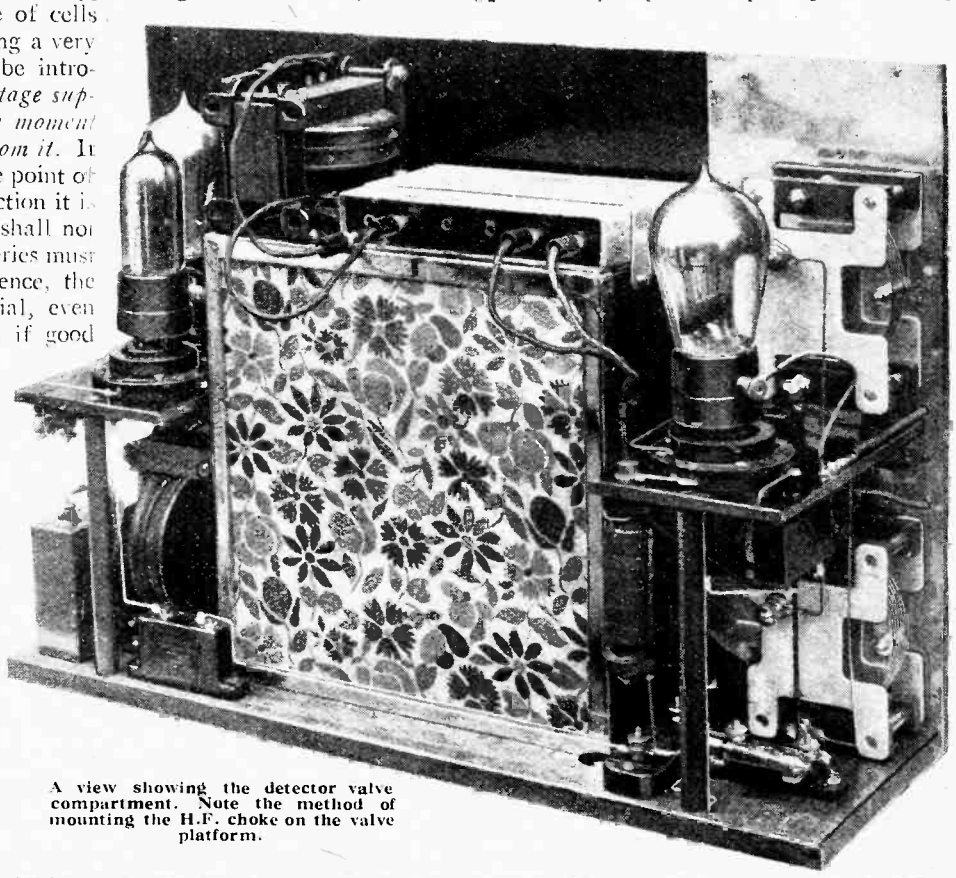
[1] *The Wireless World*, March 9th, 1927, and May 6th, 1927.

Home Portable Loud-speaker Set.—

battery has *not* been reduced by using a condenser across the H.T. in this way. Owing to the large current required by the average L.F. valve—the mean current being 5 milliamperes or more per valve—the small type of high-tension battery using the smallest type of cells will be hopelessly overrun, giving a very short life, also distortion will be introduced, since *the actual H.T. voltage supplied by such a battery at any moment depends on the current taken from it.* It follows, therefore, that from the point of view of obtaining good reproduction it is essential that the H.T. supply shall not be overloaded—*i.e.*, if dry batteries must be used on the score of convenience, the large size type cell is essential, even from the point of view of cost, if good quality is to be maintained.

A small cell battery which is overloaded will only keep a sufficiently low internal resistance for a very few weeks, after which it must be discarded, while the very large cell battery, costing about two or three times as much in first cost, will last nine or ten times as long before being discarded for high resistance, while H.T. accumulators of good make keep their low resistance for several years if kept charged, say, from two to four times per year, depending upon the capacity of the cells.

This question of H.T. supply has been gone into at some length because so many people think the small cell H.T. is all right for loud-speaker work if an H.T. condenser is used, and to show that the more expensive large size dry cells or accumulators are really worth while from the quality point of view and also from the cost point of view when the cost of correctly running the set for, say, a year is taken into account.



A view showing the detector valve compartment. Note the method of mounting the H.F. choke on the valve platform.

The Circuit.

To return to the Home Portable Set, the circuit is given in Fig. 1. The low-frequency side will be dealt with first, as it is with L.F. four-electrode valves that the writer has already dealt in previous sets, and which will therefore be more familiar to readers. The first L.F. valve is coupled in the usual way to the second valve by means of a 4 : 1 transformer X, and a choke feed output to the loud-speaker is used from the latter.

This choke (Y in Fig. 1) is used in order to make full use of the low H.T. of 40 volts, although it introduces more weight into the set. The average loud-speaker resistance (D.C.) is between 2,000 and 4,000 ohms, and the *mean* current in the last valve is somewhere about 5 milliamperes. so that the D.C. voltage drop across the loud-speaker, if the latter is connected straight in the plate circuit of the last valve, would be from 10 to 20 volts. This voltage drop is not serious when plenty of H.T. is available, but where it is limited it is of the utmost importance to reduce this loss as far as possible. The choke Y actually used is a Pye 32 henry choke, which has the comparatively low D.C. resistance of about 700 ohms—giving a D.C. voltage drop of about $3\frac{1}{2}$ volts only at 5 milliamperes plate current, which is not a serious item even with low H.T. voltages.

The use of a choke feed output, as it is called, has another advantage in that no direct current flows through the loud-speaker windings which would tend to saturate the soft iron pole-pieces of the latter, thus producing distortion, and in the case of most small loud-speakers 5 milliamperes would go some way towards doing this.

The inner grids of the two L.F. valves are connected together and tapped on to about 10 to 12 volts positive on the H.T. supply, and thus are used as space charge reducers. So much for the L.F. valves. The next thing to consider is the detector, or first valve.

On examining the circuit it will be seen that the input to the valve goes between *inner* grid and filament and that the output is taken from the plate in the usual way, the valve being used as an *anode bend* rectifier. Neglecting for the moment the *outer* grid, it will be seen that the frame and first valve constitute a normal Hartley circuit, with C_2 as the feed back, or reaction condenser, and R_1 and C_5 a resistance-capacity coupling to pass on the rectified voltages to the next valve.

In the case of an ordinary three-electrode valve of high amplification factor, the value of capacity C_2 required for the valve to oscillate is very small—only a few micro-microfarads—and it quite often happens that this amount

Home Portable Loud-speaker Set.—

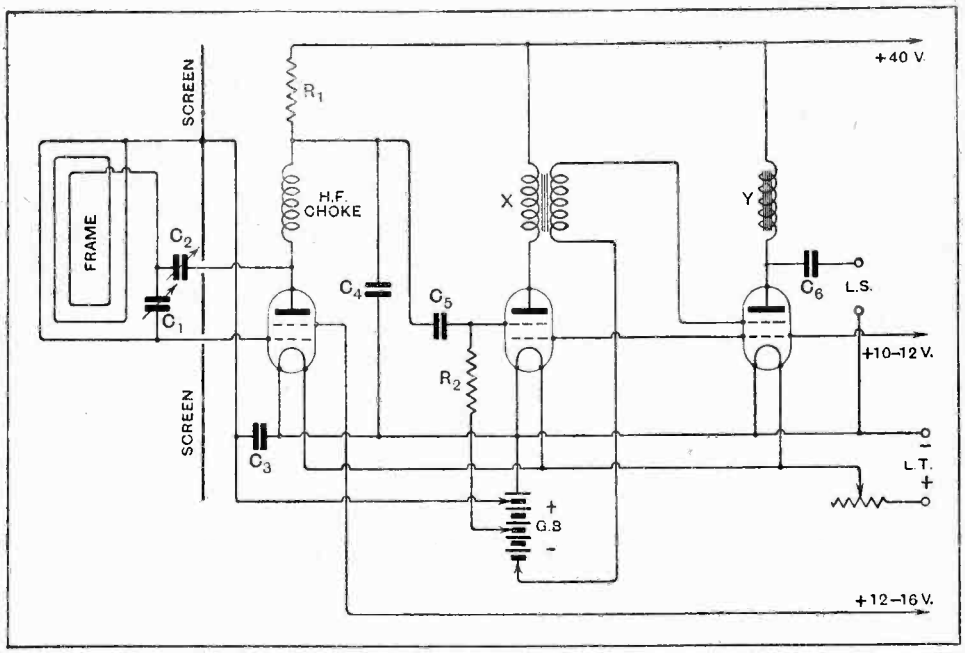
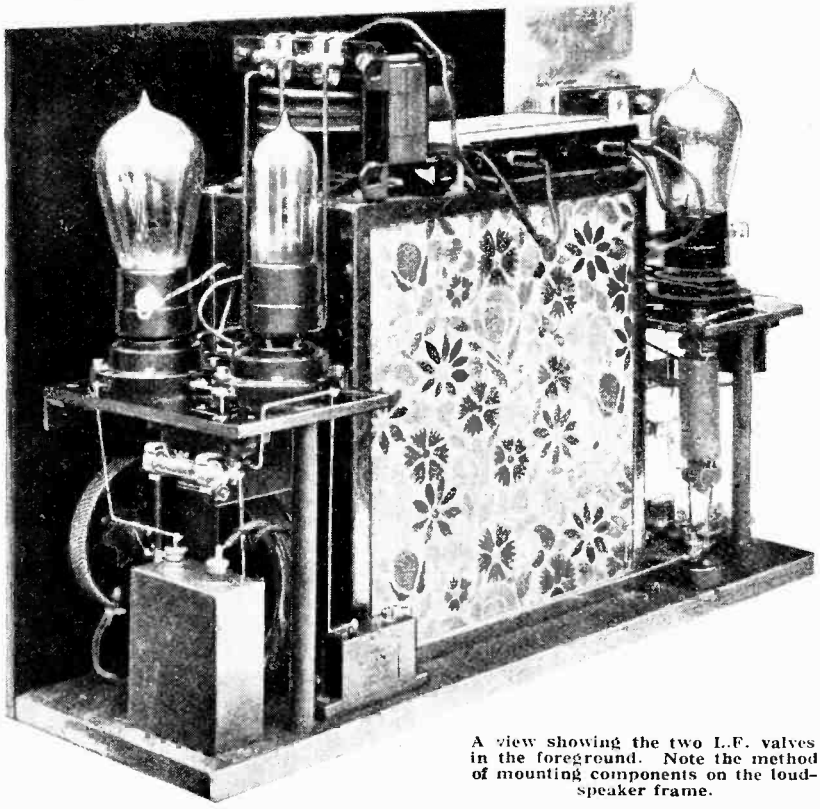


Fig. 1.—Showing the circuit diagram. The first valve is operating as a screened grid anode bend detector and the last two valves as L.F. amplifiers with space charge reducers.

of capacity, or most of it, is provided between grid and plate of the valve itself so that the detector valve oscillates very readily indeed—often so readily that it cannot be controlled. For the reception of telephony it is distinctly desirable not to oscillate, but for the reception of distant stations it is necessary to be able to go nearly up to the point of oscillation in order to get sufficient sensitivity.

The Hartley circuit is quite suitable for reception provided valves with low or medium amplification are used, but when it is desired to increase the amplification of the valve, then the trouble begins, as the reaction becomes difficult to control owing to the extremely small capacity required for C_2. If it were possible to cut out the capacity between grid and plate of the valve, while still keeping high amplification, then it will be possible to increase the value of reaction capacity and thus once more bring the set under efficient control. By the use of a 4-electrode valve, as shown in the circuit of Fig. 1, where the *outer* grid is connected to some suitable point on the H.T. battery, it is possible to eliminate effectively most of this capacity, since the *outer* grid forms an electrostatic screen between the *inner* grid (which is the operating grid in this case) and the plate, just in the same way that an earthed metal plate between two tuned circuits eliminates most of the capacity coupling between them. When the four-electrode valve is used in this way, the amplification factor is very high—over 50 in the case of the usual type—and the reaction condenser required for the circuit shown in Fig. 1 will be comparatively large—the reaction effect depending partly on the voltage applied to the outer grid—*i.e.*, the greater this voltage, the less capacity will be required to make the valve oscillate.



A view showing the two L.F. valves in the foreground. Note the method of mounting components on the loud-speaker frame.

Values of Components.

The frame aerial is wound on a wooden former about 15 inches square, as will be described later, and is tuned by the condenser C_1 of 0.0003 mfd. capacity, which should preferably be of the slow-motion type. Two-thirds of the turns are used between inner grid and filament and the remainder for reaction through C_2 to the plate.

The small condenser C_4 of 0.0001 to 0.0002 mfd. is used to fix the H.F. potential of the end of the H.F. choke and should not much exceed the value

LIST OF PARTS.

1 Musicalpha loud-speaker (Joublin & Kingsley, 317, High Holborn, London, W.C.1).
1 "Cameo" portable cabinet, oak, type O.P.T. (Carrington Mfg. Co., Ltd.).
2 "Exide" 2-volt S.P.7 (20 amp.-hr. actual) accumulators (Chloride Elec. Storage Co., Ltd.).
2 "Ever-Ready" H.T. accumulators, No. 2110 (1,800 mA.-hrs.) (Portable Electric Light Co., Ltd.).
100ft. "Lewcos" frame aerial wire (London Elec. Wire Co.).
1 "Ever-Ready" 9-volt G.B. battery (Portable Elec. Light Co., Ltd.).
1 32-henry choke (Pye).
1 Transformer (Pye) 4–1.
1 "Cosmos" H.F. choke (Metro-Vick Supplies, Ltd.).
1 Fixed condenser, 0.002, No. 620 type (Dubilier).
1 Fixed condenser, 0.005, No. 620 type (Dubilier).
1 Fixed condenser, 0.0001, No. 610 type (Dubilier).
1 Grid leak, Dumetohm, 0.5 meg. (Dubilier).
1 Grid leak, Dumetohm, 2 meg. (Dubilier).
2 Dumetohm holders (Dubilier).
1 Fixed condenser, 2 mfd. (T.C.C.).
1 Filament rheostat, 30 ohms (Burndept).
1 Variable condenser, 0.00025 mfd. (Ormond) R/122.
1 Variable condenser, 0.0003 mfd., slow motion.
3 "W.B." valve holders (Whiteley, Boneham & Co.).
1 Baseboard, 5×16.
1 "Cameo" panel, 16×11×$\frac{3}{16}$in. (Carrington Mfg. Co., Ltd.).
3 Plugs and sockets (Lisenin Wireless Co.).
1 A.P.406 four-electrode valve (Aneloy Products, 36, Forest Hill Road, East Dulwich, London, S.E.22).
1 A.P.412S four-electrode valve (Aneloy Products).
1 A.P.412L four-electrode valve (Aneloy Products).
Sistoflex, screws, aluminium, brass, W. plugs, etc.
Approximate cost complete with all valves, batteries, etc., £16.

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.

given, or else the quality of reproduction, especially in the higher notes, may be affected.

The resistance R_1 is 0.5 megohm in the set described, and R_2, 2 megohms, with a coupling condenser, C_5, of 0.005 mfd.

The condeser C_3, which is across the grid bias supply to the first valve, is used to keep the path of H.F. currents as small as possible and is not critical in value, anything of 0.0005 mfd. and upwards being suitable.

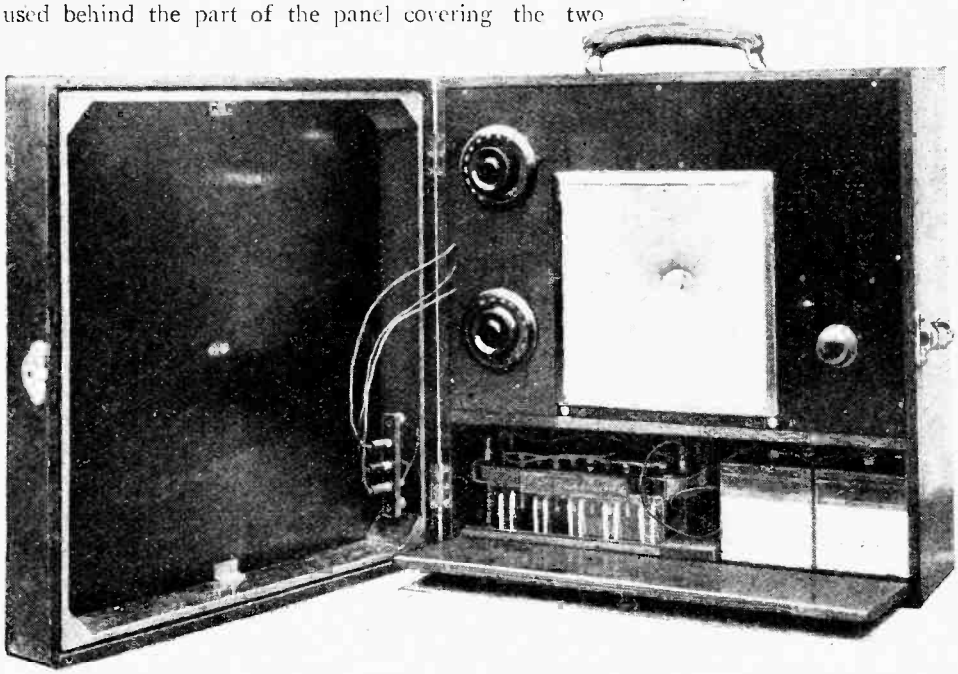
Capacity Screening.

In order to eliminate hand effects in tuning, which may be rather bad on a frame aerial set, an aluminium screen is used behind the part of the panel covering the two variable condensers, and the latter are kept away from the screen by 1-16th inch ebonite spacing washers.

The choice of a loud-speaker for a portable set is rather limited as the space occupied by most of the better-known types is so large as to prevent their use for this reason alone, while some of the small speakers available are rather inefficient. The "Musicalpha" loud-speaker used is a cone type, with a doped silk cone, and mounted in a wooden frame approximately 8in. × 8in × 4in., so that it will be seen that the space occupied, being rectangular in section, is reasonably small. The frame of this speaker is also very convenient for mounting some of the components and also for serving as a rigid support for the panel. Although the efficiency of this loud-speaker is not so good as, for example, the big "Amplion" or the Standard "Kone," yet for its size it is quite good and the output is pleasant to listen to, while the price is very reasonable.

There would seem to be quite a field for small or compact loud-speakers for portable sets—and it is to be hoped that British manufacturers will produce several types in the very near future.

The constructional details of this set, including alternative arrangements of the frame for 300-600 metres and for the Daventry wave-lengths, will be dealt with in next week's issue.



The set opened and ready for use. The cover of the battery compartment has been removed to show the batteries. The H.T. consists of two 20-volt blocks of Ever-Ready accumulator cells and the L.T. of two 2-volt Exide portable accumulators.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

S.B. Innovation.—The Silence of "Daventry Junior."—B.B.C. Staff Qualms.—Radio Etiquette in U.S.A.—The Studio Audience.—If Summer Comes.

S.B. in Britain and France.

The arrival of the French President, M. Doumergue, at Victoria Station on Monday next, May 16th, will be the subject of a running commentary by Mr. L. Hore-Belisha, M.P.

An important feature of this event will be the relaying of the President's reply by landline to Paris for rebroadcasting. This will be the first time, I believe, that a speech in England has been simultaneously broadcast by stations in Britain and France.

M. Doumergue's speech will be made between 2.15 and 2.30 p.m.

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Have You Heard "Daventry Junior"?

At the time of writing, evidence is still lacking, either on the ether or in B.B.C. engineering circles, to show that anything even faintly resembling a signal has sped upon its flight from the aerial of "Daventry Junior."

As a youngster the station may be very promising, but its natal cry, if it has gone forth, has been very effectually smothered. I imagine that the full realisation of the significance of the forthcoming tests is afflicting the engineers with something akin to the "microphone fright" of which we read so much and hear so little.

No doubt the engineers appreciate how fatal it would be to encounter failure at the present juncture, when the regional scheme, which produces such anticipatory delight at Savoy Hill, has yet to satisfy the people who count.

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A Doleful Query.

"Assuming that the regional scheme actually comes into being," writes a correspondent, "what will happen to the surplus B.B.C. staff in view of the closing down of many of the present stations? Will there be more candidates for the dole?"

No; it is unlikely that any of the staff will suffer. The impression I gather is that, although fewer in number, the regional stations will entail more work than the stations of to-day, and that the contemplated arrangements will provide for the absorption of the whole of the present staff.

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More Work for London.

On the other hand, there will undoubtedly be greater concentration of work in the London area, which will probably have to provide the bulk of the programmes for the stations in the provinces, so that the London staff will grow still more and the necessity of finding larger offices, as I hinted in last week's *Wireless World*, will grow more pressing.

More than 50 per cent. of the B.B.C. staff are already to be found behind the classic portals of 2, Savoy Hill.

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All Programmes from London?

An opinion which seems to be gaining adherents is that the ideal broadcasting dispensation in these islands would involve the distribution of nearly all programmes from London, with occasional interludes of purely local interest from stations in the provinces.

But what have the provinces to say to such a suggestion?

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Russian and Swiss.

Variety on May 13th is to be provided by Julia Bar, in Swiss yodelling songs, Virginia Faire, Walter Todd, and the Russian Corps de Balalaika.

FUTURE FEATURES.

Sunday, May 15th.

LONDON. — "Elijah" (Mendelssohn).

GLASGOW.—Glasgow Musical Festival relayed from St. Andrew's Hall.

Monday, May 16th.

LONDON.—Variety Programme.

ABERDEEN. — "Mains's Wooin'," presented by Aberdeen Radio Players.

BELFAST.—"Faust" (Gounod), Introduction and Acts I, II, and part of III.

Tuesday, May 17th.

LONDON.—Symphony Concert from Manchester.

BIRMINGHAM.—Band Programme.

CARDIFF.—A Welsh Miners' Night arranged by Hywel Precelly.

Wednesday, May 18th.

LONDON.—"An English Rose," new Light Opera by Harold Dawson.

MANCHESTER.—Songs of the Hebrides, by Hugh Mackay (tenor).

Thursday, May 19th.

BIRMINGHAM.—Symphony Concert.

CARDIFF.—A Bristol Programme.

MANCHESTER.—Vaudeville.

Friday, May 20th.

BOURNEMOUTH.—Operatic Concert.

GLASGOW.—Belfast Radio Players in "Between Ourselves."

Saturday, May 21st.

LONDON.—The Wireless Military Band.

BIRMINGHAM. — "The Carrier Pigeon," a Play by Eden Phillpotts.

Radio Etiquette.

The American nation is suffering, according to Mr. Arthur R. Freed, secretary of the Freed-Eisemann Radio Corporation of New York, from the lack of "radio etiquette."

To prove that there is some justification for such an alarming pronouncement, Mr. Freed cites a particular case. "The man who killed his wife," he says, "because she wanted to listen to classical music when he wanted to hear sports shows to what extent bad radio manners can go."

Could anybody put it more clearly than that?

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A Note of Hope.

"This is an isolated case," adds Mr. Freed, "and *I hope it will never occur again.*"

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No Alternative!

Mr. Freed need not worry himself over the possibility of such a tragedy in this country for many a long year. We don't quarrel about alternative programmes in England for an obvious reason!

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B.B.C. Criticised.

The coveted honour of being Champion Grouser for 1927 surely belongs to a friend of mine who grumbles at the humorous turns because they make him laugh.

When he laughs, the headphones rub his cheek-bones and cause inflammation.

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B.B.C. Again Criticised.

Another friend chews the rag because the London Radio Dance Band plays too quickly between 6 and 7 p.m.

"I have my tea then," he writes, "and, being musically inclined, I have to masticate in time with the music. I'm getting indigestion."

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Pity the Studio Audience.

People are always ready to pity the lot of the poor broadcast comedian, and will countenance any means of amelioration, whether it be in the shape of spotlights or a "studio audience." But what about a little sympathy for the studio audience?

The studio audience suffers the inconvenience attending all things required for a purpose other than the ostensible purpose. It is in rather the same case as the poor relation whose presence at the family feast is not unrelated to his willingness to wash up or to occupy the fourteenth chair.

Let us pity the studio audience and remember that the poor thing is in constant fear lest it laugh too loud and offend the ears of the *blasé*, or laugh too softly and incur the wrath of the comedian.

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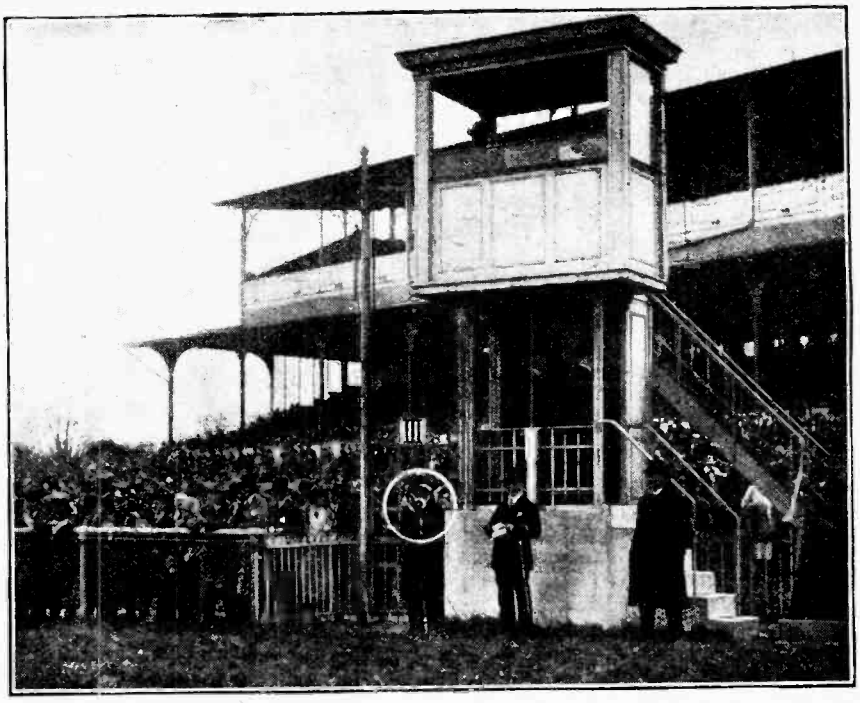
What He Forgot.

Some entertainers prefer the empty studio, but these hardy souls run a risk. The recent experience of a well-known artist is interesting.

He preferred to broadcast in an empty studio, but took the precaution of telling only the stories which he had already tried with success on the stage. At the conclusion of the turn the deadly silence of the studio and the professional restraint of the announcer conspired to engender doubts as to how the jokes had "got over." He consulted a listening friend, who said: "The turn was quite good, but you didn't give us time to laugh."

This is a case when the presence of a studio audience would have given a clue to the "time value" of each joke. The artist had forgotten to pause to enable his audience to recover itself.



RUNNING COMMENTARIES IN GERMANY. The broadcasting authorities in Germany have been quick to recognise the value of the "running commentary" as exploited in this country. This photograph, taken recently on the Cologne race-course, shows a popular sportsman, Herr H. Muller, giving his account of the spring meeting. The description was broadcast from Langenburg, Muenster and Dortmund.

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A Mozart Opera.

A studio performance of Mozart's opera, "The Magic Flute," will be broadcast from 2LO and other stations on May 26th. The artists include Sylvia Nelis, Miriam Licette, Elsie Suddaby, Alice Moxon, Gladys Palmer, Heddle Nash, Frederick Ranalow, and Sydney Russell, with the Wireless Chorus directed by Stanford Robinson and the Wireless Symphony Orchestra conducted by Percy Pitt.

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Robots on the Radio.

Life on a remote island in the decade 1950 to 1960 provides the plot for "R.U.R.," by Karel Kapel, which is to be broadcast on May 27th. The play has been translated from the Czech by P. Selver, and arranged for broadcasting by Cecil Lewis, who will be the producer. The cryptic letters composing the title stand for "Rossum's Universal Robots," and the characters consist, of course, of Robots and Robotesses.

Matheson Lang at 2LO.

The B.B.C. have made a *coup* in arranging for the broadcasting of "The Wandering Jew" on June 7th with Matheson Lang in the part of Matathias.

Some days prior to this broadcast, viz., on May 23rd, there will be a Royal command performance of the play at Drury Lane, and many of the artists taking part will also be present in the studio on June 7th. This will be the first occasion on which Mr. Matheson Lang has addressed the microphone.

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If Summer Comes.

Last year, when summer burst upon us with its accustomed severity, the B.B.C. announced a special summer-time schedule in which, among other things, the news bulletins occurred at an earlier hour.

This year little change is necessary, as the present order of programme is considered eminently suitable for summer conditions; in fact, we have had a "summer" schedule since January.

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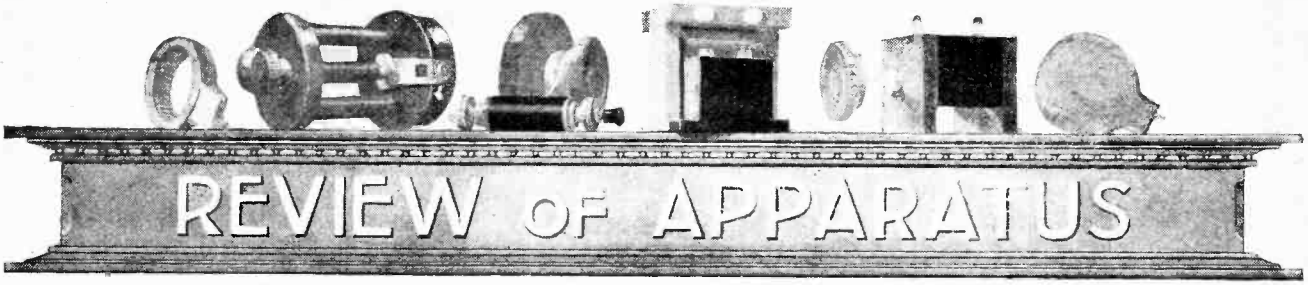
Cult of the Running Commentary.

The "Seaside Nights" which gave so much satisfaction last summer are to be repeated. Among the resorts which will provide the fare are Brighton, Blackpool, Margate, Yarmouth, Southend, and Eastbourne.

A feature which was absent from last year's activities is the running commentary, which promises to fill an important *rôle* during the "dog days." Important tennis matches at Wimbledon will be described, and time may also be devoted to several important swimming events.



Latest Products of the Manufacturers.

DUBILIER RESISTANCE COUPLING CONDENSER.

Now that the use of mica condensers has become standard practice in the construction of resistance-coupled low-frequency amplifiers, amateurs will be interested to learn that the Dubilier Condenser Co. have recently produced a special mica condenser for use in resistance-coupled circuits.

Although, no doubt, this condenser can be obtained in a range of capacity values to suit various requirements, the stock size condenser has a capacity of 0.1 mfd. It is suitable for use with anode resistances having values between 50,000 and

A new Dubilier resistance capacity coupling condenser.

150,000 ohms, the corresponding value of grid leak being probably 0.5 to 1 megohm. In the accompanying illustration a condenser is shown slightly smaller than the actual size. The moulded case carries the terminals, and extension pieces are provided at the base so that it can be secured to a baseboard with two round-headed screws. The introduction of this new condenser completes the Dubilier range, so as to meet all requirements.

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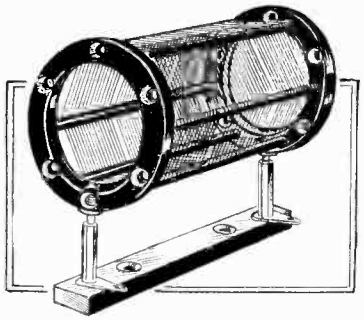
EDDYSTONE H.F. CHOKE.

The aim in designing a choke coil for use in a Reinartz or similar circuit arrangement is to provide a coil with an ample number of turns to produce the required value of inductance, the winding possessing a minimum of self-capacity.

For the construction of a short-wave receiver special care must be taken to ensure that the winding possesses an exceedingly small value of self-capacity, and



The air-spaced fine wire Eddystone choke coil for use in the construction of receiving sets operating over a wave range of about 20 to 100 metres.

Stratton and Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham, have included in their range of components a single-layer coil consisting of a practically air supported space winding. For building a receiving set for use on wavelengths between 20 and 100 metres this coil can be recommended. A mounting base with pin connector is supplied with this component, so that it can be changed for a coil of higher inductance value if the same receiver is to be used for reception on broadcast and other wavelengths.

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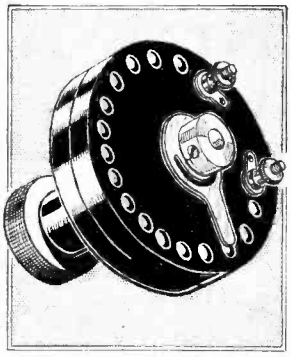
P.D. VOLUME CONTROL.

There are many sets in which no provision is made for critically controlling volume. Volume control is, of course, essential, partly to regulate the sound intensity to suit the listener's requirements and also critically to regulate the input to the loud-speaker in order to reduce distortion to a minimum. The tuning controls are invariably used for reducing as well as increasing volume when a multi-valve set is used for local reception, but much better quality can be obtained and volume control more conveniently carried out if a variable resistance is arranged either to regulate the input to the low-frequency amplifier or to control the speech currents passed to the loud-speaker.

The "P.D." volume control manufactured by Automobile Accessories (Bristol), Ltd., 93-95, Victoria Street, Bristol, is a compact wire-wound variable resistance provided with a 17-stud switch. It is intended for connecting in parallel with the loud-speaker, and the resistance change varies from the off position when the loud-speaker is unshunted to the maximum position when the volume control acts as a short circuit. This component can be conveniently added to any existing set, and is secured to the panel by the usual one-hole-fixing nut, and its two terminals are linked across to the output terminals of the set. The maxi-



An easily fitted volume control for connecting in parallel across the output terminals of a receiving set

mum resistance is about 6,000 ohms, and being wire wound it was found to be constant in its resistance value at any setting.

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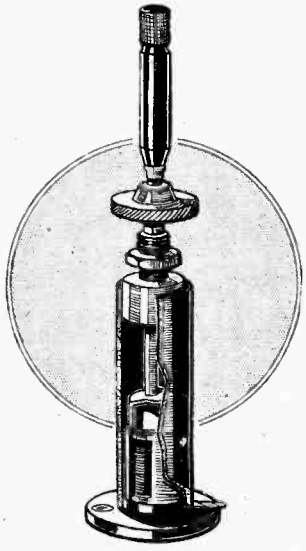
NEW POLAR NEUTRALISING CONDENSER.

There are very few neutralising condensers available in which the design provides for baseboard mounting and which are capable of providing the critical degree of capacity adjustment required.

Modifications have been made to the neutralising condenser manufactured by the Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, London, W.C.2, so that, as well as being suitable for securing to the panel by one-hole

fixing, a flange has been fitted to provide for screwing down to the baseboard. Instead of the plates consisting of two cylinders sliding one into the other, only half cylinders are employed, so that a very critical control of capacity can be obtained, not only by advancing one



The modified form of Polar neutralising condenser suitable for baseboard as well as one-hole fixing.

plate towards the other, but also by rotating. A locking screw is provided to hold the spindle of the moving plate secure. The condenser is quite durable, possesses good insulating properties, and is of a suitable capacity for use in a stabilised circuit where the number of neutralising turns is equal to the primary turns of the H.F. intervalve coupling.

BOOKS RECEIVED.

"Modern Scientific Ideas, Especially the Idea of Discontinuity," by Sir Oliver Lodge, being the expanded substance of six talks on "Atoms and Worlds," broadcast in October and November, 1926, 79 pp., published by Ernest Benn, Ltd., London, E.C. Price 6d.

"Effect of Eddy Currents in a Core Consisting of Circular Wires," by Chester Snow. 24 pp., with 4 diagrams (curves). Published by the Bureau of Standards, Washington, D.C. (Scientific Paper No. 544). Price 10 cents.

"Radio Formulario," compiled by Ugo Guerra. A wireless pocket-book of tables, data, circuits and useful notes. With detachable diary. Published by Casa Editrice, "Elphis," Naples.

"Funkbastlers Radio Bucherei (Part I) —Selektive Hochleistungs Schaltungen." by Joachim Winckelmann. A handbook for listeners giving notes and diagrams of circuits and instructions for winding coils. 30 pp., with 19 diagrams. Published by Leo Kajet, Leipzig. Price 1 mark.

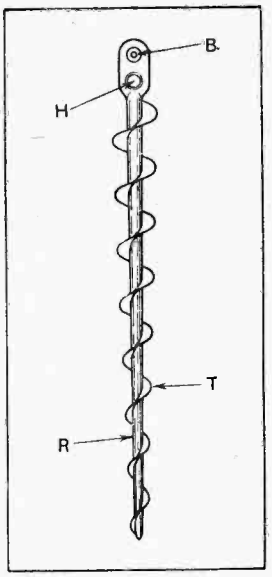
RECENT INVENTIONS.

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.

Spiral Earth Tube.
(No. 265,389.)

Application date: Feb. 17th, 1926.

An earth tube is described in the above British patent by T. Nicholls. The illustration shows the form of the tube, which consists of a rod portion R provided with a spiral thread T having an appreciable area. The upper end of the tube or rod R is flattened, and is provided with a hole H, and terminals B. Instead of hammering the tube into the ground it can be screwed in simply by placing a tommy bar through the hole H and screwing the tube right into the ground. An additional feature of the invention, of course, lies in the fact that the area of contact is considerably increased by the use of the spiral thread T.



Spiral earth tube. (No. 265,389.)

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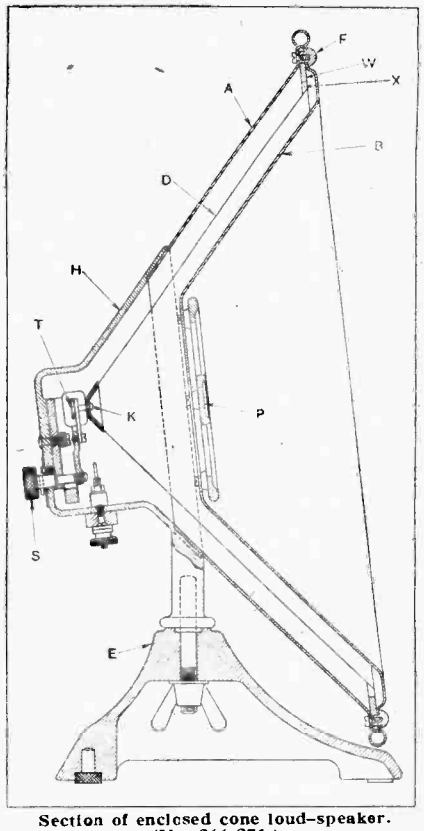
An Enclosed Cone Speaker.
(No. 266,271.)

Application date: Nov. 28th, 1925.

S. G. Brown describes in the above British patent a form of fairly freely supported cone which is protected on either side by two metal cones. The main features of the invention will be obvious from examination of the illustration. The diaphragm D is a cone of paper or other light rigid material, and is connected at the base to a reed type of telephone movement T provided with an adjusting screw S. This type of movement has been previously described in these columns. The diaphragm is enclosed between two metal cones, the back one being fixed to the housing H, which contains the telephone mechanism, and the whole is fixed to a support stand E. The back cone is actually provided with perforations, although this is not shown. The two cones A and B are attached at their peripheries, and the two are held together by bolts passing through flanged edges F. This junction is also used to hold in position a ring W of wood, which in turn supports the edge of the diaphragm D by means of very thin tissue paper or similar material as shown at X. The front cone is truncated, and is provided with a perforated



Section of enclosed cone loud-speaker. (No. 266,271.)

circular disc P through which the sound from the diaphragm can pass. The chief object of this form of construction is to secure a fairly light and free method of supporting the diaphragm, and at the same time make the loud-speaker fairly robust.

TRANSMITTERS' NOTES AND QUERIES.

Amateurs in Rome.

The Royal Frederico Cesi School, Via Cernaia 4, Rome, of which Prof. Ruggero Vicaro is Director, is now transmitting on 33 and 43 metres, using the call-sign EI IFC. For normal working this station uses a Hartley direct circuit with Radiotecnique or Philips Transmitting valves, the supply being 2,000 volts A.C. or R.A.C., and for low-power work the same circuit with Philips or Weston 10-watt valves and 300 volts D.C. or R.A.C.

EI IFC will be glad to get into touch with British amateurs willing to carry out experiments on low-power and high-power work, and, in return, the Director will put his laboratory and technical staff at the disposal of British amateurs desiring precision measurements. IFC is on the air every night for European and DX work.

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Swiss Experimental Station.

A small 60-watt short-wave experimental transmitting station is now operated by the Telegraph and Radio Service, with the call-sign EH 9OC. Programmes from the Berne Broadcasting station are relayed from 20.30 to 21.45 B.S.T., on 32 metres every Monday, Thursday and Saturday, after which experimental CQs are sent for half an hour. Reports will be welcomed and should be addressed to Case No. 63, Poste Transit, Berne.

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Radio Jargon.

We have never concealed our dislike of the misuse of "Radiese" in ordinary written correspondence and have sometimes commented on the curious mixture of languages in the columns of some of our French contemporaries. We are therefore entirely in agreement with a correspondent in the *Journal des 8*" who writes as follows on the absurd misuse of the code "73" as a suitable finish to correspondence: "The employment of "'s" after the formula of courtesy "73" is superfluous, for "73" stands for "best regards"; why then add a possessive "s"? Perhaps to give it a more American air; but is it not a redundance? Again, why put a superfluous "best" before the "73"? "73" itself means "best regards"; would you write in French "meilleurs meilleurs souvenirs"?

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Nationality Prefixes.

The nationality prefixes suggested by the A.R.R.L. of Hartford, Conn., appear to be generally adopted by most foreign countries, and, despite their obvious imperfections, are to be welcomed as evolving some sort of order from the old state of chaos. It is still somewhat difficult to associate a Brazilian station with SB, or a Chilean amateur with SC, and the European "E" occasionally proves a stumbling block when given out by radio-telephony with its Continental pronunciation. We have heard of an enthusiastic amateur who believed he was picking up clear telephony from Nepal (AN) and was bitterly disappointed on discovering that the station he had heard was in Holland (EN).

The prefix ET is, under the American scheme, divided between Poland, Esthonia, Latvia and Lithuania, and we understand that amateurs in these countries will distinguish their respective nationalities by the initial letter or figure of their call-signs, thus :—

ET P — —	will indicate	Poland.
ET 1 — —	,, ,,	Lithuania.
ET 2 — —	,, ,,	Latvia.
ET 3 — —	,, ,,	Esthonia.

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New Call-Signs Allotted and Stations Identified.

G 5BQ	S. J. Styles, 15, Pickwick Rd., Dulwich, S.E.21. Transmits on 8, 23, and 45 metres and welcomes reports.
G 5HV	W. H. Martin, Lynwood, Myrtlefield Park, Balmoral, Belfast.
G 5ML	(ex 2BVL) F. W. Miles, 266, Earlsden Ave., N., Coventry. Transmits on 23, 45 and 90 metres and will welcome co-operation and reports.
G 5ZC	F. J. Clark, 2, Acre Rd., Colliers Wood, Merton, S.W.19.
G 6WT	Capt. G. C. Wilmot, 20, Parkfield Rd., Sefton Park, Liverpool. (Late KM1 and FN2C, Nigeria). Transmits on 23 and 44–46 metres.
2BIX	J. Butterworth, 1088, Manchester Rd., Castleton, Lancs.
2BNB	J. K. Fenly, Hughenden, 546, Chester Rd., Erdington, Birmingham.
2BNU	J. W. Knight, 203, Yorkshire St., Rochdale, Lancs.
2BPU	(ex 6GR) J. Scotson, Entwistle Rd., Rochdale, Lancs.
EAS 2	Leonardo Picallo, Palma, Mallorca, Spain.

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QRA's Wanted.

G 5BC, G 5FO, G 6LP, G 6WW.

NEWS FROM THE CLUBS.

Internal Action of the Valve.

In a very interesting lecture given before the Radio Society of Great Britain on April 27th, Mr. A. C. Bartlett, of the Osram valve research department at Wembley, dealt with the laws governing the motion of electrons in the vacuous space of the thermionic valve, and showed that their behaviour rested on simple physical laws, and could be calculated to a reasonable degree of accuracy.

Mr. Bartlett gave some fascinating details concerning the problems of designing the electrodes. It was shown, for instance, that long filaments are overheated by the "space current," and that the magnetic field in long filaments is sufficiently strong to deflect the electrons from the anode. This effect (known as the magnetic effect) was clearly illustrated by lantern slides.

A method of overcoming the magnetron effect is the use of the indirectly heated cathode, such as is obtained in the Osram K.L.1 valve, while the advantages of having a large cathode diameter were also explained.

Passing on to the control of anode current, the lecturer showed how in a two-electrode valve the anode current could be controlled by the magnetic field produced by a solenoid placed round the valve co-axially with the filament and anode, the magnetic field deflecting the electrons from the filament. This is known as magnetic control, as distinct from the electrostatic control obtained in the usual way by means of the grid.

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The Past Year in Manchester.

The reports of the secretary and treasurer, read at the annual general meeting of the Radio Experimental Society of Manchester on April 29th, were highly satisfactory. The attendance during the past year has been good at all meetings, and has justified the arrangements made for providing lectures and demonstrations. It is hoped shortly to publish a syllabus of next season's activities.

The individual research scheme, launched with such success last year, is being carried on, and new members have been urged to take up subjects for research.

Dr. St. John has been elected President, while a new Vice-President has been appointed in the person of Mr. E. Butterworth, M.Sc., A.Inst.P., who has also been elected an honorary life member for services rendered.

Hon. Secretary: Mr. J. Levy, 19, Lansdowne Road, West Didsbury, Manchester.

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Transmissions from 2FZ.

Regarding future transmissions from the experimental station 2FZ, the Radio Experimental Society of Manchester has decided to continue these on Tuesdays from 7.30 to 10 p.m., operating on 200 metres.

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Wireless in Dublin.

The new Marconi "straight" 3-valve receiver employing the K.L.1 type of valve was demonstrated by Mr. F. G. Clarke, of Marconi's (Ireland), Ltd., at the April meeting of the Wireless Society of Ireland, held at 12, Trinity Street, Dublin. The lecturer gave a clear description of the manner in which the K.L.1 valve functions, and he showed that good and clear loud-speaker reception could be obtained from the Dublin and Daventry stations with complete absence of A.C. "hum."

The Society's short-wave transmitter has recently carried out some interesting tests on a wavelength of 45 metres with local experimenters and with amateurs in Great Britain, Sweden, Spain, and Latvia. It is hoped shortly to turn attention to short-wave telephony transmissions.

The Society's club room is now open every Monday night for experimental work and informal discussions.

The Hon. Secretary is Mr. H. Hodgens.

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.

VALVE PRICES.

Sir,—After the publication of my letter in your issue of February 16th on the subject of valve prices, you kindly sent me copies of a selection of the letters which you received from your readers in reply, and, after consultation with the members of this Association, I am now replying to the principal points raised by your correspondents.

(1) Several of your readers suggest that the purpose of this Association is to maintain prices at a high level. This is certainly not the case. The primary aim of the Association is to attain and maintain the highest possible standard in the manufacture of valves and to ensure that the most suitable type of valve for every requirement is made available to the public. This necessitates the *control* of prices, not only to prevent a price war between members of the Association, which, apart from other objections, would inevitably lead to cheeseparing in research and manufacture, and the production of poor quality or unsuitable valves, but also to provide so that when reductions in prices are made they should be made at the right time and simultaneously by various manufacturers, as otherwise the prices of valves might vary almost from week to week, and the complications of distribution of valves amongst retailers under such conditions would be too great to contemplate.

(2) It is suggested in some of the letters which you have sent me that the selling price of a valve should be based on the actual manufacturing cost, plus a reasonable addition for profit. It is true that the actual manufacturing cost plays an important part in deciding the selling price of a valve, but many other points have to be taken into consideration, and amongst these should be included the cost of research work, the cost of new machinery, and machinery which becomes obsolete with developments, also the cost of patent rights, which have to be acquired often at considerable cost. If British manufacturers are to continue to lead the way in valve development, it is essential that they should be prepared to incur considerable expenditure on research work.

(3) It is suggested that the valve should be produced on the "Ford" car principle of mass production. If this were possible the price of valves would undoubtedly be brought down, but the development of the valve is at present in far too great a state of flux to permit of any manufacturer adopting really mass production methods. One has only to look back over the past year to observe how frequently new types of valves have been produced to meet special requirements, and so long as this kind of thing continues it is not possible to employ really mass production methods. The development of the valve is so rapid to-day that, to keep up to date, expensive apparatus has to be relentlessly scrapped at quite frequent intervals to make place for new equipment, and many processes in valve manufacture which have been developed at great cost during the past two or three years have, in the course of time, been abandoned as obsolete and have given way to other and more recent methods. The valve manufacturer has to face this continually changing situation, which, although present to some extent in most modern industries, is quite exceptional in the case of valve manufacture. One direction in which added costs may be reduced is by limiting the number of types of valves, and this matter is at present receiving the close attention of the Association.

(4) As regards the prices at which valves of British manufacture are sold in the Colonies and elsewhere, on the face of it it may seem unfair that the purchaser at home may, in some cases, be paying a higher price for a valve than his friends abroad; it is unfortunate that this situation should exist in certain instances, but it must be realised that the British manufacturer, if he desires to get his valves on to the foreign and Colonial markets, must be prepared to sell them there at the current prices in those countries for valves of the type he manufactures; this sometimes means that he must sell at a very low price, but unless he were prepared to do this he would have to keep out of the foreign and Colonial markets altogether.

(5) There are valves sold in this country where prices are in competition with those of this Association. Some of these valves are manufactured here, but the majority are imported from abroad. In the case of the latter valves, at any rate, the purchaser is at a disadvantage, in that he has no certainty of redress if a valve purchased by him should prove to be faulty, and certainly he has no service at the back of the valve. Non-Association valves manufactured in this country are, we believe, mostly copies of Association types, but without infringement of patents we doubt if valves would be up to a satisfactory standard, and if they are, then sooner or later those firms manufacturing these valves will find that they are selling at an uneconomic rate, as has been shown by the closing down of several valve factories during the past twelve months.

London, W.C.1. H. HOWITT,
April 30th, 1927. Secretary,
British Radio Valve Manufacturers' Association.

EMPIRE BROADCASTING.

Sir,—I was much interested in your Editorial in the issue of April 27th on Empire broadcasting. Your remarks with regard to the Dutch being the first nation to broadcast to her dominions bring home the fact once again that we are, as a nation, far too conservative, and never do anything before the pace has been set by someone else. The value of such a service would possibly extend above that of just a broadcasting organisation, and might prove beneficial to a very high extent in times of disturbance. We are constantly having the word "Empire" put before us, and it is a recognised fact that any measure which is going to bring our dominions in closer touch with the Mother Country is of foremost importance.

Like most useful suggestions, however, one imagines that the bodies or organisations whom this particular case might concern will say: "Yes, very nice and so forth," and there the matter will rest. I suggest, therefore, that measures should be taken immediately by the right persons, with a view to establishing a high-power short wave Empire broadcasting station in this country.

It appears that some difficulty is likely to arise as to who are the right persons to take such a scheme in hand. But it seems that we have here an admirable opportunity of bringing back some of the prosperity to the present time badly depressed British wireless industry. British manufacturers have never done radio export trade of any magnitude, possibly due to the difficulties of obtaining licences from the Marconi Co., to do so, but if they could show that a large amount of business could be done with the colonies that difficulty would possibly disappear.

At present the radio manufacturer in this country does little or no business abroad, comparative to what he does at home, because there is not the demand. Supposing, however, the Government licensed an organisation of British manufacturers to erect a station such as that suggested, the trade would not only greatly benefit, but also the entire community of the British Empire

Britishers abroad are sufficiently patriotic to buy British goods (not only due to patriotism, but because we happen to produce the finest goods in the world in so far as radio apparatus is concerned) when they realise that the service carried on for them at home is supported by the British industry. With the number of quite wealthy radio concerns in this country at the present time one sees no reason why a number of them should not form a company for the purpose of Empire broadcasting in exactly the same way as the B.B.C. was formed. A very necessary measure, of course, before such a scheme was gone into in detail, would be the definite assertion that the Government would allow such a service to operate.

Such a scheme as the one outlined would not require very large capital; quite a small private company with money put up by the various members of the industry interested, the return on their money being a large export trade. Difficulties of a minor nature might arise, but one sees no reason why the basic scheme should not be a success. To put an Empire broadcasting station under the control of the B.B.C. is rather a tall order, as one imagines that the B.B.C. have quite enough to do in supplying the British Isles with broadcasting on their not over-abundant income, let alone providing the whole Empire. I put forward my little idea above because I think Empire broadcasting would be an excellent institution, benefiting the colonies and Great Britain in more ways than one. And as a previous radio manufacturer and wireless engineer of some years' standing, I believe that an Empire broadcasting station run by the trade would help to bring in much more business and so relieve the depressing period that the radio industry is now passing through. DALLAS BOWER.

Brighton,
April 29th, 1927.

Sir,—I notice that in your Editorial of April 27th and May 4th you refer to a new wireless station PCJJ erected in Holland and now working on 30 metres, and that you suggest that this country should follow its example. There seems to me to be no reason why this should not be done by utilising the present beam stations, as I understand successful telephony transmissions have taken place at these stations while they were, at the same time, handling ordinary traffic on automatic C.W.

Your readers who have listened to PCJJ have no doubt noticed that the station is being largely used for propaganda purposes on behalf of the company which runs it. This seems to me to be a matter which should occupy the attention of British manufacturers who are prohibited from using wireless for this purpose. OTHO W. NICHOLSON. G6 MP.

London, May 5th, 1927.

B.B.C. TRANSMISSION OF PIANOFORTE MUSIC.

Sir,—If this correspondence is not already too prolonged, may I reply to Mr. Gough's letter in your recent issue as one who also enjoys in some measure the qualifications he speaks of, including a trained musical ear? My experience has been that pianoforte music transmission has not been of the same consistent standard as, say, the bigger orchestral works.

It would almost seem that at the period criticised a certain amount of experiment was in hand on this. Moreover, at a recent lecture one of the B.B.C. specialists frankly admitted the problem of pianoforte transmission was difficult owing to percussion effects. Also, in one of your correspondent's letters is quoted an admission at a similar lecture that the lower frequencies in this transmission were at that time deeper modulated, presumably for the benefit of the average receiver.

In judging reception of this nature no one doubts but that the majority of receivers are capable of producing pleasing musical sound, but it is a vastly different affair to reproduce with full justice to modern transmission at its best, and it is probable the receivers and speakers that are capable of this are none too numerous. As an engineer, I have a feeling that the receivers described by the previous correspondents on this subject and used at reasonable range are more likely to offer a true basis for judgment than a superheterodyne used at the distance Mr. Gough is placed.

Judgment of reception is also dependent upon the type of speaker and its position with reference to its acoustic surroundings. In this respect I think Dr. McLachlan, who also is, I believe, a musician, sums up the situation in the case for the moving coil-driven cone speaker: "... it would be idle to deny it offers advantages. . . ."

My own experience of modern reception is somewhat limited, but also confirms one of your correspondent's statements that greater efficiency appears to aggravate the contrast between the good and the moderate in transmission. In passing, the efficient reception of the good in transmission amply repays any trouble involved, from a musical standpoint, and is an eloquent tribute to the high standard of present-day transmission.

Incidentally, there is no excuse for not being up to date having regard to the excellent articles which have appeared in *The Wireless World* on faithful reception.

My impressions are that pianoforte transmission, while improving, has not reached the "perfect" stage yet. In coupling the "human element" in regulating transmission as further criticism, I offer it in all kindliness for the betterment of a system unique in its rapid development and efficiency, a system that must have brought immeasurable happiness to the majority of "ordinary listeners" and, I trust, to the many blessed with a musical ear. H. C. WALKER.

Roby,
May 1st, 1927

B.B.C. HIGH-POWER STATIONS.

Sir,—May I once again be allowed the courtesy of your columns to reply to Capt. Eckersley's letter in your issue of April 27th, in which he states that I am labouring under a misapprehension? I fear that Capt. Eckersley himself is labouring under two misapprehensions as regards my own letter in your issue of April 13th. If he will read my letter more carefully he will find no mention of a central six-transmitter station; in fact, I think such an idea too absurd to be taken seriously by any radio engineer. I must perhaps labour the point that the six single transmitter stations of my scheme are intended to be spread out in suitable places all over Great Britain; to quote the words of my letter, "located in suitable spots midway between populated areas."

Capt. Eckersley's second misapprehension is that I did not even mention foreign stations and was only concerned in receiving the further British ones of the chain. I think that most people who have listened to the B.B.C. so-called alternative programmes will agree that only two will not give much relief. Technically, I still venture to disagree with Capt. Eckersley and maintain that, using sets having the selectivity of those recently designed by the B.B.C., one double-wave 50kW. station, with a field strength of the order of 30 millivolts per metre at 20 miles, is likely to interfere seriously with the reception of further British alternative stations.

Time alone will show who is correct, but my own scheme undoubtedly does not suffer from that disability to the same extent. It was a serious attempt to solve the programme problem as far as it is possible with modern technical progress, a matter which, as far as I can see, the B.B.C. do not seem to take very seriously.

Finally, the six single transmitter stations of my scheme, whilst providing two alternative, daily changing, programmes to the crystal set from the nearest two stations in a superior manner, give the, at present so much needed, encouragement that the better the receiver the better the service.

Nottingham, W. J. RANDALL.
April 27th, 1927.

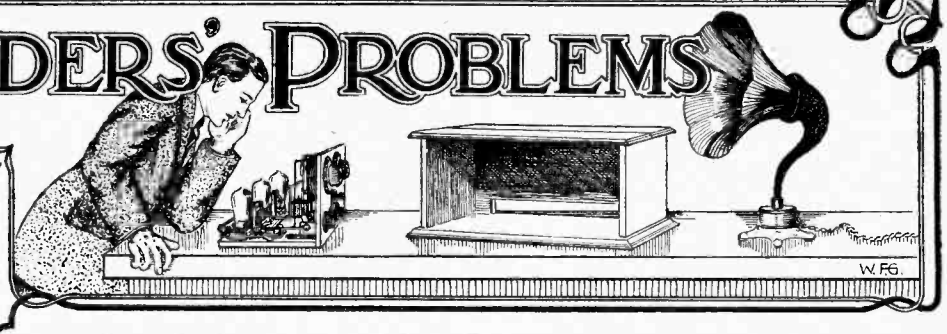
THE BEST FILAMENT VOLTAGE?

Sir,—Your correspondent, Mr. C. E. Chester, will receive plenty of support for his contention that the filament voltage of valves should be standardised at 2 volts, and not 4. The 4-volt standard is a useful compromise between the efficiency of the 6-volt and the convenience of the 2-volt, but it is clearly not the ideal standard.

The slight loss of efficiency—we shall probably never go back to high amperage for compensation—would soon be overtaken. Who dreamt two years ago of a valve with an amplification factor of 35 and an A.C. resistance of 60,000 ohms?

Manchester, W. M. WHITEMAN.

READERS' PROBLEMS



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each separate question must be accompanied by a stamped addressed envelope for postal reply.

Does Resistance Cause Losses?

I understand that if a resistance is introduced into a tuned circuit serious losses will be caused in the circuit with the concomitant effects of flat tuning, loss of sensitivity, etc. I presume that the higher the resistance the greater are the evil effects produced. Is this so? A. T. R.

You do not state in your letter whether you mean a parallel resistance shunted across the tuned circuit, for if this is the case your deductions are wrong, and the higher the resistance the less will be the evil effects produced. In brief, if a resistance is shunted in parallel with a tuned circuit, then the lower the resistance the greater the losses. If on the contrary, the resistance is connected in series with the tuned circuit such as in the lead running from one side of the tuning coil to the tuning condenser, then the converse is true, and the higher the resistance the greater the losses. One practical instance of the foregoing is the case of a variable condenser shunted across a coil for the purpose of tuning it. The condenser is obviously in parallel with the inductance, and, therefore, the insulation resistance between the fixed and moving plates of the condenser should be as high as possible to avoid losses in this manner. Obviously, if this insulation resistance is lower, the same effect will be produced as if an actual resistance had been shunted across the condenser or coil.

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A Dangerous Pitfall.

I have a receiver consisting of an H.F. valve, detector, and L.F. valve. The detector is a D.E.5B, and the coupling to the L.F. valve is by means of a 150,000 ohm anode resistance. I see that there are now several valves on the market having a magnification factor greatly in excess of the 20 given by this valve. Should I get greater amplification, therefore, by substituting one of these high magnification factor valves? The valve I have in mind has an impedance of 150,000 ohms and an amplification factor of 30. G. L. G.

The answer is definitely No. In any case you would get less amplification, since magnification does not depend upon amplification factor alone. It has often been pointed out in this journal that to get the approximate maximum of the amplification factor of any valve used in a resistance-coupled stage, it is necessary that the external resistance be at least five times the valve impedance. In your case your external resistance of 150,000 ohms is roughly five times the impedance of the D.E.5B, which is 30,000 ohms, and so you are getting as near as possible the full amplification factor of the valve; about 90 per cent. probably. We will assume, however, for the sake of simplicity, that you are getting the full amplification factor (in practice this is not possible). If you now substitute your proposed valve, we find that at once its impedance is exactly five times that of your previous valve, therefore in order to get 90 per cent. of its amplification factor of 50, your anode resistance would have to be raised to at least 0.75 megohm, and you would not, as you suppose, be getting the full 50 amplification factor of the valve, but would only be getting a percentage of it. In actual practice, from this point of view alone, and ignoring other considerations, you would get less amplification by substituting this particular valve.

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An Efficient Hartley Receiver.

I was interested in the portable receiver using a single-valve Hartley circuit, which was published in your issue of July 21st last year. I am desirous of adding an L.F. stage to it, and shall be glad if you will give me the necessary diagram. G. L. S.

We publish in Fig. 1 the diagram which you require. A good neutralising condenser will serve as the reaction condenser, whilst the H.F. choke may consist of any of the commercial ones which are upon the market, or may be home-made, in accordance with the instructions in the "Readers' Problems" section of January 12th, 1927. You should not forget to use a good type of L.F. transformer. By careful adjustment of the detector valve H.T. voltage you will find that the reaction control of this receiver is very smooth.

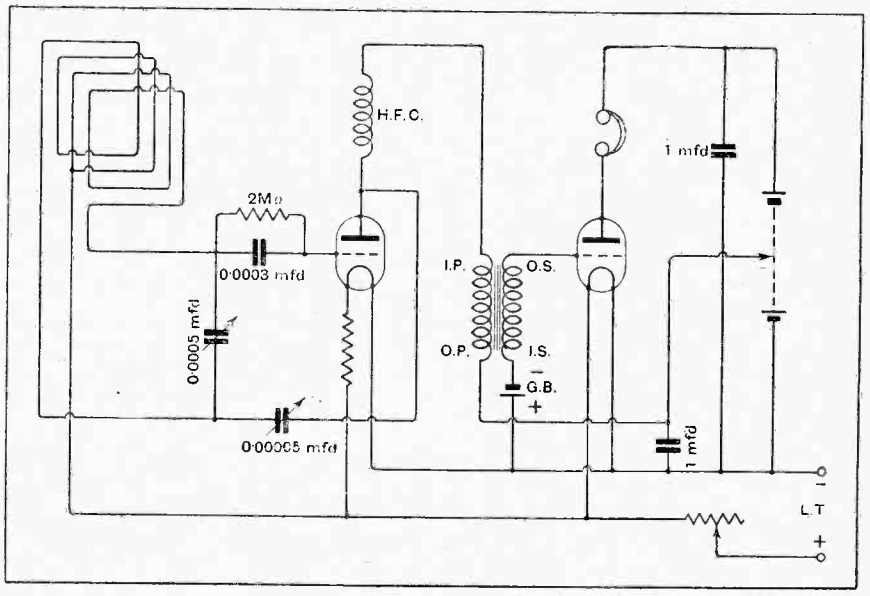

Fig. 1.—Frame aerial Hartley receiver with a stage of L.F. amplification.

Too Many Microamperes.

I have made up a receiver using the modern type of resistance coupling, using 1-megohm anode resistances in the plate circuit of each valve, these resistances being grid leaks of the ordinary type. I am unfortunately troubled with severe crackling noises, and I put this down to the use of the grid leaks. Must I substitute a wire-wound resistance, and, if so, can you tell me where to obtain them?

N. C. T.

The trouble you are experiencing is undoubtedly due to the form of anode resistance as you rightly suppose. You must not expect the ordinary type of grid leak, which is only made to carry a current of a few microamperes, such as are met with in leaky grid rectification, to carry such a heavy current. They may work all right at first, but will speedily give trouble later on, due to the disintegration of the graphite or other material of which they are composed. You are meeting, in fact, the same kind of trouble which used to be experienced by experimenters two or three years ago when they used non-wire-wound 100,000-ohms resistances for this purpose, the modern wire-wound 100,000-ohm resistance being not then available. You cannot, of course, use a 1-megohm anode wire-wound resistance, because, so far as we are aware, no such article is upon the market, and if it were its self-capacity would probably be high. If you specially desire a wire-wound anode resistance you could use two 500,000-ohm wire-wound resistances in series, but you could equally well and with considerably less space and expense use a proper "metallised" type of grid leak, such as are now readily available upon the British market, they being made specially for this purpose and capable of carrying a current of several hundred microamperes. Of course, even in the "modern" type of resistance amplifier, one never comes up against such low plate currents as 10 or 20 microamperes, such as are present in the grid circuit of a leaky grid rectifier; somewhere about two or three hundred microamperes is nearer the mark for the value of the plate current in a "modern" type of resistance amplifier.

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Transmitting Licences.

I am desirous of obtaining a transmitting licence, but am not sure of the qualifications required before I am permitted to transmit, and shall be glad if you will give me full particulars.

A. L. I.

It is impossible for us to give you full particulars, and you are advised to write to the Secretary of the G.P.O., London, who will give you all the necessary information which you require. Briefly, it is necessary for you to be capable of transmitting and receiving, using the Morse code, at a speed of not less than 12 words per minute, and an actual practical examination is carried out on this point. You are required also to possess sufficient technical knowledge to satisfy the authorities as to your ability to operate transmitting apparatus before a licence is granted, and also to state the reason for your requiring this licence; in other words, you are required to state the particular line of research necessitating the use of transmitting apparatus upon which you desire to embark.

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Dropping the Voltmeter.

I have constructed a battery eliminator for obtaining H.T. from my A.C. mains. Formerly I used an H.T. accumulator, and used a 150 volt moving coil voltmeter for measuring the voltage. Now I find that while the H.T. eliminator gives most excellent results normally, a terrific hum develops immediately I put the voltmeter across the H.T. terminals. I also notice that the voltmeter registers a very low value of voltage, and signal strength falls off greatly. Where have I gone wrong?

A. L. R.

The hum is probaby caused by the comparative low resistance of the voltmeter, which being shunted across the H.T. terminals of your set draws a very large current from the eliminator, a very much greater current in fact, than the eliminator is designed to supply. The natural result of drawing too large a current through the iron core smoothing chokes is to magnetically saturate them, and thus render their smoothing effect negligible, and so a loud hum is heard.

With regard to the remainder of your query, of course, by heavily overloading the instrument in this manner, you will naturally be dropping a great deal more volts across your rectifying valve. It is impossible to make use of an "ordinary" type of moving coil voltmeter in this manner, although it is perfectly satisfactory for accumulators, and also may be used with a dry H.T. battery. It should only be connected across a dry battery for the few seconds necessary to take a reading. Of course an ordinary moving iron voltmeter which is of low resistance should never be used to do this with a dry battery of any description.

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A Switching Problem.

I have a conventional three-valve set (detector and two transformer-coupled L.F.s), and wish to introduce switching whereby the first stage low-frequency amplifier may be cut out of circuit. The detector valve is of high impedance, and so has a transformer with a high primary inductance in its anode circuit, which should remain there when working on two valves. I also wish to keep the loud-speaker permanently connected to the third valve.

These requirements seem rather difficult to satisfy, but perhaps you know of some fairly simple method of connection using a single switch without too many blades.

C. T. T.

It is quite possible to carry out the desired change over by means of a double-pole change-over switch, or a three-pole switch if automatic control of the first L.F. filament is required. This latter arrangement is shown in Fig. 2. The one disadvantage is that separate grid bias batteries are necessary for each L.F. valve; moreover, that for the second is at high potential. It should accordingly be well insulated, and made up with the smallest obtainable dry cells, as manufactured for miniature flash-lamps.

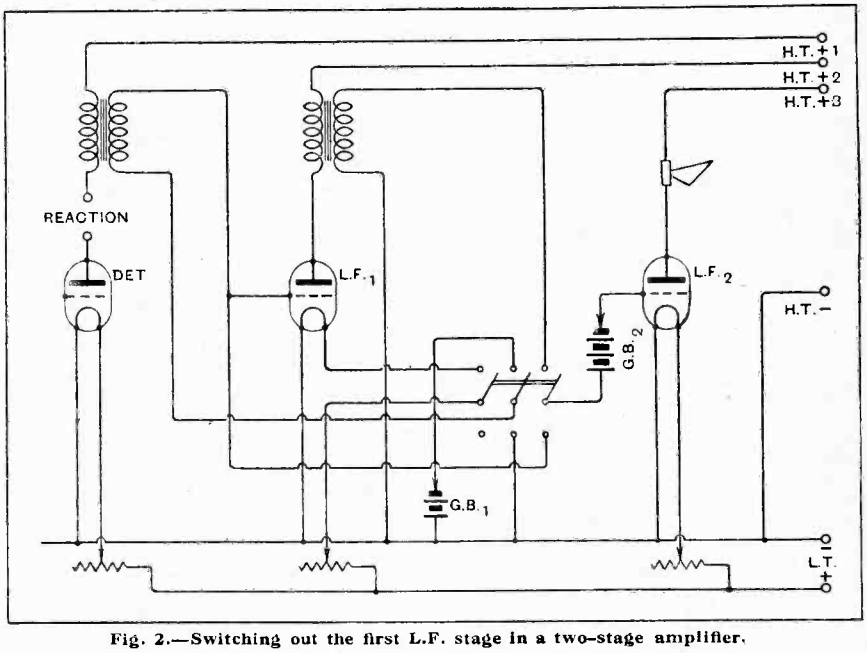

Fig. 2.—Switching out the first L.F. stage in a two-stage amplifier.

Soon Remedied.

I have on hand a number of cylindrical inductance coils made by myself, and wound for various wavelengths. I now wish to experiment with centre-tapped coil circuits, and should be glad if you would tell me the number of turns for the various wavelengths. T. L. S.

The number of turns for specific bands of wavelengths is, of course, no different from the number of turns which would be required in a coil having no centre tap. Thus if one has made a grid coil for use in a straight detector and two L.F. receiver, and one decides to change over to the Hartley circuit, which requires a centre-tapped coil, the same coil will cover the same band of wavelengths. You are advised, therefore, merely to put a centre tapping on each of your coils.

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A Simple Conversion.

I have at present a three-valve broadcast receiver consisting of a "Hartley" regenerative detector, followed by two transformer-coupled L.F. stages. I shall be glad if you will inform me in what way I can convert this into the "Schnell" circuit. T. R. G. D.

It is quite a simple matter for you to convert your receiver from the "Hartley" to the "Schnell" circuit. All you have to do is first to remove your existing "Hartley" reaction condenser, and substitute in its place a 0.00005 mfd. fixed condenser; such instruments are sold by Messrs. Peto Scott, Ltd., 77, City Road, London, E.C.1, but if unobtainable two 0.0001 mfd. fixed condensers may be used in series. Having done this, you must connect a 0.0005 mfd. variable condenser (preferably fitted with a slow-motion device) from the plate of the valve down to L.T.−. It should be remembered that if the plates of this condenser touch, the H.T. battery would be short-circuited, and we should advise a large fixed condenser in series with it in order to avoid the possibility of this mishap, or, of course, you could get over the trouble by connecting from plate of valve to H.T.+ instead of to L.T.−. This new variable condenser will then control reaction.

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A Useful Device.

I have a detector and two L.F. set, which gives adequate volume on the loud-speaker. Owing to ear trouble I find that I myself can hear much better on headphones. If I arrange to connect the telephones after the first L.F. valve, then not only is it not quite loud enough for me, but the loud-speaker does not function as well. Briefly, then, I desire to use telephones at the same time as the loud-speaker is in operation, and I require some method, therefore, of controlling the volume in the telephones independent of that in the loud-speaker. W. G.

Your problem is a perfectly simple one, and all you have to do is to adopt the method of connecting telephones and loud-speaker which we give in Fig. 3. The volume control across the telephones will, if it is a good one, enable you to control the volume of your telephones from inaudibility up to full strength. If possible, use a good wire wound instrument such as the "P.D. Volume Control," manufactured by Messrs. Automobile Accessories, Ltd., 93-95, Victoria Street, Bristol, or any similar instrument by other makers. There are, of course, a large number of inferior volume

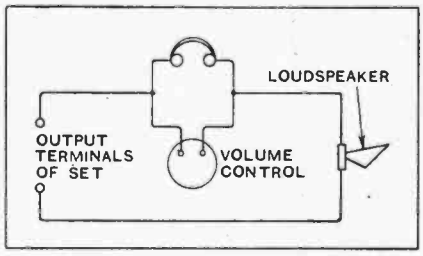

Fig. 3.—Simultaneous use of headphones and loud-speaker.

controls, many of foreign design, upon the market. This will control the volume in your telephones without in any way affecting the loud-speaker volume. Naturally you could, if you so desired, have another volume control across the loud-speaker which would enable you to control loud-speaker volume without altering the volume in the telephones, although usually, in most receivers, there is some device for controlling the total output which could be set so as to give adequate volume in the loud-speaker, and then the telephones volume control adjusted afterwards. Needless to say, if you connect your volume control directly across the output terminals of the set, it will affect both the volume control of the telephones and loud-speaker. This method is quite sound, as it can be used either in the case when the loud-speaker and headphones are connected directly in the plate circuit of the final valve, when a choke filter circuit is used, or after a 1 : 1 ratio telephone transformer. In the latter case, of course, the part of Fig. 3 which we have labelled output terminals of set will be the output terminals of the choke filter device, or the secondary of the transformer as the case may be.

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Getting It Both Ways.

I have built a single-valve set employing the "Weagant" circuit. I find that this receiver gives perfectly satisfactory results on the normal broadcasting band, but reaction is extremely erratic on the long wave band, the set not only increasing the reaction effect and finally oscillating when I increase the capacity of the reaction condenser, as it should do normally, but also exhibiting the same phenomena when I attempt to cut out reaction altogether by setting the reaction condenser to its minimum position. Can you tell me where I have gone wrong? T. N.

The trouble which you mention is probably due to the fact that your H.F. choke is resonating on the long-wave side of the receiver, and if it does this, of course, you will naturally get these effects, because you will get the normal type of "Weagant" reaction when increasing the condenser capacity, and owing to the resonant choke you will simply get a tuned plate circuit when setting the condenser to minimum value. The result is that the valve will oscillate if the grid circuit damping is not too heavy owing to the fact that both grid and plate circuits are in tune with each other. This method of tuned-plate regeneration used to be a great favourite in America for broadcast receivers before the coming of modern H.F. amplification. The remedy is to alter the value of the choke so that it is no longer resonant, and we would advise you to remove turns from the choke until this trouble is eliminated, although you can cure it by putting another H.F. choke in series. In the former case you would be moving this resonant point below, and in the latter case you would be raising the resonant point above the wavelength band on which you desire to work.

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A Rule of Thumb.

You gave very recently a rough-and-ready formula for ascertaining the correct grid bias for any valve. I have unfortunately mislaid the copy containing the necessary information, and should be obliged if you would repeat it. N. V.

A rough idea of the correct grid bias required may be obtained by dividing the H.T. voltage applied by twice the amplification factor of the valve. As an example, we may take a D.E.5 valve, which has a voltage factor of 7, with 140 volts on the anode. This gives us 140÷14 which equals 10; in practice, this grid bias voltage, or perhaps even a slightly higher one, would work well. It should be clearly stated that this formula must only be taken as a rough indication; it is, nevertheless, very useful, and applies particularly to the more efficient types of valves.

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BROADCASTING AND THE PATENT POSITION.

IN this country, broadcasting and the design of broadcast receivers is so closely linked up with the general licence to manufacture under Marconi patents which is issued by that company that it would seem out of place to omit to make reference to an important modification in the terms of this licence which the Marconi Company is at present requiring of its licensees.

Early History.

It will be remembered that about the time that the Broadcasting Company was formed by representatives of the wireless industry with the sanction of the Post Office, the question of manufacture of sets involving the use of circuit principles which the Marconi Company claimed were covered by patents which they held was the subject of much discussion, and eventually the Marconi Company undertook to license all *bona fide* British manufacturers who agreed to pay to them a royalty calculated on the basis of 12s. 6d. per valve holder. This general licence, it was considered, would avoid the very difficult task of collecting royalties in respect of individual patents which might be made use of by the manufacturers. At the time that the establishment of broadcasting stations in this country was under consideration by the Post Office, a state of affairs existed where the Marconi Company might, in virtue of the patents which they controlled, have held a position of monopoly in manufacture of receivers, and it seems likely that the licence from the Post Office for the British Broadcasting Company to operate was granted on the understanding that *bona fide* British manufacturers would be able to come into the industry and be licensed under Marconi patents on terms which had the approval of the Post Office.

A Mixed Blessing.

We have in the past pointed out that, whilst the granting of these general licences by the Marconi Company no doubt opened the door of this new industry to many manufacturers who otherwise would have found it difficult to compete with those who had access to the use of existing patents, yet, on the other hand, it has had one very unfortunate effect, in that, because for a certain sum all manufacturers have been able to utilise circuit arrangements necessary for the operation of satisfactory receivers, they have sadly neglected to undertake research work on their own account and acquire for themselves patents of importance, the value of which would, perhaps, only become fully apparent as certain fundamental patents held by the Marconi Company ran out.

The modification to the general licence which the Marconi Company is now requiring of its licensees is in respect of the basis on which the royalties have been calculated, viz., 12s. 6d. per valve holder. It is now required that, to avoid any misunderstanding or dispute in connection with the meaning which the Marconi Company attached to that original wording, another clause should be inserted in the agreement to define a valve

CONTENTS

holder as applying only to a valve containing the usual three elements of filament, grid, and plate, and placing outside the terms of this general licence the employment of any valves containing anything other or in addition to the usual three elements.

The Marconi Explanation.

On making enquiries at Marconi House an official of the Marconi Company explained that the action taken was solely with the object of elucidating the present situation. When broadcasting began and licences for the manufacture of broadcast receiving apparatus under Marconi patents were first issued, the only type of valve likely to be used was that containing the three usual electrodes. With the rapid development in the design and manufacture of valves, however, many fresh types of valve with multiple electrodes and multiple performance have come into use in connection with broadcast reception.

The intention of the original licence was that a charge of 12s. 6d. should be made for the service performed by each three-electrode valve, but with certain of the new types of valve there is a possibility of misunderstanding in regard to the intention of the licence. The Marconi Company, therefore, has communicated with its licensees with the object of clearing up the situation and enabling the business of manufacturing under licence to be carried on without misunderstanding on the basis that was originally intended.

Effect of the New Clause.

The above explanation makes it clear to us that the terms of the general licence so modified will not authorise manufacturers, unless a separate licence is negotiated for, to use four-electrode valves, multiple valves such as the new German "Loewe" valve, nor the new Hull screened valve recently developed in America, the importance of which, for high-frequency amplification, can scarcely be over-estimated.

It is possible that, within a comparatively short period, sets which employ three-electrode valves only may come to be regarded as obsolete. By this it is not meant to convey the impression that they will be unsatisfactory in their performance, but that the new valves will be so popular that it will be difficult for sets employing only the three-electrode valves to compete with the new arrivals in the market. We may, in point of fact, find that the industry has returned to its former state when the Marconi Company held a monopoly control over the supply of broadcast receivers, and, unless there existed any understanding on the subject of a general licence between the Marconi Company and the Post Office when the Broadcasting Company was constituted, then the issue of licences to permit the manufacture of sets employing the new valves may be restricted to certain manufacturers instead of being generally available, and it may be that the royalty charges which the Marconi Company will feel it necessary for them to impose will have a very serious influence on the future prosperity of the broadcasting industry as a whole.

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EMPIRE BROADCASTING.

WITH pardonable pride the Dutch nation is rejoicing over the prowess of PCJJ, the Philips experimental short-wave station at Eindhoven which awoke one recent morning to find itself famous.

The spirit animating the enterprise of Holland is symbolised in vigorous style in a cartoon, by the celebrated artist Louis Raemaekers, which appeared a few days ago in the well-known Amsterdam "Telegraaf," and bore the following legend:—

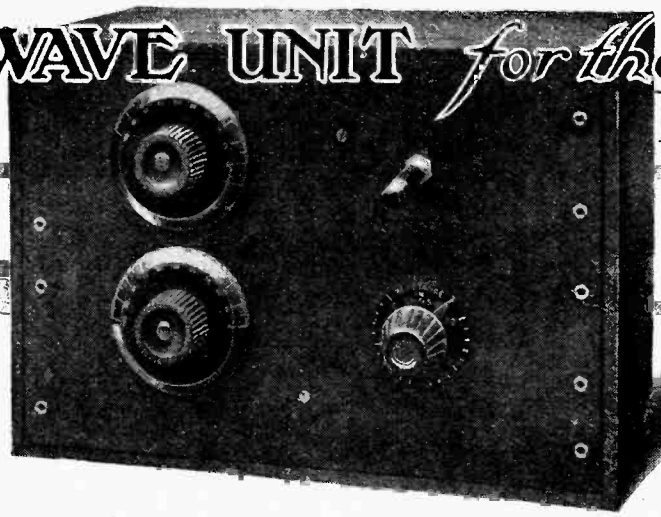
"This evening the transmission of the 9th Symphony of Beethoven will be broadcast to all listeners in the world by the short-wave station of Philips Radio Works. At the same time, this thought-wave of peace and charity will find an echo in the hearts of all who enjoy the reception."

"Broadcast to all listeners in the world" is an optimistic phrase, but the success already secured by the Dutch station justifies a sanguine outlook.

British colonists can at last hear programmes from Europe, but the thought is hardly calculated to bring a glow of pride to British cheeks. Until Britain follows the lead already set and establishes a short-wave broadcasting station for maintaining touch with the Dominions, we can only hope that the delight with which our kith and kin overseas pick up the Dutch programmes may blind them to the lethargy at home.

Under Correspondence we publish further interesting letters on the subject of Empire Broadcasting.

LONG-WAVE UNIT for the NUCLEUS RECEIVER



By H. F. SMITH.

An H.F. Amplifier for Wavelengths from 800-3,000 Metres.

IT was reported in the daily Press a few days ago that a South Coast listener, charged with maintaining an unlicensed receiving set, made the excuse that during the last eighteen months he had heard "nothing worth while listening to." Now the B.B.C. has to put up with some harsh criticism, but it is hardly conceivable that over this considerable period of time anyone could have failed to find a single item which appealed, so the only possible conclusion is that the alleged unlicensed receiver was itself at fault. The majority of those living on the coast at some distance from a station have learnt by hard experience that transmissions on the normal broadcast waveband are spoilt by spark interference, and that Daventry is the only station which can be relied upon to provide good signals with any degree of reliability. Moreover, many have found out that even on the long waves something rather better than the average in the matter of selectivity is necessary to overcome interference from the growing number of broadcasting stations working between 1,000 and 2,000 metres, and also from commercial Morse transmissions. It is, then, both for the benefit of those who have to depend on Daventry, and also for the not inconsiderable number who like to be able to tune in the foreign high-power stations with some certainty, that the instrument to be described in this article was designed.

The unit comprises a single stage of transformer-coupled high-frequency amplification, and, while primarily intended for use with the "Nucleus" receiver,[1] it is possible, as a rule, to add it to any conventional detector-L.F. set without any great difficulty. The circuit diagram given in Fig. 1 shows that the aerial is loosely coupled and separately tuned; the writer is convinced that, in spite of the extra control necessary, it is worth while reverting to this well-tried arrangement, which has considerable advantages on the longer waves. An alternative series condenser is provided, in order that a wide band of wavelengths may be covered without the necessity for frequent changing of coils.

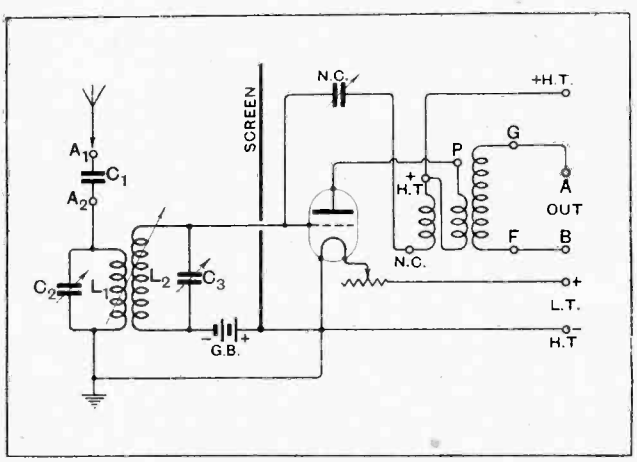


Fig. 1.—The circuit diagram of the unit. C_1, 0.0003 mfd.; C_2, C_3, 0.0005 mfd.

H.F. Transformer Design.

A conventional neutralising system is included, as this is absolutely essential when aerial damping is reduced by loose coupling. The secondary of the transformer is joined to output sockets marked A and B in the diagram. These are for connection respectively to grid and filament of the detector valve contained in the "Nucleus" set, the transformer being tuned by the 0.0003 mfd. variable condenser contained in that unit. The wavelength band covered with that capacity is from about 800 to 2,200 metres; to receive the Eiffel Tower transmissions it is necessary to connect in parallel a fixed condenser of 0.0002 or 0.0003 mfd.

The heart of an H.F. amplifier is the transformer, and it is worth while taking pains to produce a coupling which will give good amplification combined with sufficient selectivity. The design chosen is based on one described by W. James in *Experimental Wireless* for January, 1927; its secondary consists of a No. 300

[1] *The Wireless World*, Dec. 1st, 1926.

Long-wave Unit for the Nucleus Receiver.—"Lewcos" coil, with plug and protective band removed. Over this is wound the primary winding, separated from it by ten spacers cut from ebonite, and measuring 1½in. × $\frac{5}{16}$in. × ⅛in. thick. A shallow depression, 1in. in length, is filed on each of these strips, one of which is fitted with a 10B.A. screw at each end, while two others carry a single screw. The disposition of these strips, together with the connections of windings to the screws, will be clear from a consideration of Figs. 1, 3, and 7, in each of which the same lettering (G, F, P, N.C., and H.T. +) has been adopted.

The primary winding has a total of fifty turns of No. 40 D.S.C. wire, spaced to occupy the full length of the inch-long depression on the strips already mentioned. These strips are not grooved, so the spacing between turns must be estimated, and need not be perfectly regular.

When the primary winding is completed, another spacer measuring 1in. in length, $\frac{3}{16}$in. wide, and $\frac{1}{16}$in. in thickness, should be placed over each of the originals, and held in position with either a rubber band (which is afterwards removed) or else a trace of molten Chatterton's compound at each end. These are for the support of the neutralising winding, also with fifty turns of No. 40 D.S.C. wire, which is spaced to occupy nearly the full length of the strips.

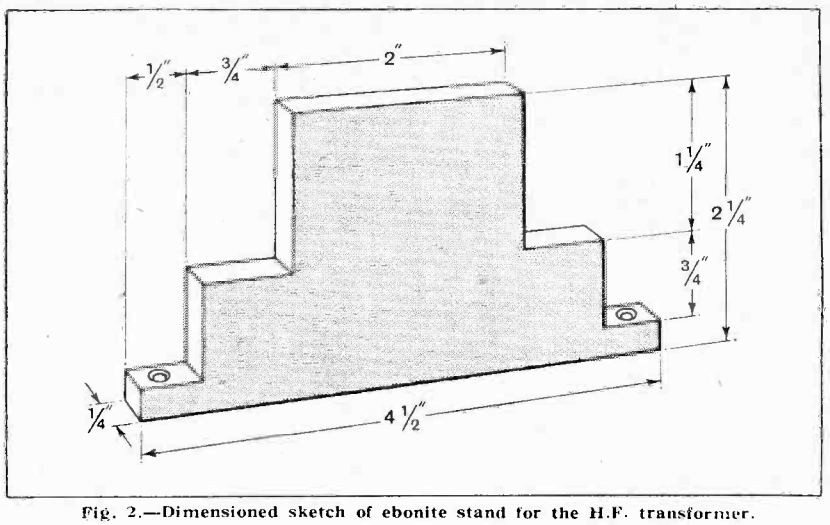


Fig. 2.—Dimensioned sketch of ebonite stand for the H.F. transformer.

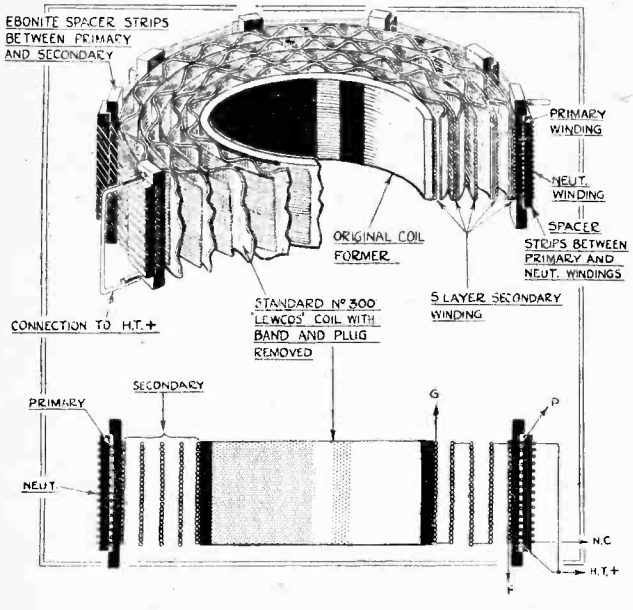


Fig. 3.—"Cut-away" sketch and section through the H.F. transformer, showing method of construction and connections of the ends of the windings.

The completed transformer is slipped on an ebonite support cut from a piece of scrap ebonite to the dimensions given in Fig. 2, a single screw being inserted into its upper surface to hold a double-ended soldering tag for anchoring the inner end of the secondary winding, the outer end of which is led straight to a short length of stiff wire soldered to the appropriate socket. While winding the transformer every care should be taken to avoid breaking these leading-out wires of the original coil, which are of stranded cable; they may be protected by attaching them temporarily to the inner surface of the coil former with Chatterton's compound. It should also be remembered that secondary, primary, and neutralising windings should all run in the same direction.

Layout.

The general arrangement of the unit corresponds closely with that of others in the same series which have already been described, and it may be accommodated in a cabinet of similar dimensions. The baseboard is raised on wooden strips 1¼in. in depth in order that the bias cells may be mounted underneath it. Some apology may appear to be necessary for the apparent crudity of the coil mounting, but, in practice, this simple arrangement proves

LIST OF PARTS.

1 Ebonite panel, 12in. × 8in. × ¼in.
2 Variable condensers, 0·0005 mfd. (Utility).
1 Fixed condenser, 0·0003 mfd. (Dubilier).
1 Neutralising condenser (Gambrell).
2 Single coil holders (Athol).
1 Valve holder (Triumph).
1 Rheostat, 20 ohms (Jennens).
1 Coil, No. 300 (Lewcos).
2 Dry cells, "O" size (Ever Ready).
Sockets, ebonite, screws, aluminium sheet, wood, etc.

Total cost, without coils or cabinet, approximately £2 8 0

In the "List of Parts" included in the description 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.

Long-wave Unit for the Nucleus Receiver.—

quite satisfactory, as when the best coupling is once found it is seldom necessary to alter it; by adopting this plan it is possible to make the dimensions of the instrument uniform with that of the others. A consideration of the photograph on page 614 will show that the aerial coil socket is secured to the baseboard by a single screw, so that it may be moved in relation to the secondary, which is fixed.

The wiring was carried out with No. 18 bare tinned wire, no insulation being considered necessary where leads are taken through the baseboard, as they are all at low potential. It should be noted that the connections to the moving coil holder are made of flexible wires, which are anchored to screws inserted in a small ebonite block. This is clearly shown in the practical wiring plan.

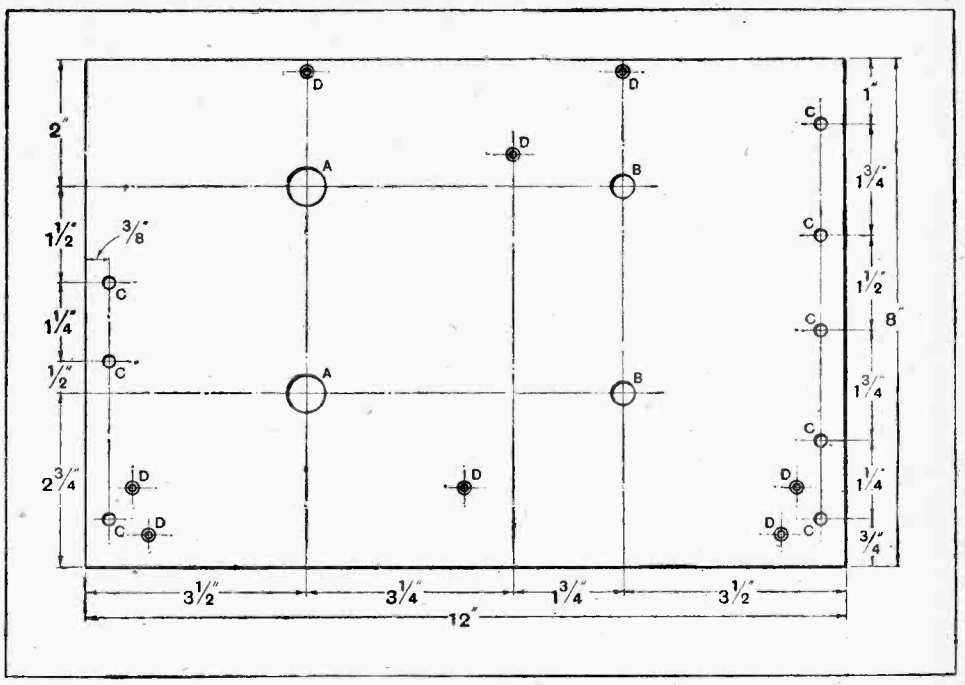


Fig. 4.—Drilling details of the panel. A, 5/8in.; B, 3/8in.; C, 3/16in., tapped 1B.A.; D, 1/8in., countersunk for 6B.A. and No. 4 wood screws.

The H.F. transformer as described is intended for use with a valve of, very roughly, 20,000 ohms impedance, which will have an amplification factor of about 20 (a little less in the case of 2-volt filaments). Representative valves having suitable characteristics are the Cossor 610 H.F., Marconi and Osram D.E.5B and D.E.H.610, Mullard P.M.5X, and S.T.61. Most of these have their counterparts in the 2- and 4-volt ranges. The use of an unsuitable valve may result in a very considerable reduction in amplification.

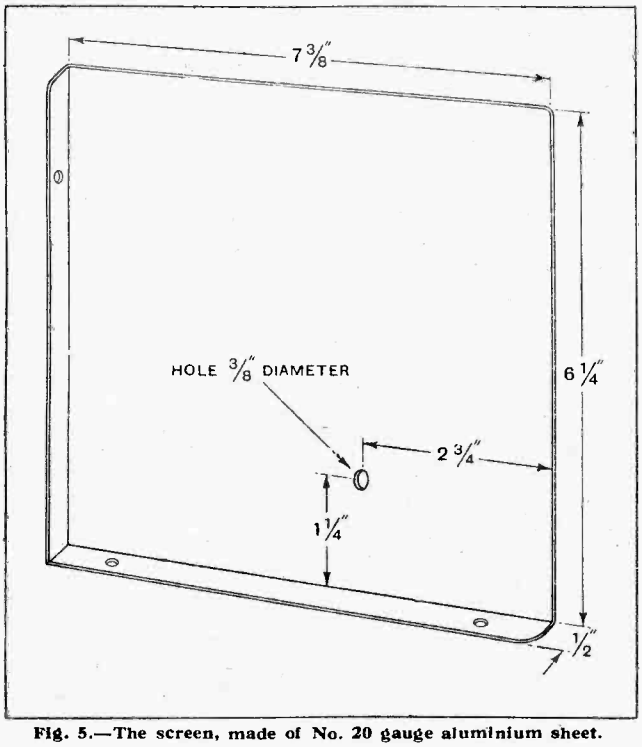


Fig. 5.—The screen, made of No. 20 gauge aluminium sheet.

Before connecting the amplifier to the "Nucleus" receiver it should be realised that the difficulties of separating H.F. and L.F. currents in the anode circuit of the detector valve become more pronounced as the wavelength is increased, so it will be almost essential to connect a damping resistance of from 0.25 to 0.5 megohm directly in the grid circuit of the first L.F. amplifier. This arrangement was discussed in connection with the "All Wave Four" described in *The Wireless World* for April, 27th, 1927.

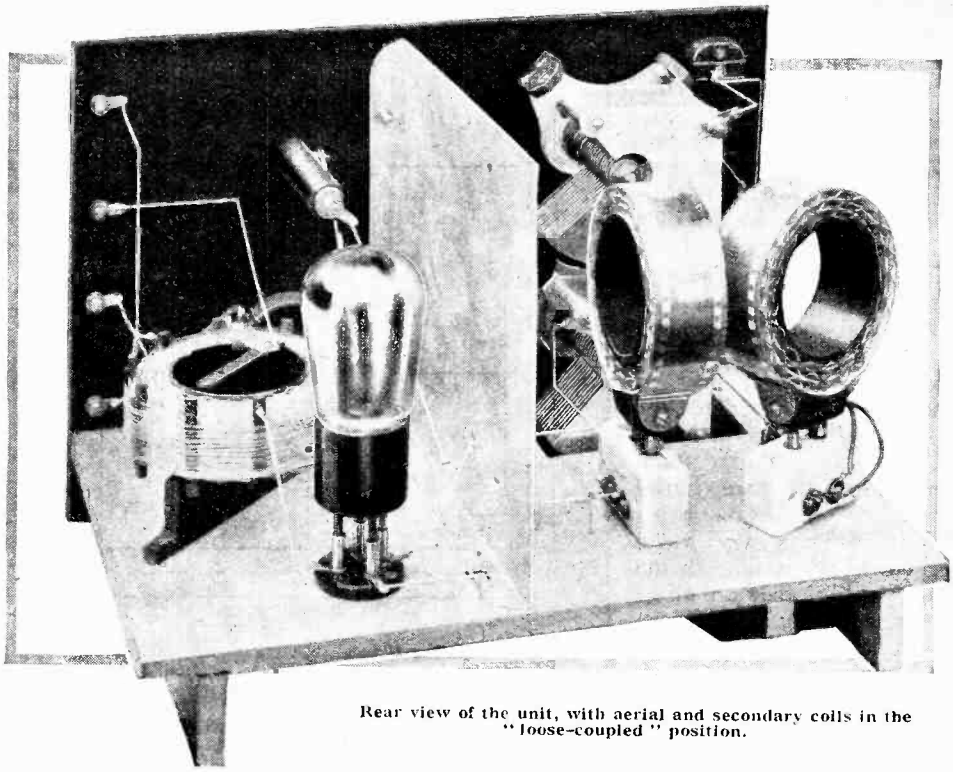
Tuning and Neutralising Adjustments.

The operation of a two-circuit tuner is at first rather strange to those who have been used to direct-coupled receivers with not more than two dials, although it is an art which is easily acquired with practice. Before attempting to master it the H.F. valve should be balanced. The amplifier is connected to the detector-L.F. unit by joining adjacent sockets with short lengths of wire terminating in plugs, and Nos. 150 and 250 coils are inserted in aerial (L_1) and secondary (L_2) holders, their axes being set at an angle of about 45 degrees. All three dials should be rotated until their circuits come into tune, the resulting oscillation being checked by manipulation of the balancing condenser, as described a number of times in this journal. When the set appears to be perfectly stable, even with the aerial coil removed, the search for actual signals may be commenced, remembering that the golden rule for operating any receiver of this description is to make comparatively small changes in the dial readings of each condenser in turn, thus keeping the circuits more or less in tune. The table on page 615

Long-wave Unit for the Nucleus Receiver.—

which shows the actual adjustments for several of the more popular long-wave stations on the receiver actually described, should be of assistance, although it must be pointed out that the data for the aerial circuit (L_1 and C_2) will vary—often very considerably—as the condenser setting depends on the characteristics of the aerial system. That on which these tests were made has a somewhat lower capacity than the average, and it is for this reason that a No. 200 coil was used for L_1, in place of a No. 150, as recommended above.

As soon as a station is tuned in, a record should be made, both in order to facilitate future reception of the same station and also as an aid to finding others on nearby wavelengths. Provided that the coupling remains fixed, the set may be calibrated with considerable accuracy. It is a good plan to find a satisfactory average coupling position, and then to keep to it except under unusual conditions, where maximum selectivity becomes necessary. Incidentally, the data given in the table was obtained with the axes of the coils in the aerial and secondary circuits at an angle of about 80 degrees.



Rear view of the unit, with aerial and secondary coils in the "loose-coupled" position.

It is never an easy matter to convey to the prospective constructor information as to the results which should be obtained with any particular instrument. Local conditions, and the efficiency of the aerial-earth system, will always be the deciding factors, but, as reception on the long waves is always more certain than on the 300-500-metre band, it is considered that a description of results obtained will not be likely to mislead the reader whose conditions are up to the average.

Tested near London, with an aerial about 34ft. in height and an overall length of about 80ft. in conjunction with the "Nucleus" receiver and an extra resistance-coupled L.F. stage, it was found that all the principal European high-power stations were receivable at loud-speaker strength in daylight. With the second L.F. valve omitted, Daventry signals were still strong enough to overload an ordinary power valve, as were those from Hilversum. Radio Paris and Eiffel Tower, under these conditions, were a little too weak for really good loud-

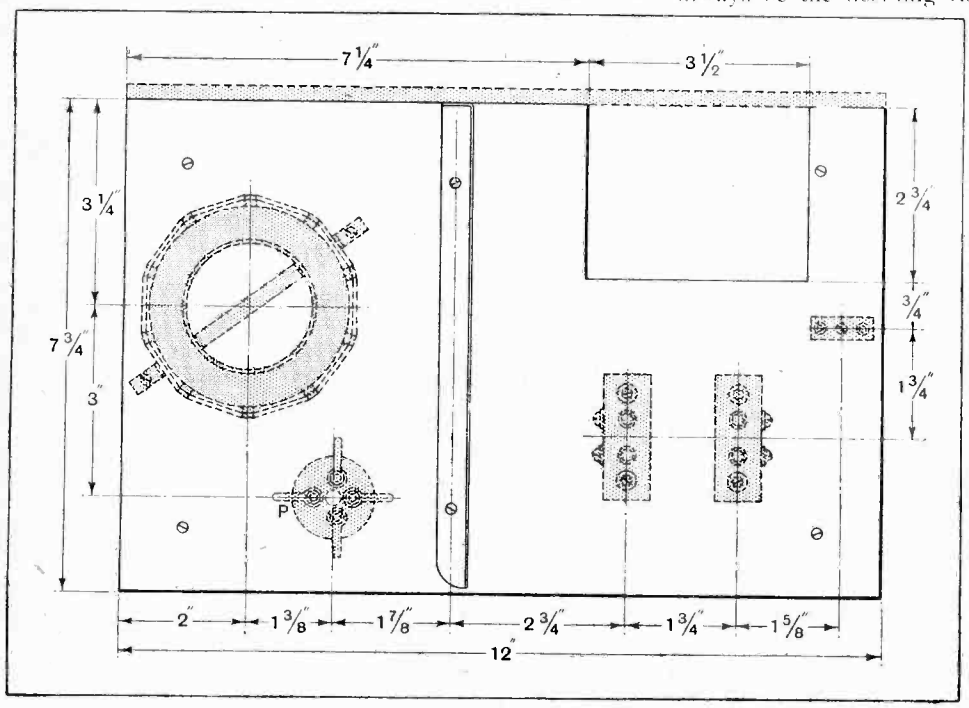


Fig. 6.—Layout of components on the baseboard, which is cut away to clear the moving vanes of the secondary tuning condenser.

Long-wave Unit for the Nucleus Receiver.—

TABLE OF ADJUSTMENTS.

STATION.	Aerial Socket.	Aerial Coil (L_1).	Sec. Coil (L_2).	Condenser Readings.		
				C_1.	C_2.	H.F.C.
Hilversum	A_1	Lewcos 200	Lewcos 250	13	29	26
Koenigswusterhausen.	A_1	,, ,,	,, ,,	26	36	39
Motala	A_1	,, ,,	,, ,,	30	47	44
Daventry	A_2	,, ,,	,, ,,	40	57	62
Radio Paris	A_2	,, ,,	,, ,,	60	66	71

speaker reproduction, although ample volume was obtained with the addition of the second amplifier.

It was found necessary to use a No. 250 coil as L_1 for the reception of the last-mentioned station, although a No. 200 would be large enough with many aerials. With a secondary coil of 250 turns the condenser C_3 was at almost maximum capacity, so it would be preferable to use a No. 300; indeed, it is probably best to retain this coil for all wavelengths, although selectivity will be *slightly* less than if a higher ratio of capacity to inductance is employed.

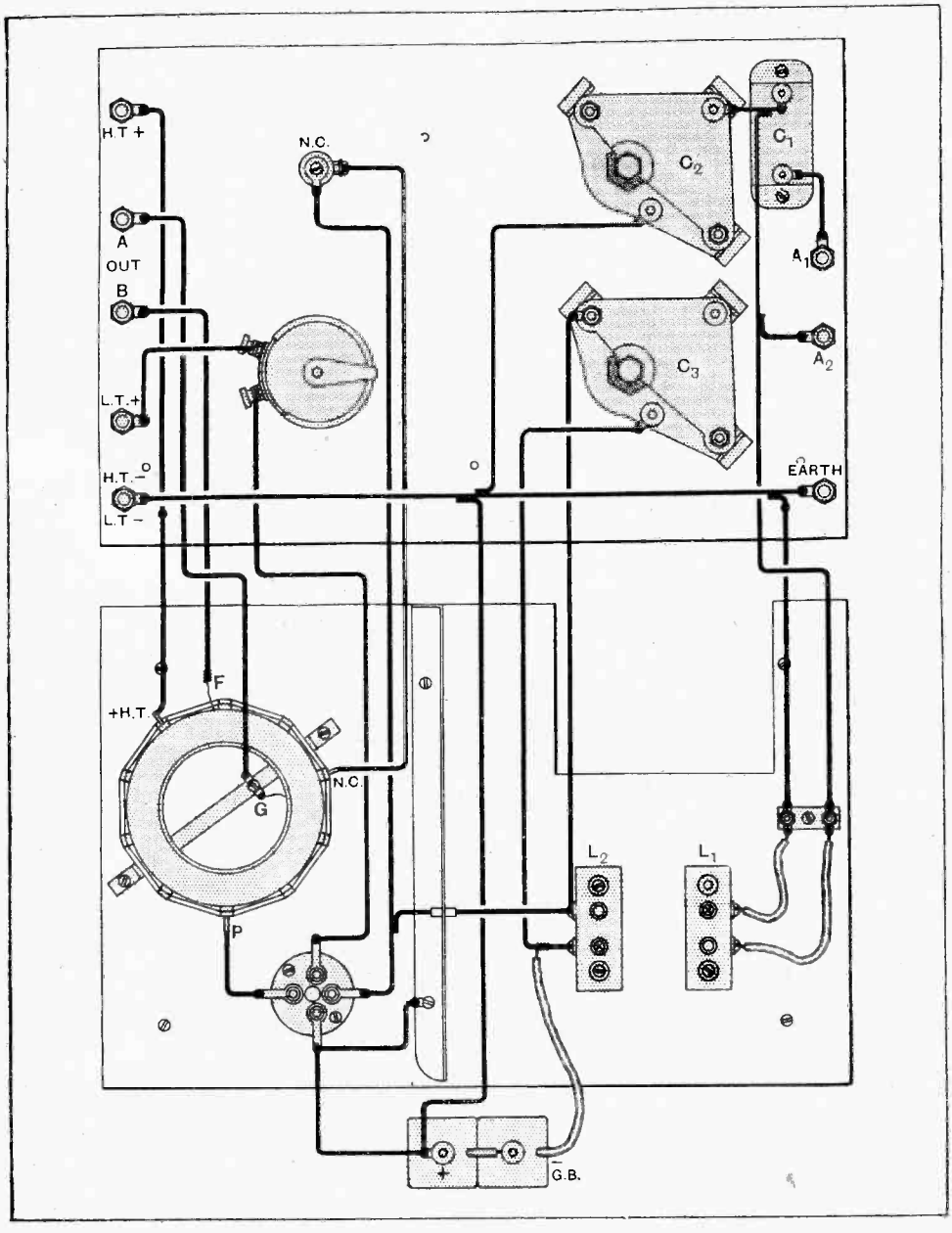


Fig. 7.—The practical wiring plan. The grid bias cells are actually mounted under the baseboard, below the moving coil holder.

The aeroplane and aerodrome telephony transmissions on 900 metres may be well received by the help of this unit. An aerial coil of from 100 to 150 turns will be required for this wavelength, and if the latter is used the aerial should be connected to the A_1 terminal.

Reaction Control.

The neutralising condenser is mounted in an accessible position on the panel, and thus may be considered as a control of reaction; when its capacity is changed slightly on either side of that giving a perfect balance, a certain amount of regeneration is produced, and the whole receiver becomes more sensitive. However, it has been found that this control is hardly necessary, and the amateur is recommended to operate his set in a neutralised condition. By doing so, risk of causing interference with others is entirely obviated, and in any case the advantage gained by using reaction in this particular set is very slight.

When the amplifier socket marked H.T. + is joined to its corresponding socket on the "Nucleus" receiver, as it is intended to be, the high-tension voltage applied to the H.F. valve will, of course, be the same as that supplied to the others—as a rule about 120 volts. This pressure is quite suitable for the type of valve recommended above, but if necessary the socket may be connected directly to a tapping on the H.T. battery.

NEWS FROM THE CLUBS.

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

Loud-speakers Tested and Demonstrated.

Before an audience of about 100 persons at a meeting of the Muswell Hill and District Radio Society on April 27th, Mr. J. E. Roe, A.M.I.E.E., of the B.B.C. gave a demonstration of the R.K. type loud-speaker, which gave very impressive results. The lecturer tested a number of cone loud-speakers, owned by members, giving fairly good results, and he affirmed that it was impossible with a horn loud-speaker to reproduce the low notes properly unless the horn is some 16in. long.

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H.F. Neutralising.

Capt. H. J. Round, M.C., M.I.E.E., was present at an informal meeting of the Muswell Hill and District Radio Society on May 4th, and he gave members particulars of a highly efficient H.F. neutralising method which he had evolved. The system embodied an ordinary H.F. and detector stage, the aerial coil being tapped at about one-third of its length and the tuned anode at about one-quarter. A tightly coupled coil was wound round the earth end and H.T. end of the aerial and anode coils respectively with about 14 turns on an ordinary solenoid. The end turn of the aerial neutralising coil was joined to the first turn of the anode neutralising coil and the first turn of the aerial neutralising coil was coupled through a small variable condenser to the end turn of the anode neutralising coil. Reaction could be introduced by joining a variable condenser to the detector plate from the condenser to a reaction coil and thence to earth.

The Society is planning an active summer and intending members are asked to communicate with the Hon. Secretary, Mr. G. S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 18th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. At the Institution, Savoy Place, W.C.2. Lecture: "A Wireless Works Laboratory," by Mr. P. K. Turner.

Muswell Hill and District Radio Society. At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration of Screened Coils, by Captain Tinsley (of Messrs. Peto Scott, Ltd.).

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove. Lecture: "L.F. Amplification," by Mr. L. Tracy.

THURSDAY, MAY 19th.

Golders Green and Hendon Radio Society.—At 8 p.m. At the Club House, Willifield Way, N.W.11. Elementary Wireless Transmission, with demonstration, by Mr. Maurice Child.

FRIDAY, MAY 20th.

Radio Society of Great Britain.—Informal meeting. At 6 p.m. (tea at 5.30). At the Institution of Electrical Engineers, Savoy Place, W.C.2. Discussion: "Electrical Measurements," to be opened by Mr. F. M. Colebrook.

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About Measuring Instruments.

Mr. E. H. Laister continued his lecture on "Electrical Measuring Instruments" at the meeting of the North Middlesex Wireless Club held on April 27th. The lecturer, dealing first with the Kelvin Quadrant Voltmeter, said that the great advantage of this instrument was that no current flowed through it though some 40 volts were necessary to give a full scale deflection. Turning to current measuring instruments the lecturer took as his example the Kelvin Electric Balance. In this case two coils are balanced on a very ingeniously suspended bar, and placed in the field of four fixed coils. The coils are so connected up that when current is passed through the whole six coils, a torsional effect is produced, which is counterbalanced, and the pointer brought back to zero, by the movement of a rider on a graduated bar. The graduation of this bar, and the displacement of the rider necessary to bring the pointer back to zero, can be arranged to give a direct reading of the current flowing.

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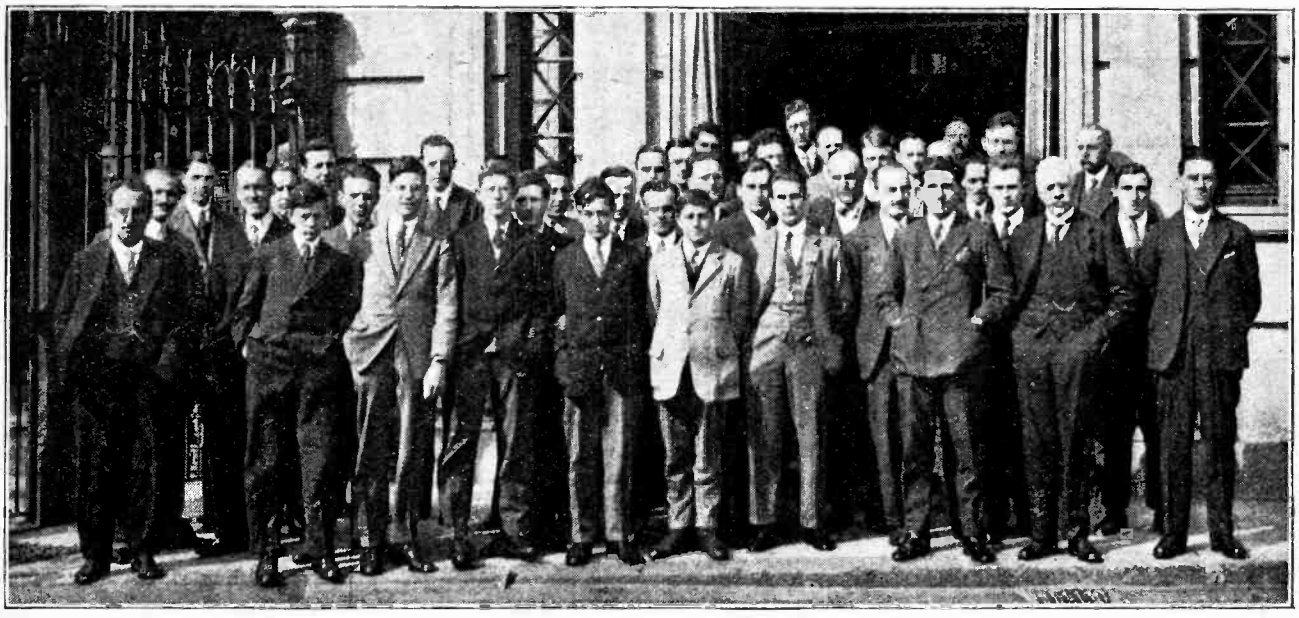
Tricks with a Voltmeter.

The lecturer concluded with a series of carefully explained instruments with a valve circuit designed to demonstrate that the readings on a voltmeter applied to such a circuit could not be accepted at their face value. This was strikingly illustrated by placing the voltmeter first across the H.T. battery, then in turn across the plate and filament of the valve and across the phones. It was found that when the drop of potential across the phones was added to the voltage of the plate, the sum of these voltages did not make up the voltage of the H.T. battery. The discrepancy amounting in some cases to 8 or 10 volts was due to the resistance of the voltmeter.

Hon. Secretary, Mr. H. A. Green, 100, Pellatt Grove, Wood Green, N.22.



SOCIETIES VISIT OSRAM VALVE WORKS. Members of the Western Metropolitan Group of Radio Societies photographed on the occasion of a recent visit to the works of the M.O. Valve Co., Ltd., at Hammersmith. The societies represented were Golders Green & Hendon, Hounslow, Inland Revenue, Lyons, Muswell Hill, Tottenham, and Wembley.

SAC LECLANCHÉ CELLS.

Discharge Tests on Small Cells Designed for H.T. Supply.

By F. BLAKEY and I. F. SAMUELS.

THE question of the supply of high-tension current for wireless receivers has met with considerable attention in some of its aspects, and it is not proposed to re-cover any of this ground. Rectified A.C. supply, smoothed D.C. supply, accumulators and dry batteries, have been dealt with fairly exhaustively, but on a subject which appears to be evoking considerable interest at the present time, viz., that of small batteries of the sac Leclanché type, very little appears to be known.

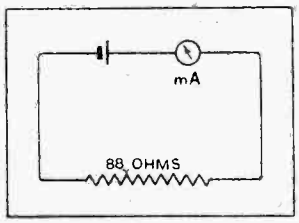


Fig. 1.—Simple circuit used in discharge tests. Neglecting the resistance of the meter, the E.M.F. of the cell (on load) is 88 × current reading in amperes.

In view, therefore, of the scarcity of information available, other than that of a general nature, supplied by the various makers of this type of cell, it was decided to conduct some tests of a quantitative nature on a recognised make.

Two types of cell were under consideration, one containing a large sac approximately 1in. in diameter, and one using the smaller type of sac. The zincs in each case were weighed, and the loss in weight determined at intervals.

A solution of ammonium chloride of 20 per cent. strength was used in both cells. In the case of the larger cell using the same volume of liquid as the small cell it was found that, due to an accumulation of zinc chloride, it was necessary to renew the solution after the equivalent of two months' use.

Originally, it was decided to subject the cells to a discharge of 10 milliamps. with fixed intervals for recuperation and so to obtain a comparison of their respective lives as well as general information on the subject. Afterwards, however, in order to shorten the length of time necessary for running the cells down, a higher discharge was decided on. Since it was assumed that 8 milliamps. would be the average amount of current to be supplied, double this output was arranged for, this not being considered unreasonable for the size of the cell. An 88-ohm coil of Eureka wire was connected in series with a sensitive milliammeter. No voltage readings were taken, since from a consideration of Ohm's Law, the potential existing across this coil could be calculated accurately for any reading of the current. The two cells were tested separately.

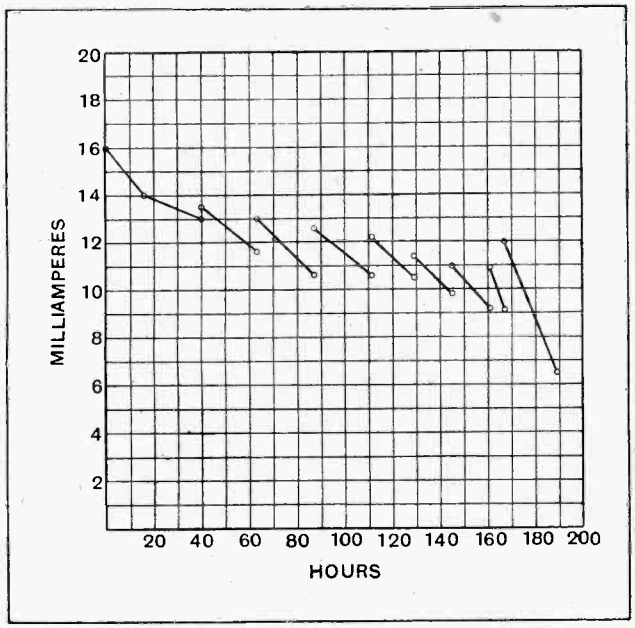


Fig. 2.—Discharge graph of large type cell (1). Recuperation periods are indicated by discontinuity of the curve, only discharge time being indicated on the graph.

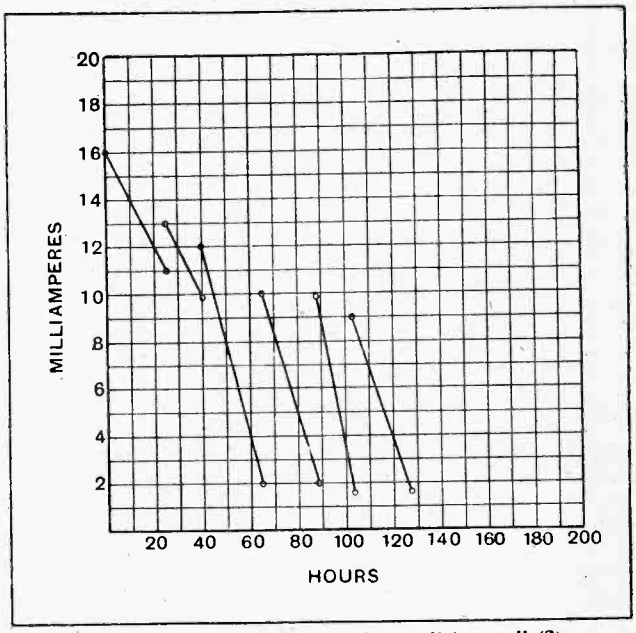


Fig. 3.—Discharge curves for the small type cell (2).

At the commencement of the test the discharge was 16.0 milliamps. in each case, giving a potential drop of 1.41 volt across the coil. This is the closed circuit voltage, and is comparable with that obtained ordinarily across the H.T. terminals of the set while working.

The graphs show the readings taken during discharge. The discontinuities in the curve show the recuperation intervals. It was not found possible to keep the time periods of the tests of cells 1 and 2 altogether comparable, but the results are so conclusive as to make this a secondary consideration.

In the case of the larger cell the amount of zinc supplied (8.4 grams) allows for a theoretical life of approxi-

Sac Leclanché Cells.—

mately 7 ampere-hours, and on the basis of 8 milliamps. for three hours per day, this should be sufficient for 290 days or 9½ months.

In the smaller cell the zinc was larger (12 grams), and allowed for a theoretical life of thirteen months' service on the same basis. It was found from the weighings that in practice, due to disintegration, it would be impossible to count on more than six months from either of the zincs.

From the curves the influence of the size of the sac is readily observable. The very steep slope of the lines in Fig. 3 indicates rapid polarisation, and the ultimate E.M.F. is as low as 0.13 volt. The more gentle slopes in Fig. 2 are indicative of slower polarisation. The photograph (Fig. 4) shows the cells with zincs and sacs after use. The disintegration of the zinc is quite marked.

Fig. 4—Appearance of cells at conclusion of tests showing disintegration of zincs.

The tables below give the principal details of the cells and also the measurements taken during discharge :—

TABLE 1.

	Large Cell.	Small Cell.
Size of Zinc	3.75 × 5 cms.	7 × 3.75 cms.
Thickness of Zinc	0.5 mm.	0.5 mm.
Weight of Zinc	8.4 grams	12 grams
Volume of Solution	25 c.c.	25 c.c.
Size of sac	2.5 cms. dia.	1.5 cms. dia.

CELL 1.

No. of Hours.	Total No. Hours.	Starting Current (mA.).	Finishing Current (mA.).	Average (mA.).
16	16	16.0	14.0	15.0
24	40	14.0	13.0	14.0
23	63	13.5	11.6	12.55
24	87	13.0	10.6	11.8
24½	111½	12.6	10.6	11.6
17½	129	12.2	10.5	11.35
16	145	11.4	9.8	10.6
16	161	11.0	9.2	10.1
6	167	10.9	9.1	10.0
22	189	12.0	6.5	9.8

Total: 189 hours. Average discharge: 11.7 mA.
Total discharge: 2,220 milliampere hours. Test discontinued.

CELL 2.

No. of Hours.	Total No. of Hours.	Starting Current (mA.).	Finishing Current (mA.).	Average (mA.).
24	24	16.0	11.0	13.5
16	40	13.4	9.8	11.6
24	64	12.0	2.0	7.0
24	88	10.0	2.0	6.0
16	104	9.8	1.5	5.6
24	128	8.0	1.5	4.7

Total: 128 hours. Average discharge: 8.7 mA. Total discharge: 1,180 milliampere-hours.

Conclusions.

In drawing any conclusions from these tests many factors have to be considered. Generally speaking, space occupied is not of primary importance, and so the extra bulkiness of this type of battery is not serious. There are occasions, however, which would on this account render their use undesirable; for portability, for instance, these cells are not to be recommended, both on account of their bulk and for the ease with which the electrolyte is spilled.

There is, however, one field in which they are likely to prove extremely useful. Stocks of zinc, sal ammoniac and sacs can easily be maintained without deterioration, and for places where it is impossible to use the other types of cell, this type of cell is a veritable boon in that a new battery can be made up quite easily at any time. Further, it is quite an easy matter to remove a faulty cell and recharge it.

CRYSTAL DETECTORS.

Recent Research with Galena Crystals.

THE rectifying action of crystal detectors has been the subject of many theories and much speculation. At one time it was thought that the rectification was due to a thermal effect, and more recently an electronic theory has been put forward which accounts for many of the observed phenomena.

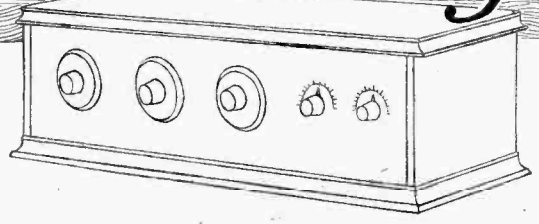
The distribution of sensitive and insensitive spots over the surface of a crystal, however, does not seem to obey any fixed law, and no theories have so far been advanced which satisfactorily account for the fact that good and bad spots are often found in close proximity.

Some light is thrown on this problem, however, by the results of investigations by Messrs. A. Schleede and H. Buggisch of the chemical composition of galena. They have shown that small crystals of galena, chemically formed from lead and sulphur, are not of uniform chemical composition and that certain crystals contain more sulphur than is indicated by the chemical formula. It was found that crystals with the highest sensitivity as detectors contained an excess of sulphur.

The logical conclusion is that minute crystals rich in sulphur constitute the sensitive spots in a galena crystal detector, and in this discovery also is to be found an explanation of the wide difference in quality between specimens of natural galena mined in different parts of the world.

H. K.

PRACTICAL HINTS AND TIPS



Aids to Better Reception.

Theoretical Diagrams Simplified.

H.F TRANSFORMER CONNECTIONS.

Experience shows that the great majority of failures to obtain good results with several of the receivers including the modern type of H.F. transformer are directly traceable to faults in this component itself. Attention has already been called in these columns to the need for good insulation and correct spacing between primary, neutralising, and secondary windings, but emphasis may also be laid on the absolute necessity for proper connection of the various terminal points. In particular, it should be remembered that the primary and neutralising coils are wound over the low-potential end of the secondary—that which connects, generally through a grid bias battery or potentiometer, to the filament of the succeeding valve, and *not* over that end which is joined to the grid.

Results, of a sort, may be obtained if this connection of the secondary is incorrect, but the amplification will be poor in comparison with that which should be expected, and the set is certain to be unstable; it will generally be found that a separate adjustment of the neutralising condenser becomes necessary for each setting of the tuning dials. Constructors of sets including these transformers who are dissatisfied with the performance of their receivers should check the wiring carefully, being guided by Fig. 1, in which the connections of both aerial-grid and H.F. intervalve transformers, as well as the relative positions of the various windings, are clearly shown. The letter indicates the points to which the ends of each section are connected: G corresponds to grid, F (or G.B.) to filament (generally through the grid bias battery, as stated above), P to plate, N.C. to neutralising condenser, A to aerial, and E to earth.

In the sketch showing the H.F. transformer, the section of the neutralising winding is indicated by full dots, while the primary, with which it is interwound, is shown by circles.

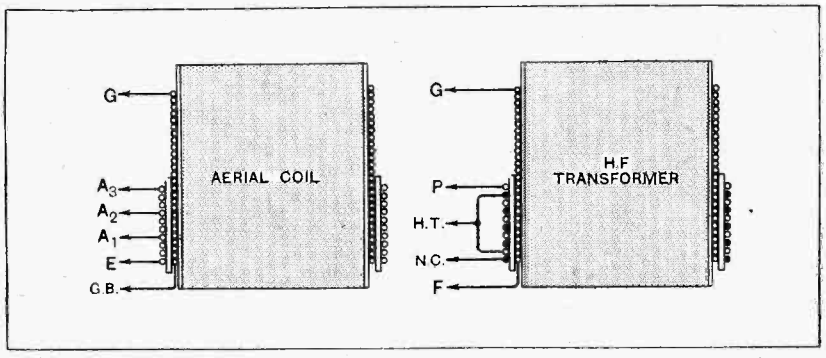


Fig. 1.—Sectional sketches of aerial-grid and H.F. transformers, showing ultimate connections of the terminal points.

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THE REACTOR VALVE.

The advantage of a separate reacting valve is most pronounced when it is used in conjunction with one of the recently introduced high-magnification valves functioning as a bottom-bend detector, with a high ohmic resistance in its anode circuit. There is no doubt, however, that there are some points in favour of this arrangement as applied to the leaky grid

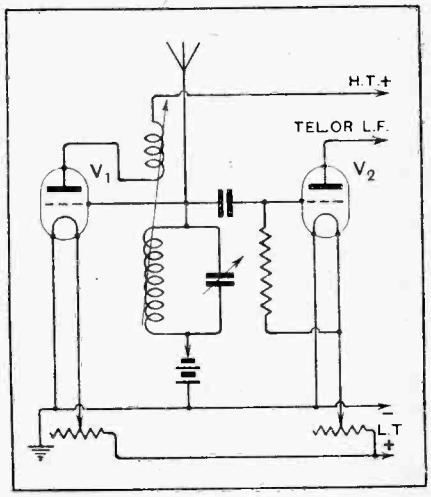

Fig. 2.—Controlling grid voltage of a reactor valve.

rectifier, which usually has to perform the operations of both detection and regeneration. Its adjustment can hardly be absolutely correct for both functions, and in practice one has to effect a compromise between those giving best detection and smoothest control of reaction.

When a separate reactor is used with an anode detector, where there is no grid circuit condenser (which would act as an insulator), the grids of both valves automatically assume the same potential, and thus types having different characteristics must obviously be fitted, as the rectifier should be working on the bend of its curve and the reactor on the straight portion. With the grid circuit detector, however, conditions are different, and provided that the leak is connected between grid and filament, and not across the condenser, the grid of

the reacting valve will normally be at zero voltage. In order to economise in H.T. battery current and to prevent additional damping, it is advisable to insert a small bias battery of one or two cells, as shown in Fig. 2, in such a way that a negative voltage is applied to the grid of V_1, which is the reactor. The detector, V_2, is effectively insulated from this battery by the condenser, and its grid potential is determined by the point of connection of the lower end of the leak to the filament circuit, irrespective of the bias voltage applied to the reactor.

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THE REASON FOR NEUTRALISING.

It must not be thought that the addition of a balancing or neutralising device adds anything to the effectiveness of a high-frequency intervalve coupling. Indeed, it would not be far short of the mark to say that such arrangements are rather more likely to introduce a reduction in signal strength, unless designed with the greatest care; they cannot in themselves add amplification, but make possible the use of lightly damped efficient circuits, and in particular of a loosely coupled and selective aerial-grid coupling. Were it not for the introduction of the principle of neutralisation, the application of such devices to a receiver including H.F. amplification would be impossible; or, more accurately, valueless, as artificial damping would be required in order to prevent uncontrollable self-oscillation.

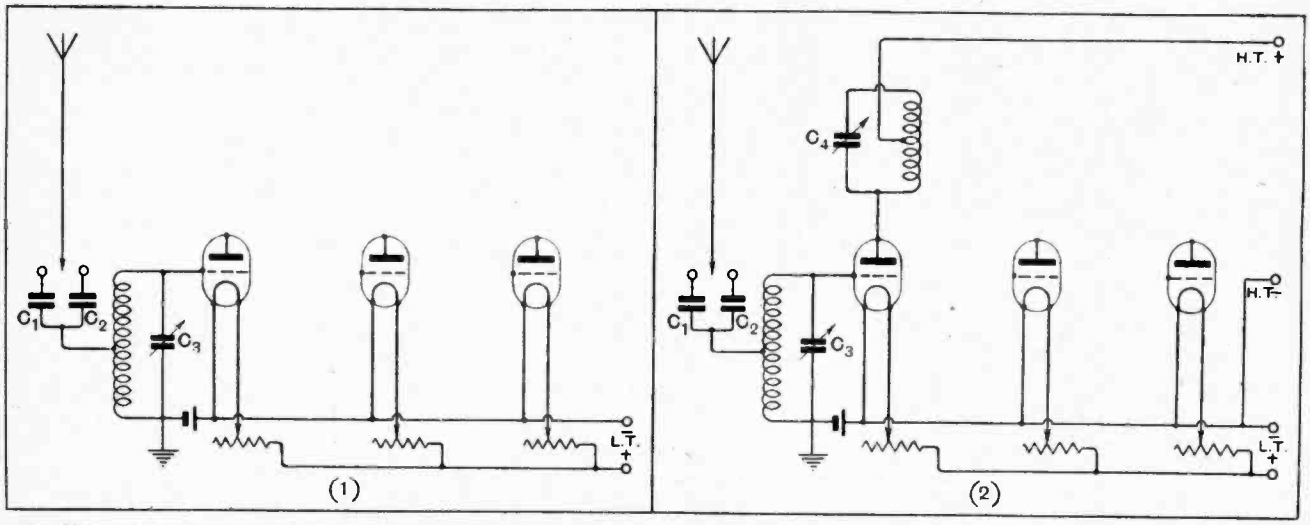
DISSECTED DIAGRAMS.

Practical Points in Design and Construction.

No. 71.—A Neutralised Tuned Anode Receiver.

(To be concluded in next week's issue.)

The present series of diagrams is intended to show progressively, and in an easily understandable manner, the various points to which special attention should be paid in the design of typical wireless receivers, and at the same time to assist the beginner in mastering the art of reading circuit diagrams. While giving less H.F. amplification than a well-designed transformer, the neutralised tuned anode coupling shown below has some advantages from the point of view of simplicity and easy interchange of wavelengths.



The filaments are connected in parallel across the L.T. battery, with separate controlling rheostats. A tuned coil is connected between grid and filament of the H.F. valve. A bias cell is interposed, while——

—— the aerial is connected to the centre point through one of the alternative series condensers. The plate of this valve is connected to one side of a tuned anode coil, the centre point of which is joined to H.T. +.

ALTHOUGH separate rheostats are shown for each valve, this elaboration is hardly necessary, particularly in a circuit of this description, if valves of similar filament characteristics are used.

A capacity of about 0.0005 mfd. is suitable for C_3, although one of 0.0003 mfd. may be substituted. The coil may be of the commercial centre-tapped pattern, or can be home-made, with about 70 turns of No. 24 D.C.C. wire on a 3in. former. For the long waves, a section-wound coil of 250 turns of No. 28 D.C.C., with a mean diameter of 3in., is recommended. The series condensers C_1 and C_2 are inserted in order to reduce aerial damping; they should have capacities of about 0.0001 and 0.0003 mfd. respectively, the larger being used for long waves. Alternatively, a variable condenser of 0.0005 mfd. may replace these two fixed capacities; it should be regarded rather as a control of aerial coupling than a tuning device. The anode coil and its tuning condenser C_4 may be similar to those suggested for the grid circuit.

The choice of the H.F. valve is a matter of some importance. If good amplification, combined with selectivity, is to be obtained, one with an impedance of about 70,000 ohms and an amplification factor of about 35 should be used.

THE LOGARITHMIC CONDENSER

How the New Condenser Serves as an Aid to Tuning.

By F. H. HAYNES.

IT is interesting to reflect that less than three years ago all variable condensers used for tuning purposes were fitted with semicircular shaped plates in which the change of capacity advanced uniformly as the dial moved from 0 to 180 degrees. Thus if the capacity at 10 deg. was 20 $\mu\mu$F,[1] then at 20 deg. the capacity would be 40 $\mu\mu$F, and at 90 deg. 180 $\mu\mu$F. At that time it was customary to allocate bands of wavelengths for certain classes of communication, and the wavelengths adopted by the various stations within a band were evenly spaced. If wavelengths of 200 to 400 metres were to be used for broadcasting then station A might operate on 200 metres, B on 250 metres, C on 300, and so on.

Square Law and S.L.F. Scales.

As the wavelength to which a circuit tunes varies as the square root of the capacity of the tuning condenser, it was soon observed that stations near the lower end of the tuning scale of the condenser were separated by only small intervals, while it was necessary to rotate the dial through a much greater distance to produce the same wavelength change when using the condenser near its maximum capacity. This led to the straight line capacity condenser being completely superseded by the "square law," or straight line wavelength condenser having plates shaped so that the capacity change was proportional to the square of the degree setting of the dial. With the scale of the dial increasing according to the square of the capacity value of the condenser, and the wavelength depending upon the square root of the capacity, it is obvious that the condenser scale of a square law condenser is directly proportional to the wavelength, a given increase in the degree setting of the dial representing a definite band of wavelengths.

Now that station wavelengths are allocated according to their relative frequencies[2] instead of by uniform numerical difference of wavelength it is obvious that the scale of the tuning condenser should be so devised that "frequencies" rather than "wavelengths" should be equally spaced around the scale of the tuning condenser. This is the aim of the straight line frequency condenser in general use to-day. As frequency varies inversely with wavelength, their product being a constant, it follows that the plates of the S.L.F. condenser must be shaped so that the capacity change is inversely proportional to the square of the scale divisions. The contour of plates designed to produce a capacity change varying inversely as the square of the wavelength (S.L.F.) follows an hyperbolic spiral, the actual part of the spiral employed depending upon the simple ratio between the highest and lowest frequencies to which the condenser is required to tune.

It may be said that comparatively few of the S.L. condensers available on the market are mathematically perfect, yet the particular plate shape adopted may add to the convenience of tuning so that any errors in plate shape which may exist are not readily revealed to the user.

Condenser plate design is now to undergo another modification, the need for which having primarily arisen from the practice of linking together several tuning condensers to a common control though bringing with it other advantages. Recently tuning condensers have appeared on the market in which the capacity change varies logarithmically.

Slide Rules and Abacs.

To more easily appreciate the merits and particular application of the logarithmic condenser, one might consider the method by which the relationship between inductance, capacity, and wavelength (or frequency) is determined. Wavelength is proportional to the square root of

[1] $\mu\mu$F = micromicrofarads. 20 $\mu\mu$F = 0.00002 mfd.

[2] Frequency × wavelength = 300,000,000 approximately.

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the inductance-capacity product or expressed in practical units,

$$\lambda = 1885\sqrt{LC}. \quad \ldots\ldots\ldots \quad (1)$$

λ being the wavelength in metres, L the inductance in microhenries (μH), and C the capacity in microfarads

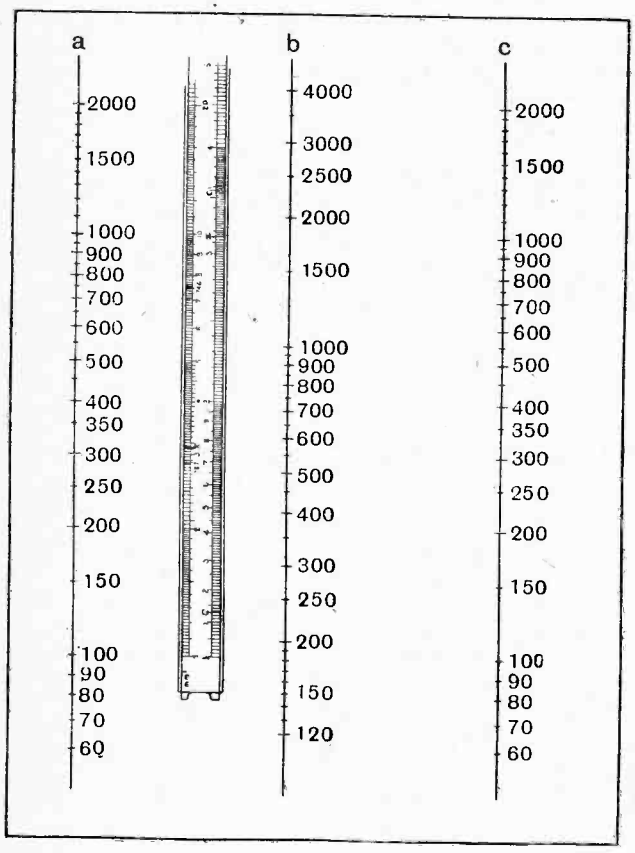

Fig. 1.—WAVELENGTH ABAC. The three logarithmic scales a, b and c represent inductance in microhenries, wavelength in metres and capacity in micromicrofarads. B is equidistant from a and c. Given any two of the factors of wavelength, inductance and capacity, the third is revealed by the point at which a straight edge cuts the scale of the factor to be determined when bridging the two given values on the other scales. The figures on the slide rule scale coincide with the markings on the scale a and show the method by which a scale of this sort is set out.

(μF). In making use of a slide rule to solve this equation the actual process becomes

$$\log \lambda = \log 1885 + \tfrac{1}{2} \log L + \tfrac{1}{2} \log C \quad \ldots\ldots \quad (2)$$

Several graphical methods have been devised comprising logarithmic scales for solving this equation, the best known being probably a wavelength "abac." Such an abac is shown in Fig. 1, and it is quite easy, without a mathematical knowledge, to trace out its operation. The three scales are marked off logarithmically by transferring the scale of a slide rule or reading off the logarithms of the numbers from a table of logarithms and setting out the values along one edge of a piece of squared graph paper. All three lines are equally spaced. The abac is used by placing a straight edge between points on the inductance and capacity scales representing the logarithms of inductance and capacity, the wavelength (or frequency) being read off at the point of intersection on the middle scale.

In setting out the scales it is only necessary to determine one point on the wavelength line, marking off the logarithms of the wavelengths above and below this point.

It will readily be seen that for a given increase or decrease on the scale (c) representing the logarithms of the capacity, and with the straight edge at a fixed point on the inductance scale (a) that the point of intersection on the wavelength scale is moved by half the amount of the logarithm of the capacity. Similarly changes on the inductance scale, (a) produce a change on the logarithmic scale of wavelengths equal to half the logarithm of the inductance. Scale (b) is actually displaced by an amount equal to the logarithm of 1885 as required by the equation (2).

The arithmetic mean, or half the sum of the logarithms of inductance and capacity, is obtained in an interesting form of wavelength slide rule[3] by arranging the two scales to read one against the other, one of the scales being reversed (Fig. 2). The logarithms of the wavelength are in this instance set out on twice the scale of the logarithms of inductance and capacity. The sliding scale of capacity (or inductance) also carries a pointer moving against the scale of wavelength, which moves in the same direction for a decrease in the value of the reading taken on the inductance (or capacity) scale, while at any setting of the scale all combinations of inductance and capacity which produce a given wavelength can be read off. A modification of this form of wavelength slide rule has been devised[4] in which a movable capacity index slides with respect to a fixed inductance index and reads against a fixed wavelength index set out on twice the scale.

Circular Wavelength Calculator.

Continuing in the design of wavelength slide rules, Fig. 3 shows a circular form of calculator such as can be easily constructed from cardboard, and in which the scales of inductance, capacity, and wavelength are each set out so that the resultant can be read off given a combination of any two of the factors. Here, again, wavelength is represented on twice the scale of the logarithms of capacity and inductance and is displaced by an amount equal to the logarithm of 1885.

Thus with a given coil the inductance pointer takes up a

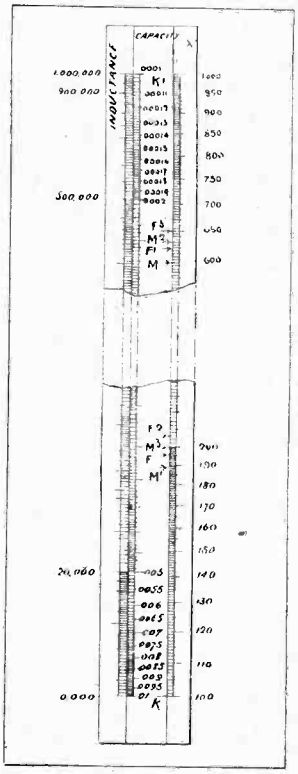

Fig. 2.—A WAVELENGTH SLIDE RULE. The logarithmic scales of inductance and capacity are reversed one against the other so as to give the arithmetic mean of the values, wavelength being set out on the fixed scale at the right hand side.

[3] Patent No. 103,197, A. J. Martin, July 27th, 1916.

[4] Designed by Dr. B. Hodgson and Dr. S. Brydon. *The Wireless World*, Feb. 4th, 1922.

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fixed position, and as the capacity pointer is rotated the resulting wavelengths can be read off or *vice versa*. It will be noticed that the logarithmic capacity scale (and hence the inductance scale which is similar) occupies nearly 180 degrees, and can therefore be marked off with the corresponding scale degrees of a particular condenser. It will, however, be necessary to measure the capacity of the condenser, say, at every 10 degrees, and mark in the dial settings to coincide with the measured values of capacity. If, however, the tuning condenser is fitted with plates shaped to follow a logarithmic law between the minimum and maximum settings, then a uniformly spaced scale of degrees on the calculator can take the place of the logarithmic scale of capacity.

Relationship Between Circular Calculator and Logarithmic Condenser.

The utility of the arrangement will be appreciated by setting the wavelength and capacity scales to the wavelength and tuning dial reading in degrees when listening to a local station of known wavelength, so that the apparent inductance of the tuning coil will be revealed on the inductance scale. That the inductance value of a coil can be readily determined in this way is perhaps in itself of little importance, but the feature aimed at is to be able to predetermine the condenser settings required to tune to any given wavelength. With the inductance pointer retained in the position which is given by combining the dial setting in degrees with a known wavelength it is only necessary to rotate the wavelength indicator to the setting of a station to which it is desired to tune when the actual condenser setting in degrees will be revealed. If the tuning coil is changed the inductance pointer must be reset by again tuning to the local station.

Progressing, it must now be apparent that the adjustable scale of wavelengths can be accommodated on the tuning dial itself when used in association with a tuning condenser following a logarithmic law (Fig. 4). A logarithmic scale of wavelength is engraved around the rim of the dial, the scale being twice that of the capacity change of the condenser. This scale is adjustable and provided with a simple means for locking it in position on the centre disc, which is rigidly attached to the spindle of the condenser (Fig. 5). Wavelengths in common use are engraved right round the dial, and if necessary the markings may be extended in spiral form.

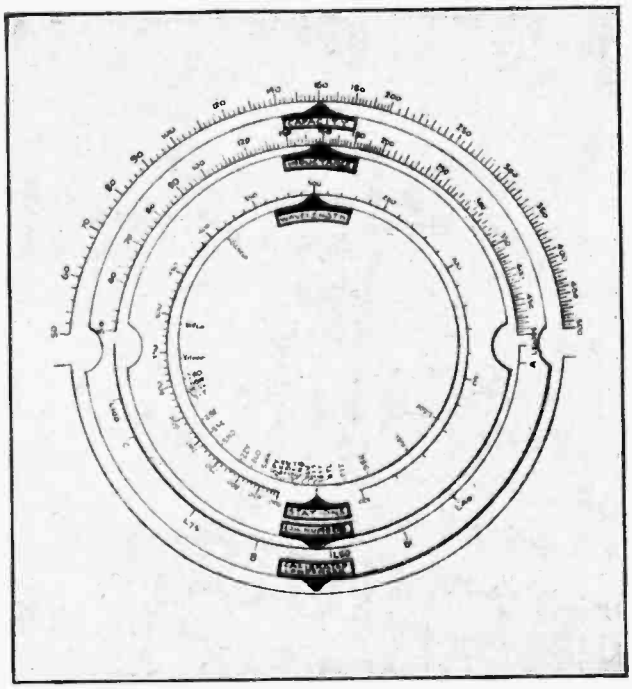

Fig. 3.—CIRCULAR WAVELENGTH CALCULATOR. The logarithmic scale of wavelength on the centre dial is marked off on twice the scale of the semicircles representing inductance and capacity. It is from a consideration of the operation of this form of calculator that the action of the logarithmic condenser as an aid to tuning can be more readily understood.

Supplying Condensers with Calibrated Wavelength Dials.

Just as a square law or S.L.F. variable condenser can be supplied with a calibrated scale of capacity, so can a tuning condenser fitted with logarithmic plates be supplied with a wavelength scale which is correct irrespective of the size of the tuning inductance with which it is to be associated. It will be seen that the extent of rotation of the condenser spindle required to change from one given wavelength setting to another is the same irrespective of the size of the coil, and it will therefore be appreciated that "gang" condensers, if required to tune several circuits simultaneously in which small differences in the inductance values of the coils may exist, that the plates of the condensers must be designed to follow the logarithmic law. The much sought after ideal of building a long-range receiver with several stages of tuned high-frequency amplification and operated with a single dial is only possible provided that the condensers which are linked together on the common shaft are logarithmic, and assuming, as one must, irrespective of the "law" of the condensers that the distributed capacities in coils and valves are nearly similar in each case and that the value of such stray parallel capacity is comparable with that decided upon by the manufacturer when determining the shape of the plates.

Nothing has been said up to this moment concerning the capacity of the tuned circuit at the zero setting of the condenser, and in determining the shape of a condenser plate which is to follow a straight line in respect of the tuning of a circuit all stray capacities which are added to the capacity of the tuning condenser must be taken into account. The plate shape (Fig. 6) is obtained by taking a sheet of graph paper in which the lines along the vertical axis are set out logarithmically, or, alternatively, ordinary squared paper may be used as in the accompanying calibration charts, the antilogarithms of the numbers subsequently being taken from a table. A straight line is drawn joining the estimated capacity of the condenser at zero plus an average value of coil, valve, and other stray capacities with the required maximum capacity to which again the external stray capacities have been added.[5] (Figs. 7 and 8.)

Experience shows that an average value of stray

[5] Refer to "Condenser Plate Design," by W. H. F. Griffiths, *The Wireless World*, June 23rd, 1926. Also *Experimental Wireless*, January, 1926.

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parallel capacity can be taken as some 26 $\mu\mu$F, in addition to the zero capacity of the condenser. This value has been determined using a single layer inductance of 150 microhenries bridged across with the grid and filament of a Mullard type 256 valve with the normal voltage applied to its filament together with the associated valve-holder and wiring.

Tests on Logarithmic Condensers.

At present there are on the market the "Cyldon," "Ormond," and "Formo" logarithmic condensers, and curves showing capacity and wavelength calibrations are given on the adjoining page. That these curves very slightly deviate from the straight line is due to the fact that somewhat different values of estimated external capacity were adopted by their designers.

When plotting the capacity curve (Fig. 8) of the

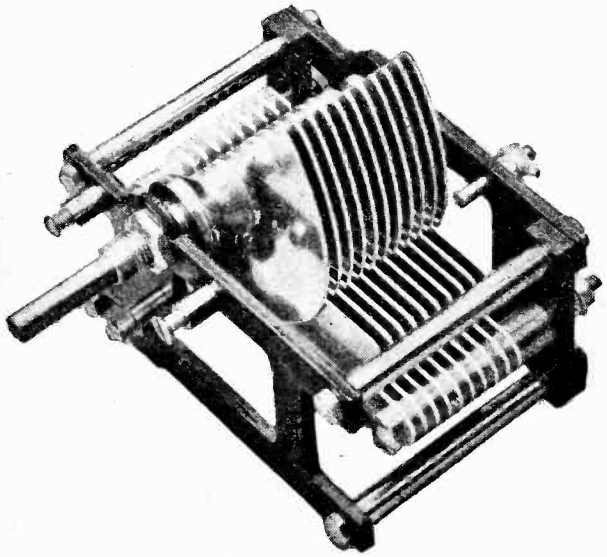


Fig. 4.—The new Cyldon logarithmic condenser.

"Cyldon" condenser, however, before extracting the logarithms of capacity obtained at every 10 degrees an amount of only 20 $\mu\mu$F. was added, this value being specified by the manufacturer. The curve slightly bows away from a straight line between zero and 80 degrees the maximum error occurring at about 50 degrees. From 90 to 180 degrees the logarithms of the capacity fall on a perfectly straight line.

In the case of the "Ormond" condenser the capacity curve (Fig. 7) is practically a straight line, and in the absence of any stated value of circuit capacity 26 $\mu\mu$F was added as representing the stray external capacity to the capacity values obtained before taking the logarithms.

A wavelength calibration of the "Cyldon" condenser (Fig. 10) shows an almost uniform bowing away from the straight line joining the maximum and minimum capacities the bottom of the bend occurring at about 45 degrees. This arises, however, from the fact that the plate shape was determined with a stray of 20 $\mu\mu$F which, it may be pointed out, is a value appreciably lower than that which normally exists in practice.

The "Ormond" wavelength calibration (Fig. 9) plotted with logarithms of wavelength closely approaches a straight line, though here, again, the minimum capacity differs slightly from the figure used by the designer.

It would seem a mistake to build a condenser with a very low minimum, as the stray capacity which has to be taken into account is large compared with the minimum capacity of the condenser. In order that a reasonable latitude may be allowed for in the value of the stray capacity, it would be advisable to adopt a higher zero capacity in the condenser itself. Incidentally, a low zero value invariably increases the

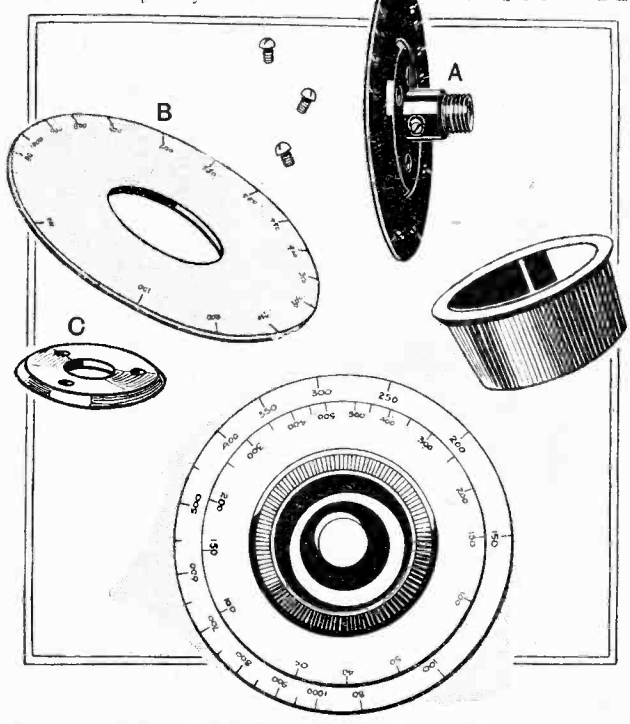


Fig. 5.—ADJUSTABLE LOGARITHMIC DIAL. The centre dial A is locked on to the shaft of the condenser. By means of the locking plate C the outer dial B is secured to A but can be independently rotated and carries a wavelength scale which holds good in respect of the condenser and is independent of the size of the tuning coil. It is set in position by tuning to a station of known wavelength when the wavelengths produced at other settings of the condenser are then revealed. Scales of inductance and capacity may be arranged as shown on the centre dial, one reading against an index on the wavelength dial and the other against an extension of the pointer which is used with the wavelength scale.

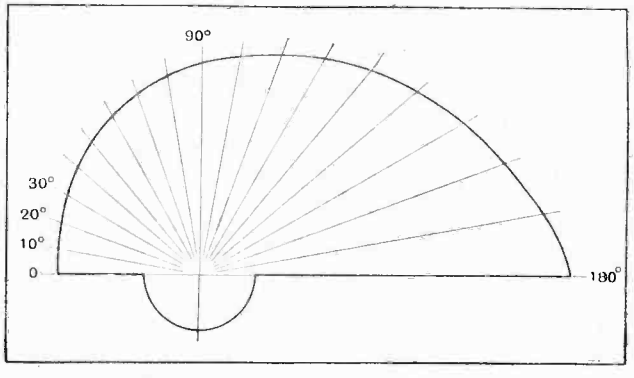
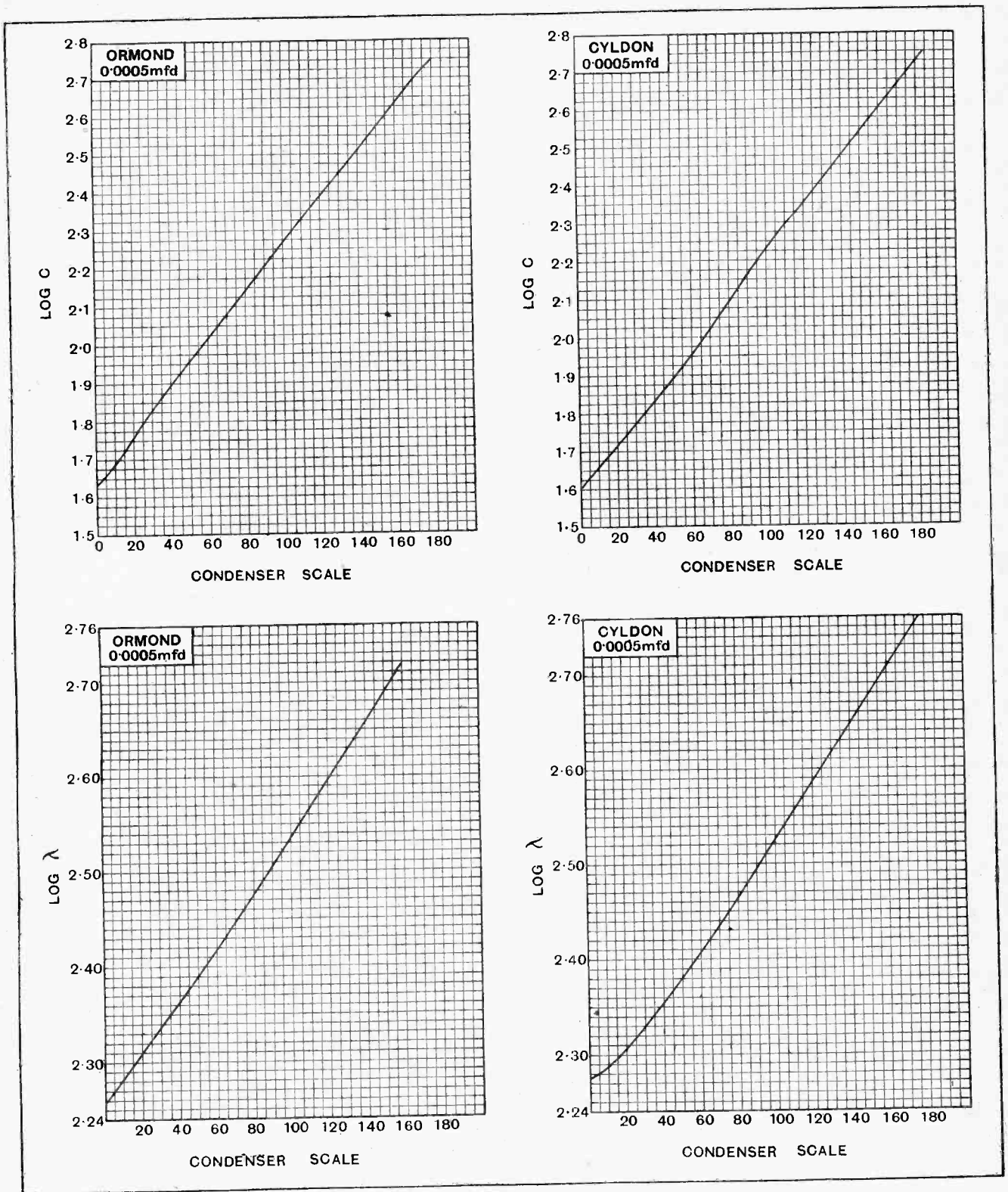


Fig. 6.—The plate shape of the logarithmic condenser.



Figs. 7 and 8.—Logarithms of the capacity plotted against the scale settings in the case of the Ormond and Cyldon logarithmic condensers. Before taking the logarithms of the capacity values a small value has been added representing the stray capacity in the condenser circuit.

Figs. 9 and 10.—Curves showing the logarithms of the wavelength plotted against scale degrees. The departure from a straight line in the case of the Cyldon condenser is partly due to the zero capacity of the circuit being different from the value used when designing the plates.

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resistance of the condenser near the zero end of its scale.

It will be realised in the case of the square law and S.L.F. condensers that the aim is merely to provide a convenience in tuning, and any error which may exist in their design will not be readily apparent. The logarithmic condenser, however, serves the definite purpose of permitting the manufacturer to supply a wavelength scale irrespective of the size of the coil within the limits with which the condenser is to be used, and errors in the plate shape will be readily observed when using the logarithmic condenser for predetermining the wavelength settings for tuning to particular stations. Well-designed logarithmic condensers supplied with wavelength scales will be found to be reasonably accurate for tuning even the aerial circuit of a receiver, assuming the use of an aerial transformer. An accuracy equivalent to one or two degrees of a 180-degree scale will be obtained when tuning on intervalve H.F. coupling. It is, of course, first necessary to correctly set the dials by tuning to a station of known wavelength. Assembled to form a gang condenser a sufficient closeness of tuning between the several tuned stages can be obtained providing that the sections are individually adjusted to correspond at one setting. Incidentally, the contour of the logarithmic plate shape is midway between square-law and S.L.F., giving a tuning scale which in general use is to be preferred while "sharpness of tuning" is uniform throughout the scale.

MERITS OF THE LOGARITHMIC CONDENSER.

1. **Convenient tuning scale midway between square-law and S.L.F.**
2. **Sharpness of tuning is constant throughout the scale.**
3. **Can be supplied with a calibrated wavelength dial.**
4. **As a "gang" condenser it correctly compensates for differences in the inductance values of the several tuning coils.**

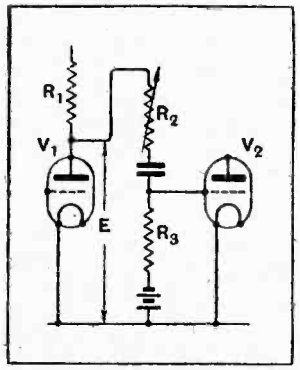
VOLUME CONTROL.

A Useful Circuit for Resistance-coupled Amplifiers.

NOW that dull-emitter valves are in almost universal use, and high-tension accumulators and mains units are coming into favour, it is becoming more and more usual to dispense with switches for cutting out amplification stages. Generally speaking, this tends towards simplicity and freedom from stray couplings, and is therefore a step in the right direction; but, although we may no longer need to switch out a valve in the interests of economy, we are still faced with the problem of adjusting the total amplification of our sets.

Where a high-frequency stage is used the volume may usually be sufficiently reduced by dimming the H.F. valve when receiving powerful signals, but when no high-frequency amplification is employed filament dimming is a most unsatisfactory method of control, and almost invariably leads to distortion. Reaction reduction or reversal is fairly satisfactory in the hands of enthusiasts, but is not recommended with sets of the "family" type. One drawback to reaction reversal is, of course, that it considerably broadens tuning, and this is particularly undesirable on long wavelengths where interference and "mush" are at all times fairly bad.

Perhaps the worst method is one sometimes advised by manufacturers of components, namely, the inclusion of a variable resistance across the loud-speaker. It is certainly very effective for controlling the amount of noise produced, but cannot possibly prevent distortion due to valve overloading. In fact, as far as this is concerned it merely amounts to shutting the stable door after the horse has escaped.



An effective volume control circuit. V_1, detector valve; V_2, 1st L.F. valve; R_1, anode resistance 150,000 ohms; R_2, variable grid leak 0—5 megohms; R_3, fixed grid leak 0.5 megohm; C, grid condenser 0.01 mfd

Tapped anode resistances, tapped chokes, and tapped transformers all provide simple and satisfactory means of control and can be strongly recommended. Unfortunately, however, it is often undesirable to use transformer coupling for the first L.F. stage, and there does not seem to be a suitable tapped choke on the market. Tapped anode resistances are obtainable, but are fairly expensive compared with the fixed type.

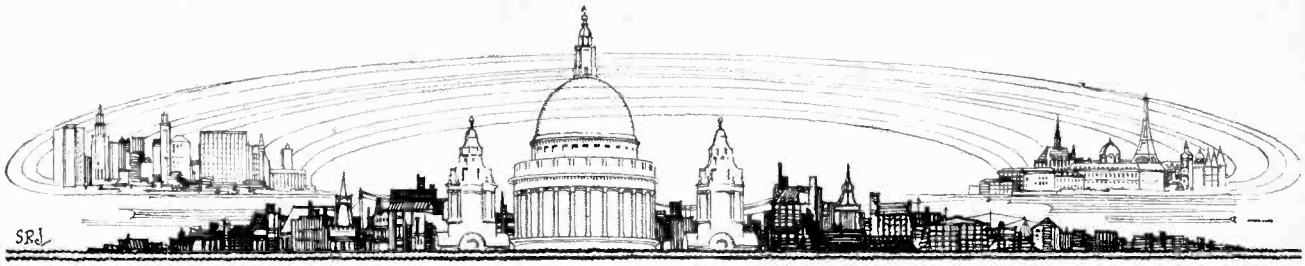
A circuit which has given every satisfaction in practice is shown in the diagram. This volume control is really a potentiometer with one fixed and one variable arm, the latter being an ordinary variable grid-leak.

As may be seen from the diagram, the potential variations E on the plate of V_1 are applied across R_2, C, R_3, and, neglecting the effect of the impedance of C, which is comparatively small, the input to the grid of V_2 will be:—

$$\text{(Total available potential, E)} \times \frac{R_3}{R_2 + R_3}$$

This means that if components of the values shown are used, approximately any degree of loudness between full and one-tenth of full volume may be obtained. The control is smooth and continuous, and does not in any way cause distortion. Care should be taken to select a variable grid-leak which shorts out in its minimum position or full volume will not be obtainable.

R. J. S.



CURRENT TOPICS

News of the Week in Brief Review.

AN IMPORTANT WEEK.

The 1927 National Radio Exhibition is to be held in the New Hall, Olympia, from September 24th to October 1st.

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ANOTHER STEP FORWARD ?

According to the daily Press, Professor Quirino Majorana, of the University of Bologna, announces that he has invented a secret wireless telephone employing ultra-violet rays.

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ON THE CARPET.

Thomas Brown, of Eastbourne, described as a carpet planner, was fined 40s. last week for operating a set without a licence. He contended that he had not received anything "worth talking about."

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LINKING UP THE COLONIES.

At a conference held at the Colonial Office last week attended by senior officials representing twenty-four self-governing Colonies and Protectorates, the question was discussed of linking up the various territories by wireless with the general scheme of Imperial radio communication. It was generally agreed that much had still to be done in this direction.

Among the territories involved are Nigeria, Northern Rhodesia, Gold Coast, Kenya, Tanganyika, Seychelles, Barbados and Trinidad.

LOOKING AHEAD IN SOUTH WALES.

It is hoped to hold a wireless exhibition in Swansea during the autumn under the auspices of the Wireless Retailers' Association.

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AUTO ALARM ON SHIPS.

At the annual meeting of the Marconi International Marine Communication Co. at the Connaught Rooms, Mr. F. G. Kellaway said it was hoped that merchant ships would soon be permitted to use the Auto Alarm, which has been the subject of experiment for several years.

The Auto Alarm gives audible warning when an S.O.S. is received, and thus dispenses with the need for constant watch.

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AIR MINISTRY AND 900-METRE WAVELENGTH.

Morse interference on 900 metres has led the Air Ministry to undertake further experiments towards its elimination. A 20-seater Vickers Rolls-Royce Vanguard aeroplane equipped as a wireless laboratory is making a series of flights to carry out exhaustive tests of short-wave wireless telephone communication between aircraft in flight and ground stations.

If the tests prove successful there is a possibility that the present working wavelength of 900 metres may be abandoned.

PORTUGUESE WIRELESS NETWORK.

The Portuguese network of wireless communication to her colonies has been completed by the inauguration of Marconi services between Lisbon and the colonies of Cape Verde, Angola and Mozambique.

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THE WIRELESS CHESS MATCH.

General disappointment was caused by the abandonment of the wireless chess match begun last week between Members of the House of Commons and of the State Legislatures of Australia.

The tourney was opened by the Prime Minister in this country and by the Duke of York at Canberra, and during the early moves all went well. Later, however, trouble developed on the land-line between Canberra and the beam station at Melbourne, with the result that the intervals between moves became too long to be endured!

Finally the contending parties agreed to a draw.

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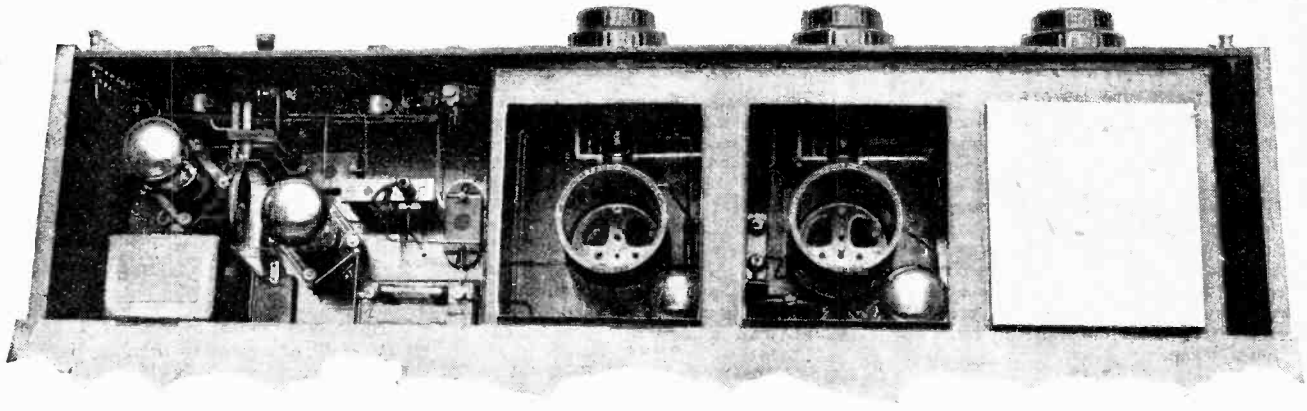
NOT A DULL EMITTER.

The day of the dull emitter is gone, judging from the following cryptic paragraph which appeared in the "Daily Express" of May 11th :—

"DOUBLE PURPOSE VALVE.

"A wireless valve which will revolutionise the design of receiving sets throughout the world is shortly to be



EXTENDING THE WAVE RANGE OF "THE WIRELESS WORLD FIVE." In this set, built by a reader, Mr A. Ryall, carefully designed interchangeable inductances wound on Colvern formers have been introduced to give reception on wavelengths up to 2,000 metres.

placed on the market. The new device, it is claimed, will not only provide all power required for the set, but also illuminate the room in which it is placed."

A rash correspondent states that he distinctly remembers a valve which performed the same dual function many years ago. "It was known," he writes, "as a bright emitter."

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WIRELESS PICTURES IN GERMANY.

The "Carlogram" is the name officially given to a photo transmitted by the Telefunken-Carolus-Siemens system, which is now the subject of further experiments by the German and Austrian Post Offices. It is hoped that in the near future there will be a "Carlograph," as the transmitting instrument is called, in each of the leading post offices.

The system is strongly supported by Dr. Hans Bredow, Wireless Commissioner in the German Ministry of Posts.

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"CRYSTALLISATION OF THE WHOLE COUNTRY."

The above rather alarming headline appears in a Tokio newspaper. Actually it refers to nothing more drastic than the decision of the Japanese Broadcasting Association to increase the power of existing stations and extend their crystal range.

Three Marconi 10kW. transmitters have been ordered for installation at Tokio, Osaka and Kumamoto, while an order has been placed with the Western Electric Co. of America for three transmitters to be installed at Sapporo, Sendai and Hiroshima respectively.

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IMPORTANT AMALGAMATION.

Many readers will be interested to learn that Messrs. R.I., Ltd., and the wireless section of Messrs. The Varley Magnet Company have joined forces, and will in future be known as R.I. and Varley, Ltd. Mr. J. Joseph, the managing director of R.I., Ltd., and Mr. J. M. G. Rees, of the Varley Magnet Co., are the directors of the new company.

Both these companies have made an intensive study of L.F. amplification—R.I. in transformer-coupled circuits, Varley in resistance capacity—with the result that the public will benefit from the pooled experience of the two firms.

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THE DANGERS OF WIRELESS.

A Polish landowner named Wyrezemski nearly lost his life a few days ago, says a Warsaw message, when villagers attributed a violent thunderstorm to the evil agency of M. Wyrezemski's wireless set. As soon as the storm was over the villagers broke into the house, but M. Wyrezemski and his family escaped by pretending to have been struck by lightning. Their prostrate forms scared the villagers, who ran away panic-stricken.

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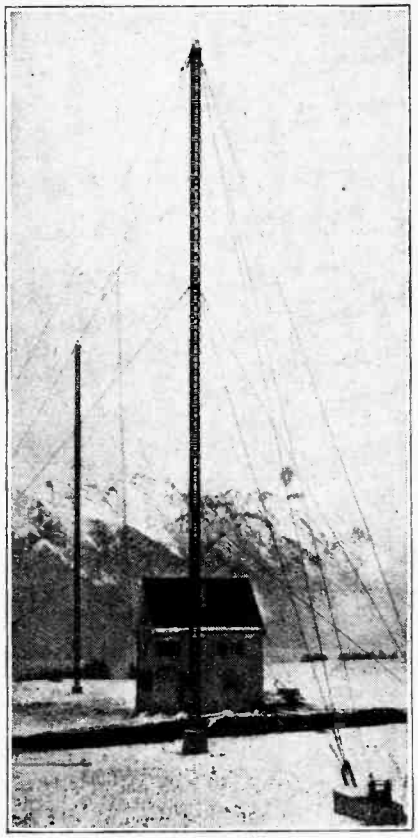
HUNGARY OPENS THE DOORS.

The Royal Hungarian Minister of Commerce has issued an ordinance pointing out that wireless receiving apparatus and component parts may henceforth be imported without special permission by anyone having a licence for the production, sale or maintenance and use of a receiving set. Transmitting apparatus is still subject to severe restrictions.



AN ALPINE STATION.—A picturesque view of the new broadcasting station near Innsbruck, in the Austrian Tyrol. The station relays the programmes from Vienna, 400 miles distant, transmitting on 294.1 metres.

A MOUNTAIN RELAY.

Few relay broadcasting stations are situated as far as 400 miles away from the parent transmitter, yet such is the case at Innsbruck, in the Austrian Tyrol, where the new relay station derives its programmes from Vienna.

Not all that distance is covered by land-line, however, and Innsbruck has perforce to rely on wired-wireless over certain sections of the route.

From Vienna to Linz the transmissions are carried by ordinary low-frequency telephony over landlines. Thence they travel by high frequency over lines to Wörgl, a little town some 45 miles from Innsbruck. At Wörgl a receiving station connects to Innsbruck by cable. The new station is using a wavelength of 294.1 metres with a 500-watt transmitter.

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TRAMWAY INTERFERENCE.

One of the peculiar local conditions with which the Innsbruck station has to contend is interference from electric tramways. This difficulty has already been overcome in Vienna, Budapest and other Continental cities by the use of the "Fischer" roller, an adjustable iron plate which runs easily and smoothly along the overhead wires.

We understand that the Tyrol Radio Club has offered to bear the expense of equipping the Innsbruck tramways with a similar device.

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RADIO SOCIETY OF GREAT BRITAIN.

At an informal meeting of the Radio Society of Great Britain to be held at 6 p.m. on Friday next, May 20th, at the Institution of Electrical Engineers, Savoy Place, W.C.2, Mr. F. M. Colebrook will open a discussion on "Electrical Measurement."

On Wednesday next, May 25th, the Society will hold an ordinary meeting at the Institution of Electrical Engineers. The lecturer will be Mr. G. G. Blake, M.I.E.E., who will take as his subject: "The Hot Wire Microphone and Audio Resonant Selection." A number of original experiments will be performed.

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2XAF RELAYED IN AUSTRALIA

Members of the Australian Industrial Delegation, now visiting the United States, were enabled to talk to the folks at home recently, when 2XAF, the short-wave experimental station of the General Electric Company at Schenectady, N.Y., broadcast speeches by four members of the delegation.

The signals from 2XAF were received so strongly in Australia that several stations were able to re-broadcast them, and listeners in many parts of the continent heard the programme originating 11,000 miles away.

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IMPORTANT CANADIAN PATENT JUDGMENT.

The Exchequer Court of Canada has recently handed down a judgment of the utmost importance to the Canadian Radio Trade; and one that may not be without an important repercussive effect in the States, writes our New York correspondent. The judgment is the result of a suit brought by the Canadian General Electric Company against the Fada Corporation of Canada for the alleged infringement of Canadian patent No. 208,583 (British 147,147), which relates to tuned radio frequency amplification, or, more correctly, geometric selectivity incorporating the use of valves. Its effect will be that practically every Canadian receiver of recent manufacture will have to pay tribute to the owners of the Alexanderson patent. Of course, the judgment may be appealed against, but no information on that point has yet been published. It is only a few weeks since the same court upheld the validity of Canadian patent 244,847 (British 147,148) to Langmuir, relating to the grid leak.

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NEW WIRELESS PHOTO SYSTEM?

According to the *Jewish Graphic*, Herr Louis Weissglas, a Jewish engineer in Vienna, has invented a new system of wireless photography "based on the use of a magneto." The device is described as "a cheap commercial proposition."

HOME PORTABLE LOUD-SPEAKER SET.

Directions for Construction and Operation.

By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

(*Concluded from page 598 of previous issue.*)

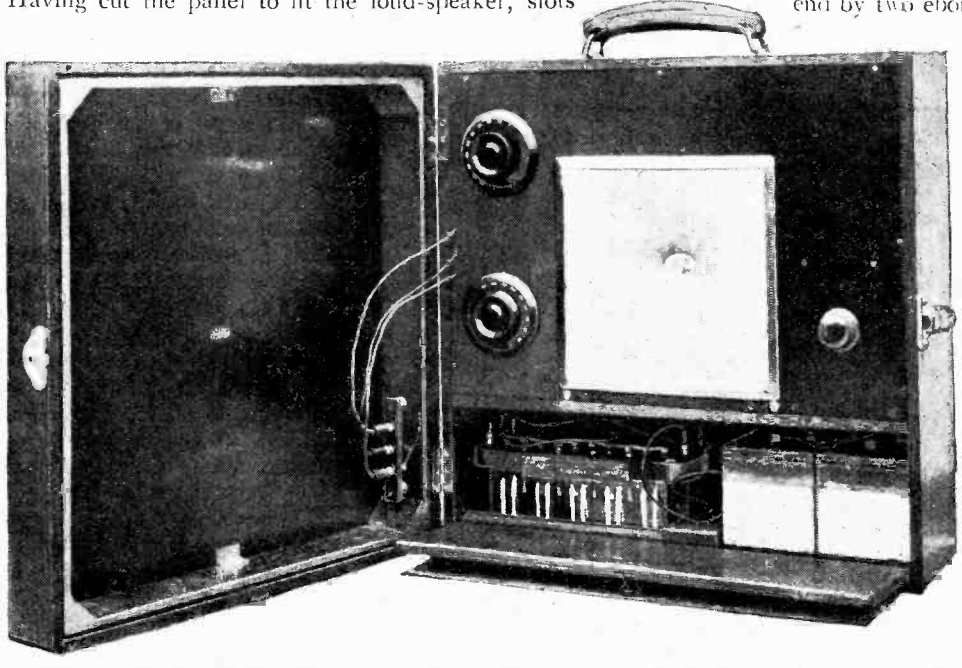
THE first part of the set to be constructed should be the panel and baseboard. The latter is of good, well-seasoned wood about ½-inch thick, and the panel from $\frac{3}{16}$in. to ¼in. If desired, a panel already cut to size can be obtained from the makers of the case.

The panel should be very carefully cut with a hacksaw to fit round the actual loud-speaker purchased—the dimensions given for this in Fig. 2 being only a guide. Having cut the panel to fit the loud-speaker, slots for the ball-legs of the latter should be cut in the baseboard and the various other holes, as shown in Fig. 2, drilled in the panel.

The piece of ebonite cut out of the centre of the panel is sufficient to make the two valve platforms illustrated in the photographs and shown with detailed dimensions in Fig. 3. These two valve platforms are supported at the panel end by two brass angle brackets, and at the rear end by two ebonite rods, as will be seen from the photographs showing the rear views of the set.

Before the loud-speaker is finally fixed into position a pair of flex leads about 8 inches long should be fixed to its terminals, which latter then fit into slots in the baseboard.

It will be seen from the two rear view photographs in the previous issue that most of the wiring is short and that there is not much visible except leads to the grid bias battery. As will be seen, the detector valve with tuning and reaction condensers and the H.F. choke are all mounted on one side of the loud-speaker and the two L.F. valves on the other. By adopting this scheme it is possible to make the wires carrying H.F. currents short, with consequent efficiency.



The complete receiver ready for use. Note that the leads to the frame aerial are deliberately lengthened to prevent fracture through repeated opening and closing of lid.

Home Portable Loud-speaker Set.—

The only visible lead joining the two compartments is that which goes from the junction of R_1 and the H.F. choke to the condenser C_5 (see Fig. 1), and the other leads —L.T. and —H.T. are fitted into slots *under* the baseboard, as shown in Fig. 4.

These slots are quite simple to cut by making two parallel cuts about ¼in. apart with a small tenon saw and then chipping out the wood between with a stout penknife—with a little care they may be made with the knife alone.

The only components not mounted on the baseboard or valve panels are the L.F. transformer X and the 9-volt grid bias battery, both of which are mounted on the top of the loud-speaker.

The transformer is screwed down direct, and the battery is held in position by means of a strap union, which is conveniently made of aluminium. When finally assembling before wiring, do not forget to put in the aluminium screen *and* the ¼in. spacing washers behind the variable condensers. This screen should be drilled with good clearance holes for the spindles and the leads to the frame, and should be made of very thin aluminium, or there will not be enough thread showing on the condenser spindles for the clamping nut to hold.

The Cabinet.

The case used to contain the set and batteries is of a standard type made by Messrs. Carringtons, and is marketed complete with battery compartment with drop-out front, and a wooden former about 15in. square, on which to wind the frame aerial. The case is well and strongly made of oak and is fairly light, weighing only 10 lb. There are three things only to be done to the case in order to fit the set—first, two large clearance holes, about one inch in diameter, should be drilled through the shelf dividing off the battery compartment for the battery leads; secondly, ⅜in. square wooden battens should be fixed round the upper compartment for the panel to fit up against; and, thirdly, two small angle brackets should be made to hold the frame aerial in position in the lid.

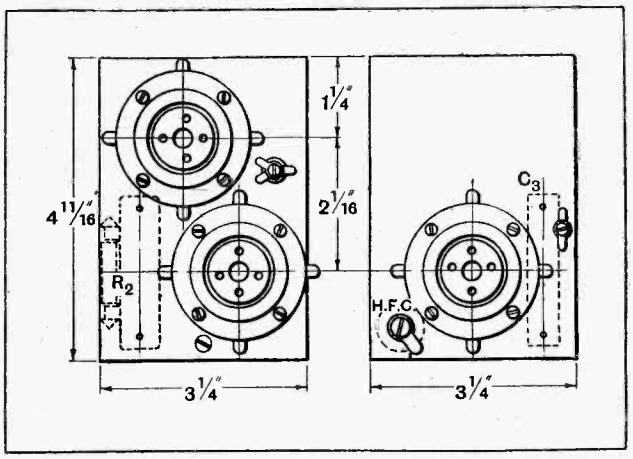


Fig. 3.—Dimensions and layout of components on the valve platforms.

The Frame Aerial.

For the lower broadcast band (300-600 metres) this frame consists of 18 turns spaced 12 turns per inch and tapped at the 12th turn. The wire used may be ordinary No. 26 D.C.C., but the Lewcos stranded frame aerial wire is not expensive and gives a frame of lower H.F. resistance, and therefore of better efficiency. Before winding the aerial it is necessary to slot the wooden frame at the corners to hold the wire in position and to make up a little ebonite bracket with three plug sockets which is mounted on the inside of the frame, as shown in the photograph of the complete set opened out for use.

Note that this bracket is mounted near the *bottom* of the frame, and not directly in line with the holes in the panel through which the leads from the set come. This is done intentionally so

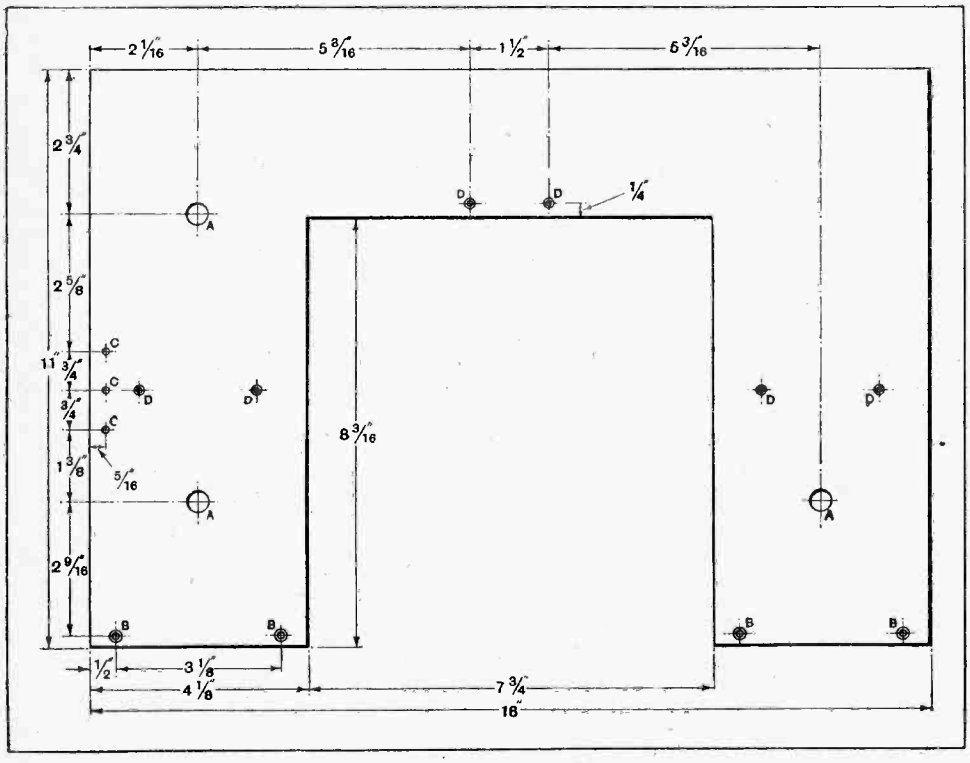


Fig. 2.—Dimensions of the main panel. A = 7/16in. dia.; B = 1/8in. dia., countersunk for No. 4 wood screws; C = 1/8in. dia.; D = 3/32in. dia., countersunk for No. 8B.A. screws.

Portable Loud-speaker Set.—as to save these leads from being badly kinked and eventually breaking with repeated opening and closing of the lid of the case—a little point, but a very practical one.

If the wire is tight wound on the frame, the slots at the corners will be found quite sufficient to hold the wire firmly in place. Three or four turns of fine wire wound over the frame and brought out to two terminals will be found useful for using an outside aerial at any time.

The Daventry frame consists of 55 turns of No. 26 D.C.C. wire close wound and tapped at the 38th turn. The larger portion is used between grid and filament of the first valve, just as with the other frame.

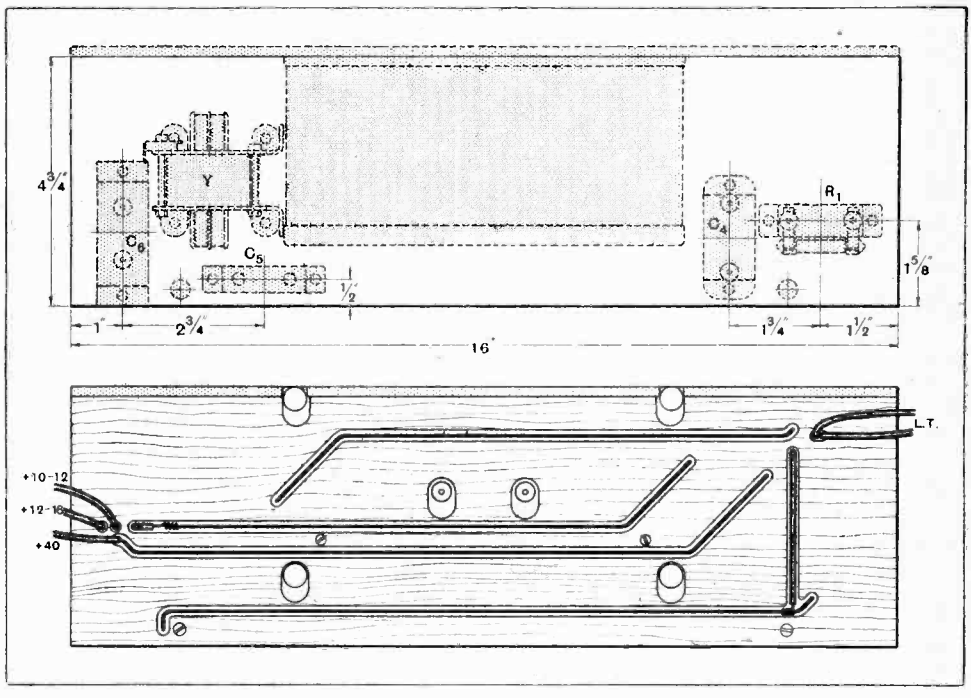
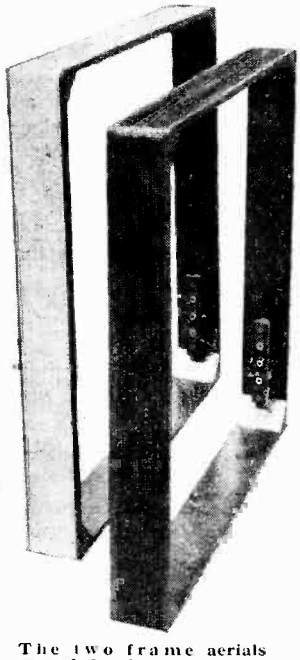


Fig. 4.—Layout of the components on the baseboard and the wiring underneath it.

It may be objected that the efficiency of this longer wave frame will not be so high as in the short-wave case, owing to the tight winding, but the frame in any case is on the small side for Daventry reception, and the extra difficulties and work involved in making a two-layered spaced winding do not result in appreciably better signals.

The Valves.

The first valve is of the 60 milliamp. class—the A.P.406—the second an A.P.412S, and the last an L.F. power valve—the A.P.412L. The two L.F. valves are of a new and highly efficient type developed by the writer, and are very suitable for portable sets, since they only take 0.1 to 0.12 ampere filament current at 4 volts and are small in size, besides being capable of handling considerable loud-speaker volume on even 40 volts H.T.



The two frame aerials wound for long and short wavelengths.

Results.

The set has been tried at varying distances from 2LO with very satisfactory results indeed. It was first tried on Wimbledon Common and then in Richmond Park, and in both places good loud-speaker strength was obtained. It was found to be quite directional, and the tuning almost constant, as expected, and a further point was noticed that it was desirable not to put the set straight on the ground, as this damps the frame aerial rather much in many cases, but to set it up on a book or a cushion or anything else handy so as to raise the bottom of the frame a few inches.

After trying in Richmond Park, the set was mounted on the car and carried further out to see how far loud speaker reception could be obtained. The first stop was Oxshott Woods, where reception was good, but, of course, not so loud as on Wimbledon Common—however, it was quite loud enough to enjoy. At Esher reception was about the same as at Oxshott, so the set was taken out farther still, to Dorking, where reception was, if anything, better than at Esher.

However, all these tests were made out in the open, and it is not to be expected that the range of the set would be as much as 25 miles when used inside the house, owing to the screening effects of the latter, but an "internal" range of about 15 miles from 2LO and corresponding ranges from other short-wave stations should be easily obtained.

The reception of Daventry is, of course, possible up to much greater ranges, of the order of 40-50 miles or more from Daventry.

As an experiment, the set was tested in London, in the region of Fleet Street, and it was found possible to tune in Daventry so that speech and music could just be distinguished on the loud-speaker. Although London is decidedly outside the 50-mile radius from Daventry, the result of this test shows that the set is quite sensitive on the longer wavelengths, in spite of the comparative inefficiency of the long-wave frame.

One thing that is most marked in using the set is the absence of microphonic noise from the valves, in spite

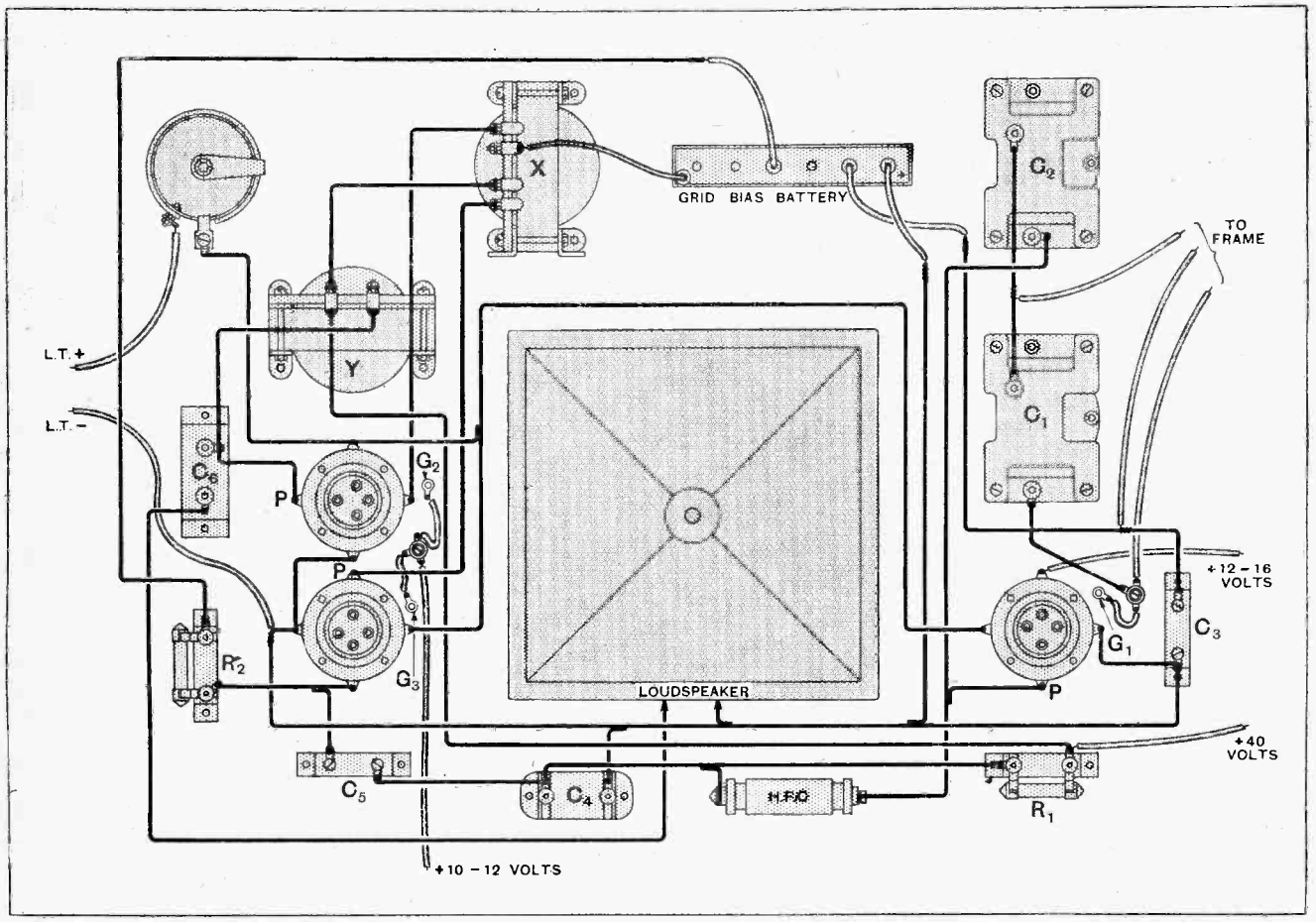


Fig. 5.—The wiring diagram of the set. C_1, C_2 and C_3 are the *inner* grid leads of the valves.

of the fact that the loud-speaker is mounted right up against them and that they are of the extremely close-spacing type.

Of course, if the panel is knocked with the valves on, the usual "ringing" will be heard in the speaker, but it very soon dies down, and on no occasion has a "howl" built up, as it quite commonly does with other close-spacing type valves when they are mounted very close to the loud-speaker.

The very smooth control of reaction obtainable on both long and short waves is no doubt the main thing which makes the range of the set comparatively wide for an o-v-2 working on a small frame with a not too efficient loud-speaker.

Beam Stations.

In response to enquiries from several correspondents we give below the wavelengths of the Marconi beam stations :—

Grimsby (GBH).—29.906 metres.

Bodmin (GBK).—26.086 metres (subject to alteration shortly to two wavelengths).

Melbourne (VIZ).—25.728 metres.

Montreal (CG).—26.269 metres (subject to alteration shortly to two wavelengths).

One of our readers, writing from Bath, states that he can easily pick up the Australian station on two valves with no aerial or earth, but that it fades out regularly at 10.30 G.M.T. and reappears at 13.00. Maximum strength is about 18.15 G.M.T., when signals are easily readable on a loud-speaker with three valves. Other beam stations, especially CG, are very constant. The receiver used has a modified Hartley circuit, with a Mullard PM2 valve for detector.

TRANSMITTERS' NOTES AND QUERIES.

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New Call Signs Allotted and Stations Identified.

G 2FV W. Scott-Hay, 24, India St., Glasgow. (Change of address.)

G 2LW W. E. Benham, 88, The Ridgeway, London, N.W.11.

G 2NQ J. W. Pallister, 26, Woodlands Rd., Middlesbrough. (Change of address.)

G 2YQ W. P. Wilson, 54, Princes Ave., London, N.3. (Change of address.)

G 5VY T. Vickery, 274, Mount Pleasant Rd., London, N.17.

G 6BB (Ex 2AJC.) H. Brabrook, 31, Court Lane, Dulwich, S.E.21, transmits on 23, 45 and 150–200 metres. (This call-sign was formerly owned by Mr. J. Bolt, Warrington.)

G 6HW L. A. Lafone, Harrow School.

G 6VV J. A. McKinnon, 22, Medway St., Chatham.

G 6WN (Ex 2BAO.) H. and L. Wilkins, 81, Studland Rd., Elthorne, W.7.

2AAM N. A. Champness, 6, Hale Gdns., London, W.3.

2ABA E. P. Allen, "Meadowcourt," Radcliffe-on-Trent, Notts.

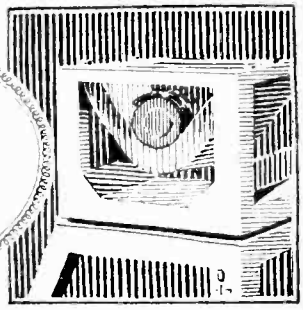
2AFA E. Thomas, 7, Turdon Rd., Morriston, Swansea.

2AVR E. Cook, Crooked Billet St., Morton, Gainsborough, Lincs.

2BJC E. H. Pidcock, 31, King Edward Ave., Worthing.

2BOD A. Hargreaves, 5, Ridge St., Barnoldswick, via Colne, Lancs.

Broadcast Brevities



News from All Quarters: By Our Special Correspondent.

An Elusive Wavelength.—The Talks Programme.—Radio and U.S. Politics.—Cutting Out the Soprano.—The Military Tournament.—Sundays in Cork.

Australia's Mystery Station.

The inner history of the "broadcasting" of the Duke of York's speech from Canberra last week is not without a flavour of humour.

A London newspaper received late information from an unknown source to the effect that a special station would transmit the speech from Melbourne on a wavelength of 33.4 metres. Although the B.B.C. had not conducted tests in short-wave reception from Australia, it was arranged that Keston should remain on the look-out during the early morning hours, Daventry keeping in readiness to broadcast anything that could be "got over."

So Keston waited, but no signal was heard on 33.4 metres, which wavelength, by the way, does not figure on any Australian lists.

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Significant Testimony.

There was no question as to the ability of Keston to pick up Australia, for earlier in the evening the well-known amateur 3BQ was heard on 32 metres.

Mr. Bell, the New Zealand experimenter, who was in morse communication with the B.B.C. engineers, stated that no short-wave broadcast from Australia had been picked up in New Zealand and that, so far as he knew, the Melbourne station did not possess a short-wave transmitter.

There is something elusive about that 33.4-metre wavelength!

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Ventriloquist at the Microphone!

A. C. Astor, the humorous ventriloquist, who arrives in this country on June 4, will broadcast from 2LO on the same evening.

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Duke of Connaught to Broadcast.

Following the luncheon of the United Associations of Great Britain and France, the speeches will be relayed from the Hotel Victoria to 2LO on May 20th. The Duke of Connaught, the Earl of Derby, the Marquess of Crewe, and the Marquis de Vogue will be heard by listeners.

Summertime Talks.

Approximately once a quarter the B.B.C. issues in a carefully arranged booklet its programme of talks and lectures for the ensuing three months. The new programme embracing the period May to July shows that a wider field of interests is being aimed at.

In the adult section the subjects covered range from Astronomy, Physiology, Botany and Biology to Psychology and Literature. The lecturers number 52, and the list includes such names as James Agate, Sir H. Walford Davies, Percy Scholes, Stacy Aumonier, Dame Henrietta Barnett and the Rt. Hon. W. Runciman.

To hope that the majority of listeners will be enticed from summertime delights in order to hear these talks might be rather rash, but the B.B.C. have spared no pains to secure the best material.

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The Old Brigade.

A programme by Veterans of Variety is in preparation for May 25th.

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Microphone Politics in U.S.A.

In view of the severely non-political nature of British broadcasting, it is interesting to note the enthusiasm already growing in America over the use of radio in the Presidential election of next year.

The broadcasting concerns, as interested parties in the question—political

AN EFFECTIVE TEACHER. Now that the novelty has worn off, broadcast lessons are taken more seriously by pupils in London schools. This photograph was taken recently at the Acland Central School, Fortess Road, N.W., where wireless lessons are becoming a regular item in the curriculum.

candidates have to pay for time on the air—are booming the value of the radio speech as a means of reaching the largest body of the electorate.

Listen to Mr. Merlin Hall Aylesworth, president of the National Broadcasting Company, giving his opinion on radio and the woman's vote.

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Appealing to the Kitchen.

"Whatever may be the degree of emancipation which the modern woman has reached," said Mr. Aylesworth, addressing the National League of Women Voters, "the fact remains that the backbone of the women's vote is the woman in the home. Radio broadcasting, with its illimitable ways of communication, can reach out from the broadcasting station to the woman at the fireside, in the parlour, and in the kitchen itself!"

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Listener Psychology.

A word from Mr. Aylesworth on another aspect of the subject:—

"A rude awakening is in store for the orator of the old school who would attempt to spellbind his audience by radio. Mass psychology plays little or no part in radio reception. No greater mistake could be made than to visualise the broadcasting audience as a mass. The speaker on a radio is really talking to a million or thirty million individuals, not to a mass audience of thirty million people. The flowers of his speech, therefore, are likely to die by the wayside. You cannot stampede the radio audience as you might in an auditorium."

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Verb. Sap.

Ignoring the political side of the question, there is much in the last paragraph which might be borne in mind by broadcast entertainers and lecturers.

A few entertainers and a sprinkling of lecturers can still "spell-bind" a wireless audience; but no one can "stampede" it.

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A Cricket Talk.

"Warwickshire Cricket," with a general review of the outlook for 1927, will be the subject of a talk by Mr. R. V. Ryder, secretary of the Warwickshire Cricket Club, from the Birmingham station on June 2.

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The Old Order Changeth.

Bremen's "Old Weigh House," an ancient renaissance building famous throughout Northern Germany, is being converted into a broadcasting station by the "Nordeutsche Rundfunk Aktiengesellschaft."

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A New Grouse.

A friend of mine blames the B.B.C. for putting out such good programmes on Tuesday.

"Tuesday is the only day on which I get a chance to test my set, as the family happen to be out," he says, "but the programme is generally so good that I forget the testing and listen all the evening."

FUTURE FEATURES.

London.

MAY 22ND.—Instrumental and Vocal Programme relayed from Rudolf Steiner Hall.
MAY 23RD.—Programme relayed from Brighton.
MAY 24TH.—Empire Day Programme.
MAY 25TH.—Veterans of Variety.
MAY 26TH.—"The Magic Flute" (Mozart).
MAY 27TH.—"R.U.R." (Karel Kapek).
MAY 28TH.—Oxford Summer Eights, running commentary.

Birmingham.

MAY 22ND.—Light Orchestral Concert.
MAY 23RD.—"The Perfect Marriage," a comedy by Leonard White.

Bournemouth.

MAY 23RD.—A Mixed Grill.
MAY 28TH.—Vocal and Instrumental Programme.

Cardiff.

MAY 23RD.—Opening Night of the Parks Concert Season, relayed from Llandaff Fields Pavilion. Speech by Lord Mayor of Cardiff.
MAY 24TH.—Our Tudor Heritage (an English-Welsh Programme for Empire Day).

Manchester.

MAY 24TH.—Empire Day Concert. "Gentlemen, the King!"—a play by Campbell Todd.
MAY 25TH.—"A Change of Spirit," a new radio comedy by E. A. Bryan.

Newcastle.

MAY 22ND.—Popular Wagner Programme.
MAY 25TH.—Northumberland and Cumberland Concert.

Glasgow.

MAY 22ND.—Sacred Scottish Programme.
MAY 23RD.—Scottish Songs and Dances.
MAY 27TH.—Wagner and Tchaikovsky Programme.

Aberdeen.

MAY 25TH.—Light Musical Humour and Variety Programme.
MAY 28TH.—Solo, vocal and instrumental concert.

Belfast.

MAY 23RD.—Speeches at the opening of the Empire Exhibition, relayed from Ulster Hall, Belfast.
MAY 24TH.—Running commentary on the Imperial Parade as it passes the City Hall.
MAY 27TH.—Running commentary on the Parade of British Industry and Commerce as it passes the City Hall, Belfast.

Yelping Sopranos.

We all know the type of soprano voice which, issuing from the mouth of a loud-speaker, will penetrate to every room in the house and half-way down the street.

Mr. Robert Hurd, programme director of the KFI broadcasting station at Los Angeles has evidently observed the same phenomenon, for he is now making things unpleasant for "yelping sopranos."

He intends no offence to musicians, he says, but in the interests of the KFI Los Angeles audience he has issued a strict edict that no more than one soprano may appear during the course of an evening's programme.

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Royal Military Tournament Broadcast.

Descriptive commentaries on the Royal Military Tournament at Olympia will be broadcast on May 21. The features of the programme to be dealt with are as follows:—Musical ride by the Royal Horse Guards; the trick riding display by the 16/5th Lancers; the physical training display by the Royal Air Force; the Scottish Pageant. Band music may possibly be included.

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Belfast Empire Week.

For the first time Belfast is celebrating this year a British Empire Week, and the B.B.C. is co-operating to make the event one of outstanding importance throughout Northern Ireland. The inaugural speeches on May 23 will be broadcast from the Belfast station, followed by a choir of one thousand voices and massed bands. Other broadcasts through the ensuing week will include speeches by Mr. Stanley Baldwin, M.P., the Duke of Abercorn, Mr. L. S. Amery, M.P., the Lord Mayor of Belfast, the High Commissioners of Australia and New Zealand, and Sir Lawrence Weaver; a running commentary on a parade of the Army, Navy, Air Force and O.T.C., of Queen's University, Belfast; and concerts and instrumental solos.

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On Sunday Only from Cork.

For the next three months the new Cork station will confine its programmes to Sunday evenings, beginning either at 8 or 8.30. Gaelic music, especially singing in the traditional method, is to be a special feature. Indeed one of the main objects of the Cork station is to cater for the Gaelic-speaking population of Southern Ireland, so that the music will be principally that of the Celtic countries, *viz.*, Ireland, Scotland, Wales, and Brittany.

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The Derby Broadcast.

The broadcasting of the Derby on June 1 is to be carried out by Mr. Geoffrey Gilbey, who will undertake the running commentary on the race, and Mr. George F. Allison, who will be responsible for the introductory matter and local colour. Four microphones will be used: two in a portable hut on the roof of the grandstand, in line with the winning post, a third in front of the stand to pick up incidental sounds, and the fourth in the unsaddling enclosure.

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,—You are rendering a public service in calling attention to the need for some effort to be made in Britain to provide a short-wave station which could be heard in some of our Dominions or Colonies.

If the British Broadcasting Corporation are approached with a request that they should provide such a station they will probably say that they require all their funds for the development of their United Kingdom Service, and that an Empire Service, with technique as it is at present, would be so variable and intermitteat as to be scarcely worth starting. I do not entirely agree with this point of view, though there are, I know, powerful arguments which can be brought forward to defend it. In particular, of course, the B.B.C. are aware that a new station of this sort would have to be paid for out of their funds, and that they would probably gain no increased revenue as a result of such a venture.

Would not the Imperial interest be best served if the Post Office were to license a private firm which has a market in the Dominions, particularly South Africa, whose time is synchronous with ours, to erect and manage such a station? The firm need not advertise obtrusively, but might be allowed to call its name at the beginning and end of each programme. This, coupled with the interest aroused by such an effort in the Dominions, would probably be more than enough inducement to any big British firm to erect the station, and thus a further link in Imperial communication would be forged without difficulty, and a useful experiment would be conducted.

A licence for two or three years might be granted, and after that time, if the need were demonstrated and the service had developed until it was fairly reliable, the B.B.C. could take it over and enter into some financial arrangement for hiring the service to Dominion broadcasting companies.

The principle of unified control of broadcasting in Britain, in which I thoroughly believe, would not be prejudiced by the issue of a separate temporary licence for this purpose, but it will be prejudiced if through lack of initiative and enterprise Britain falls behind other countries which allow greater freedom.

House of Commons, IAN FRASER.
May 7th, 1927.

Sir,—Further to my letter of April 29th on Empire broadcasting, which I note you were good enough to publish. It is gratifying to see that the matter is interesting a Member of Parliament in the person of Mr. Otho W. Nicholson, and his mention of how the matter concerns manufacturers is, I think, very closely allied to my suggested scheme.

On closer consideration, however, it appears that the formation of a company composed of British manufacturers to run the service relying on large export trade as return on capital outlaid is too large a gamble. Some more definite arrangement would have to be arrived at in order to provide a regular and comparatively steady revenue.

It seems, therefore, that this might be obtained in two ways: to put the control of the service in the hands of the Radio Manufacturers' Association or a newly formed body of manufacturers and let the Government subsidise it for a given number of years, after which time it would become self-supporting on a percentage of the licence fee for reception collected by the various colonial governments; to form an organisation whereby revenue is obtained by indirect advertising, as Mr. Nicholson suggests in his letter. One imagines the former scheme is the better of the two: (1) because it is partly under Government control; (2) because the revenue would be more steady than in the latter case.

It is extremely interesting to note that Section B (5) of the agenda of the Colonial Conference being held in London at the present time deals with "wireless communications, external and internal, and broadcasting."

In view of the fact that Empire broadcasting is a matter which might interest the Conference, perhaps it would be possible for Mr. Nicholson to give notice of a question in the House to the Colonial Secretary as to whether the matter might be discussed when the time arrives for Section B (5) of the agenda to come under discussion. The *Evening Standard* having brought the question still further to light, one awaits with interest the B.B.C. opinion on the matter. It seems, as I mentioned in my letter, that the B.B.C. have quite enough to do and are probably fully occupied at the present time with the regional high-power station scheme to give much attention to the establishment of a short-wave station. Although ultimate Government control would be desirable in an Empire broadcasting service, the B.B.C. should not, I think, be the actual controlling body. May I take this opportunity of congratulating *The Wireless World* on the excellent and progressive way it has placed this important question before its readers?

DALLAS BOWER.

Brighton, May 11th, 1927.

B.B.C. TRANSMISSION OF PIANOFORTE MUSIC.

Sir,—Apropos of the recent correspondence about distortion in piano music from London, this seems to have resolved itself largely into a controversy between highly technical gentlemen, half of whom insist that the distortion is in the transmission, and the other half that the trouble is at he receiving end.

Perhaps the experience of a provincial listener may be interesting. I, and many others to whom I have spoken, find it impossible to tune in the London transmission without distortion. This applies not only to piano items, but to the speaking voice as well. "Aha! receiver again," says our gentleman from the higher regions of mathematics and acoustics. I'm afraid I cannot meet him on his own ground, but I *can* say that, after making every possible adjustment in the attempt to secure decent quality from London, I can change to Manchester and at any time tune in pure, undistorted music and speech. And the quality of my reception has been remarked upon by one well-known violinist, as well as by my "wireless" friends.

My own theory is that the trouble is due to slight but persistent heterodyning. It did not exist six months ago, for at that time I have enjoyed a whole Sunday afternoon's programme from London on the loud-speaker without noticeable distortion.

The other possibility is, of course, local oscillation. London is the station most easily reached by the local one-valve merchant, and, apart from actual howling, there may be enough radiation to upset things from the greatly increased number of valve sets in the neighbourhood. I think, however, that the heterodyning theory fits the case better. It would probably be more apparent to a distant listener, but enough to cause slight distortion to London listeners on particular notes such as those of the piano.

This evening I have been listening to a delightful loud-speaker concert from Manchester, including piano solos. An attempt to get the London chamber music was productive of an announcer's voice with the characteristic "quack" in it as though the set were oscillating (which it definitely was not), and music which no one with a musical ear could endure.

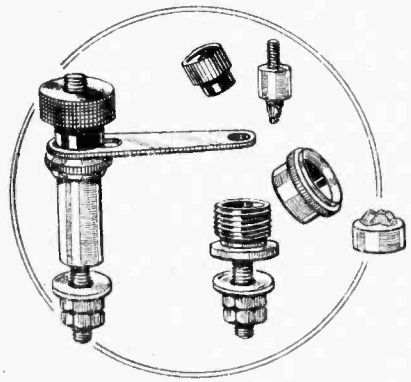
Birmingham, FRANK SMYTH.
May 9th, 1927.

NEW APPARATUS.

A Review of the Latest Products of the Manufacturers.

HINDERLICH CRYSTAL DETECTOR.

A. Hinderlich, 1, Lechmere Road, London, N.W.2, has long specialised in the supply of crystals for use as detectors. The extensive use of crystals for detection to-day has created may sources of supply, though Mr. Hinderlich has built up the reputation for himself by his several articles and instructive pamphlets of being well acquainted with the properties, selection and operation of crystals used in



Hinderlich detector dismantled to show the method of securing the crystal containers.

detectors. Now that a detector is being marketed by him, one can be sure that it fulfils all the necessary requirements for giving a reliable performance.

The several pieces which comprise the detector are shown on a slightly reduced scale in the accompanying drawing. The spring blade is adjusted as to height and position, and the crystal cup is attached by means of a small bushed ebonite knob. The lower crystal is mounted in a cup and is removed by unscrewing a holding-down ring. Two holes are required for mounting the detector on the panel.

The ebonite parts are turned and cleanly knurled, and all metal parts are nickel-plated.

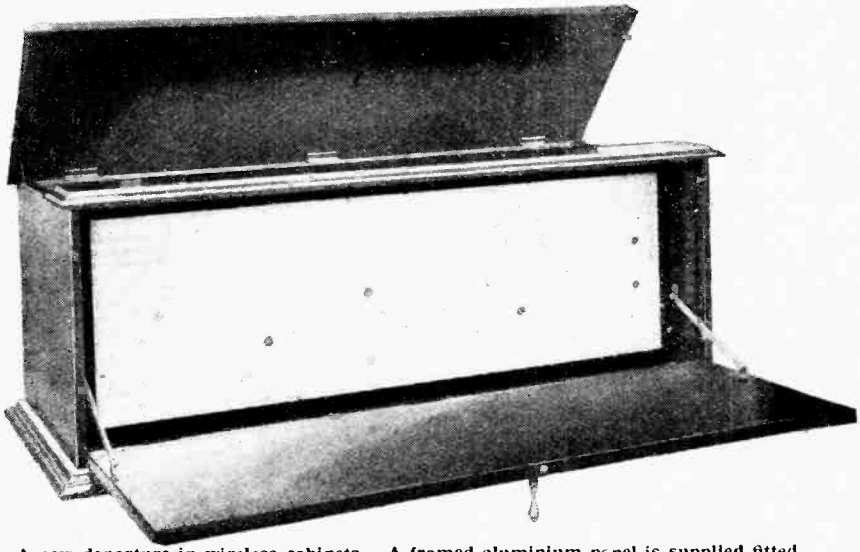
○○○○

A NEW "EVERYMAN FOUR" CABINET.

A new design of cabinet specially produced for building the "Everyman Four" receiver has been recently placed on the market by W. E. Marson, Ltd., Windus Works, Windus Road, Stamford Hill, London, N.16.

The quality of cabinets supplied for amateur use varies considerably, and this new cabinet can be employed where it is the intention to build a really high-class instrument. The accompanying illustration shows the general details of construction, and it might be pointed out that the ends of the drop front are clamped to prevent warping. The panel, which is of figured aluminium and lacquered, fits into a frame, and is an improvement on the more general method of fitting the panel close up against the walls of the cabinet. A baseboard is also supplied, together with the vertical aluminium screen which separates the aerial and H.F. tuning equipment and with the simple design adopted in the "Everyman Four" set a good receiver can easily be constructed, it being necessary only to assemble the components on panel and baseboard.

Special ebonite bushes are supplied with which to insulate the condensers and other components on the metal panel. Unless the condensers are insulated in this way, the grid cell for the first valve would be short-circuited.



A new departure in wireless cabinets. A framed aluminium panel is supplied fitted with baseboard and aluminium screen.

A NEW B.T.H. LOUD-SPEAKER.

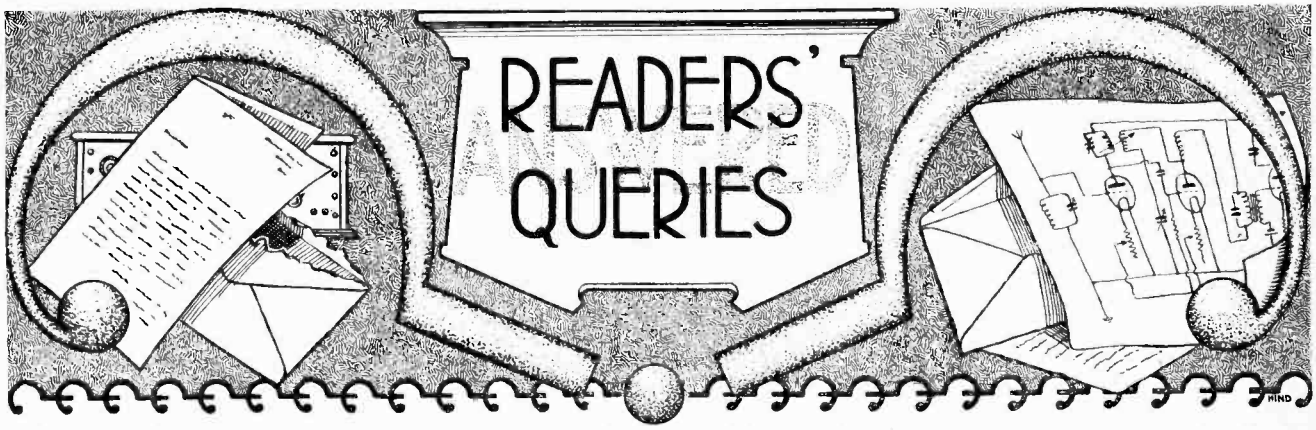
It must not be thought that the horn type loud-speaker is obsolete in view of the popularity recently attained by the cone type. Comparatively few listeners wish to use receiving sets incorporating the necessary amplifying stages which are essential if good results are to be obtained with a less sensitive loud-speaker. Horn type loud-speakers are invariably sensitive and can be operated with small input.

The B.T.H. horn type loud-speaker, giving good signal strength with small input.

The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2, have recently introduced an inexpensive model suitable for giving good volume with small input. For the reception of distant signals this new loud-speaker gives excellent results without the need for an additional amplifying stage to that used for local station reception.

One need not hesitate even if the aim is to obtain best possible quality of reproduction to adopt this loud-speaker, particularly when price is a consideration. The curved upright of the horn is of polished aluminium, and the flare as well as the base is enamelled brown. A perforated grille covered with gauze is mounted in the neck and prevents dust or other foreign matter from falling on to the diaphragm.

An adjusting screw is provided, accessible from under the base.



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each separate question must be accompanied by a stamped addressed envelope for postal reply.

"Screens" or "Screened" Coils.

I have constructed a neutralised type of receiver employing one L.F. stage, but find that the neutralising condenser requires resetting frequently, and one setting does not by any means hold good over the whole wavelength band covered by the receiver. I have been told that it is due to the absence of screened coils. Can you tell me if this is so?

T. S. J.

It is by no means improbable that the cause of your trouble is due to a certain amount of magnetic reaction between the aerial-grid H.F. transformer and the intervalve H.F. transformer, and the adoption of proper screening would probably clear up the trouble of magnetic reaction. You should, however, arrange that the screening used is as simple as possible, and that no more screening than is absolutely necessary is used. You should not place the H.F. transformers too close to the metallic screen, but should follow the design of some such receiver as the "All-wave Four" in this matter. This receiver was published in our April 27th issue. Do not attempt to place a screen fitting closely over each coil, because in this way, owing to the proximity of coil and screen, you will introduce severe losses into the circuit.

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Improving the "Everyman Portable."

Last summer I built the "Everyman Portable," described in your issue of July 21st, and obtained great success with it, but now contemplate rebuilding this receiver, and I was wondering whether you have any improvements to suggest. I might say that I myself have tried to add an extra L.F. stage, but found that it was not worth the extra weight entailed.

P. M. P.

There is one very definite improvement which you can make, without adding more than an ounce or two to the weight, although a slightly larger case is called for, having the same depth, but an inch added on to both the length and breadth. This is done by merely extending the wooden framework in the manner of certain old-fashioned picture frames. We show this clearly in Fig. 1(a), the extension pieces being the reason for the slight enlargement of the suitcase. We then cut two large slots in each of these extension pieces as in the manner of Fig. 1(b), small "nicks" being made in these slots to hold the wires at a certain spacing apart. Another suggestion would be to extend the framework as in Fig. 1(a), and instead of cutting the two big slots as in Fig. 1(b) to bore a number of holes in a line half-way down the extension piece (in the position occupied by the bottom of the slots in Fig 1(b)), these small holes being for the purpose of threading through the frame aerial wires. Of course, the holes should be spaced regularly at the distance at which it is desired to space the frame aerial wires.

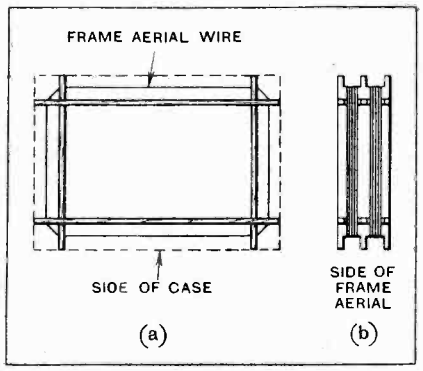

Fig. 1.—Constructing a frame aerial for a portable set.

In Fig. 1(b) actually, of course, two large slots are shown, the idea being merely to indicate the two frame aerials, the one for the local station and one for Daventry, as in the case of the original receiver. The Daventry frame aerial may be wound with narrow-gauge wire, as was done in the case of the original receiver. It will be noticed that this improved method of winding the frame aerial results in the frame wires being kept at a distance of half an inch from either the wooden framework or the leather case, the wires making contact with the woodwork only at the four corners of the frame. The result of doing this is to ensure much less damping in the frame than when wound tightly in a groove as in the case of the original receiver, and not only is reaction control considerably smoother, but the range of the set is considerably enhanced. It is advised that the low wavelength frame be wound, as in Fig. 1(b), with spaced winding. One cannot similarly space the winding of the long-wave frame aerial unless a very much deeper case is used, but, fortunately, a spaced frame for the long waves need not be used, and on the long waves the frame may be wound straight into its groove without spacing.

It should be observed that even in the case of the long-wave frame wiring, however, contact is made only at the four corners of the wooden framework. Do not forget that Figs. 1(a) and 1(b) are not drawn to the same scale as the drawings in the original article, and are only explanatory diagrams necessary for the purpose of illustrating our meaning.

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Cutting Out Complications.

I understand that some time ago you published a single-valve broadcast receiver capable of bringing in distant stations on the telephones which employed merely one coil, no extra reaction coil or other device being used, although I am told the receiver used reaction, and at the same time used a magnetically coupled aerial circuit. Can you tell me in which issue this appeared?

D. M.

This receiver was fully described on page 799 of our June 16th, 1926, issue, and, as you state, being only a single-valve receiver, of course received distant stations only on the telephones, although the addition of an efficient L.F. amplifier would enable you to receive distant stations on the loud-speaker with excellent quality. The June 16th issue may be obtained at a cost of 7d. post free

H.T. Accumulators of Inadequate Capacity.

I have an H.T. battery consisting of sixty small accumulator cells in series, but I find that their ampere-hour capacity is really not large enough for their work, and I propose adding another accumulator battery of sixty cells in parallel with them, or, alternatively, sixty Leclanché cells. Which do you advise?

R. A. S.

It will be quite in order for you to add sixty accumulator cells to your existing sixty-cell battery, and such cells need not necessarily be of the same ampere-hour capacity as those you have already. Sixty accumulator cells give an E.M.F. of 2 volts, and since sixty Leclanché cells give an E.M.F. of only 1½ volts, it is obvious that sixty Leclanché cells, no matter of what size, would give only 90 volts instead of 120, and, consequently, the accumulator cell would discharge through the Leclanché battery. You would have to have ninety Leclanché cells to give you 120 volts, but we on no account advise that you use the accumulator battery in parallel with a Leclanché battery. We think your best plan would be to dispose of your present H.T. accumulators to someone who uses a set taking a smaller output, and to purchase for yourself a complete new battery of adequate ampere-hour capacity.

°°°°

Crystal or Valves.

I wish to add a two-stage transformer-coupled L.F. amplifier to my existing crystal set, rebuilding the whole into a single instrument. Please give me a circuit diagram of the simplest possible arrangement, including switching, whereby the one or both valves may be used with the loud-speaker or crystal only on head telephones.

A. P. L.

We give herewith the circuit diagram of a suitable receiver (Fig. 2). The condenser C will be across either phones or transformer primary, depending on the position of the switch S_1, and should have the capacity recommended by the makers of your transformer. Another pole may be added to the switch S_2 and wired in such a way that the filament of the second L.F. valve may be extinguished automatically when it is not in use.

°°°°

Which?

I am desirous of constructing a really efficient and up-to-date receiver for reception of British and European broadcasting stations, and I am definitely intending to build either of the following four receivers: the "Everyman Three," the "Everyman Four," the "Wireless World Five," or the "All-wave Four." I shall be glad if you will assist me to choose the most suitable receiver.

W. B. J.

The question which you ask is rather a difficult one, since it depends entirely upon what duties you intend the receiver to perform. If, for instance, you require loud-speaker volume only on the medium distance broadcasting stations, with head-phone reception of a large number of distant stations operating on the 200 to 600 metre band, then undoubtedly the "Everyman Three" would be the receiver for you to build. If, however, you desire to receive either on telephones or loud-speaker any long-wave stations at all, then naturally this receiver would be ruled out. If you desire to receive a large number of *very distant* stations operating on the 200 to 600 metre band on the loud-speaker, then undoubtedly the "Wireless World Five" is the receiver for you to build; but, of course, in the matter of long-wave stations this receiver falls into the same category as the "Everyman Three." Should you desire to build a receiver which will give you a large number of distant stations on the loud-speaker on the 200 to 600 metre band, and desire also not to be deprived of the pleasure of listening to the morning concert from Daventry (since, of course, it must not be forgotten that Daventry invariably gives a morning concert every weekday except Saturday), which is in any case always a reliable stand-by station, then, naturally, the receiver for you to build is the "Everyman Four." Should it happen, however, that you are desirous of receiving Radio Paris, Moscow, Komintern, Warsaw, Hilversum, Konigswusterhausen, etc., with no interference from other long-wave stations, or should it happen that you desire Daventry reception at a greater distance than 100 miles or so, then this receiver must be placed into the same category as the others we have mentioned. With regard to the "All-Wave Four," this receiver will receive not only a very large number of distant stations working on the 200 to 600 metre band on the loud-speaker, but will do likewise on the long-wave band from 900 to 2,000 metres, covering the long-wave stations we have mentioned. The reason for the ability to receive *distant* long-wave stations at loud-speaker strength is that it makes use of its H.F. valve not only on the 200 to 600 metre band, but also on the 900 to 2,000 metre band. Since you know your requirements best, it will be necessary for you to finally decide upon the receiver which you will build after carefully considering the particulars we have given.

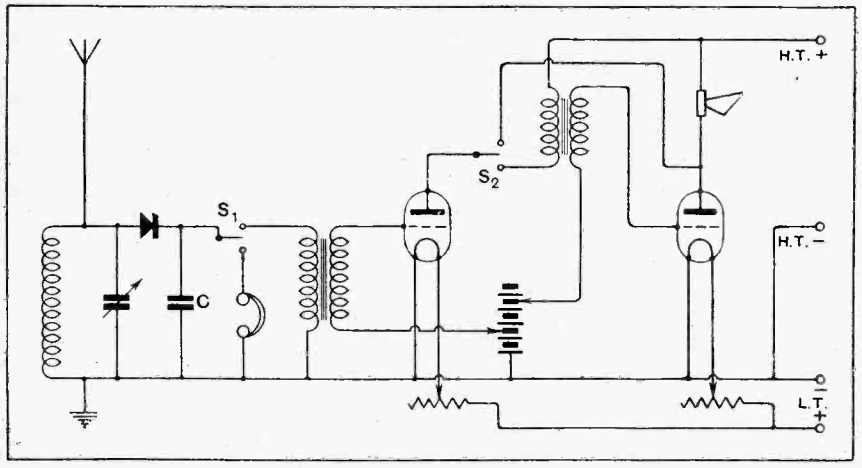

Fig. 2.—Crystal and two-valve amplifier with switches for cutting out one or both valves.

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Two Volts for Efficiency.

I notice that in several receivers described by you, you use 6-volt valves in every position except the detector position, where a 2-volt valve is used. Can you tell me the reason for this?

T. A. W.

In the receivers to which you refer it will be noticed that the detector valve is used as an anode bend rectifier, that is to say, it rectifies by reason of the fact that its working point is adjusted to the bottom bend of the grid-volts' anode-current curve. Indeed, the sharper this bend the more efficient the rectification, or, it might be said in one way, the more sensitive the valve to weak signals, provided the working point was adjusted properly on to the bottom bend. A 2-volt valve has, of course, a much shorter filament than a 6-volt valve, and since it so happens that a short-filamented valve usually has a more sharply defined bottom bend than a long-filamented valve, the reason for using a 2-volt valve as detector will be clearly seen.

°°°°

Multi-stage H.F. Amplification.

I propose to construct a set with two H.F. stages, following closely the circuit diagram of the "Wireless World Five," described in your issues of Jan. 5th and 12th. I should like, however, to avoid the complete enclosure of the coils, valve, and tuning condenser in screening cases, and to use simple vertical screens. Is this idea practicable?

H. S. S.

If your coupling transformers are to be of an efficiency and physical size equal to those used in the receiver mentioned, we are afraid that complete inter-stage screening will be necessary, as two H.F. amplifiers are proposed.

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EMPIRE BROADCASTING.

THE efforts of *The Wireless World* to stir up interest in the subject of Empire Broadcasting already show definite promise of bearing fruit in the near future. The daily Press has taken up the subject with interest, and the B.B.C. has issued a statement giving its view of the position. The matter is also to come before the Colonial Conference, which is at present holding sittings in London.

The statement of the B.B.C. is to the effect that it is ready to co-operate in any practical enterprise for providing broadcasting for different parts of the Empire, but of course it is recognised that at the present stage guaranteed results in all parts of the Empire are not possible, even with a twenty-four hour service, and naturally the B.B.C. does not feel justified to expend what, in fact, amounts to public money on such an enterprise without full authority. It is to be expected, however, that the necessary authority will not be long withheld if the colonies and overseas dominions express a desire for the establishment of such a station.

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SUMMER WIRELESS.

SUMMER time is with us again, and each year we find an increasing interest in wireless receivers for use out of doors. The number of commercial portable receivers has increased very largely this season, and in this issue we have endeavoured to give a description of all the types which are now available, whilst an article dealing in more detail with sets which are representative of distinct classes should provide a useful guide to those who are in doubt as to what type of set will meet their own requirements.

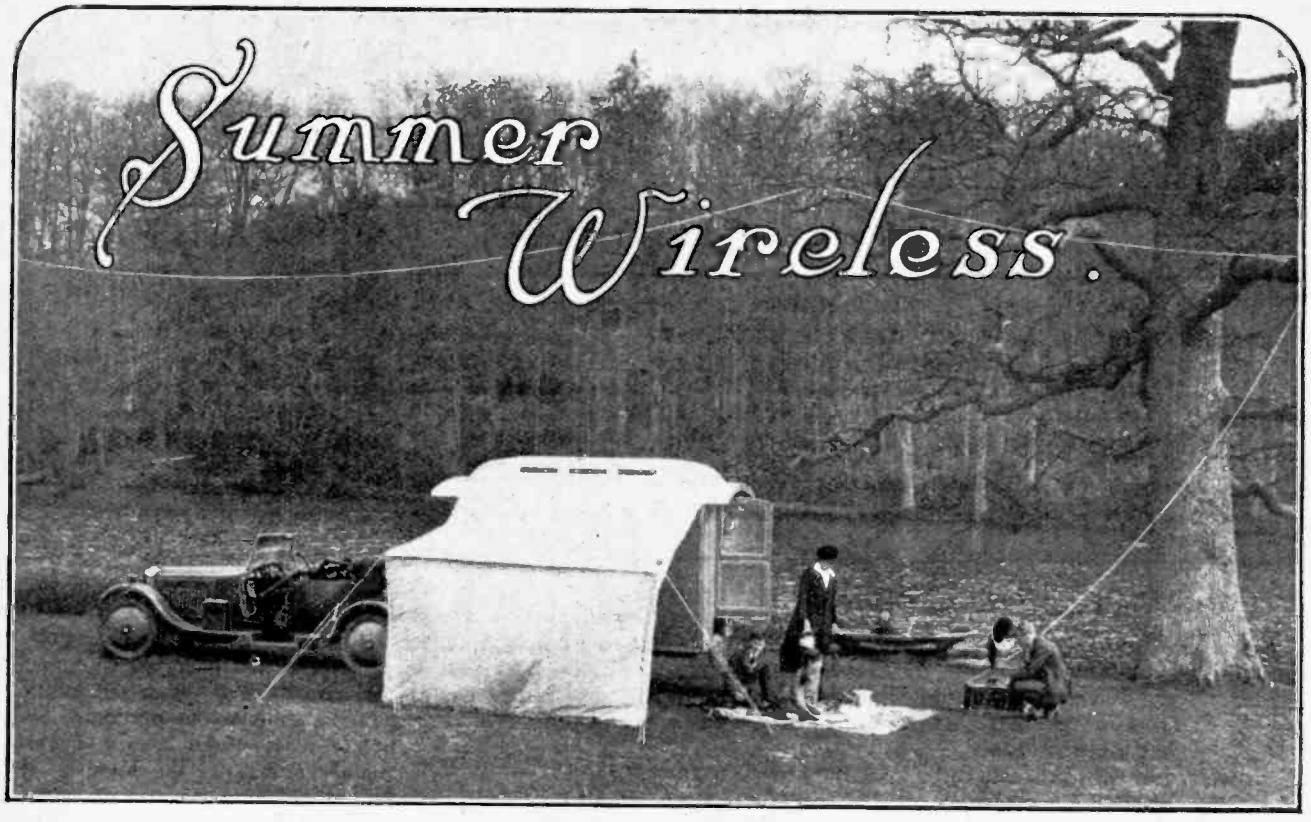
In the past year or two there has been an enormous increase in this country in the extent to which the public spend their leisure time in the summer out of doors, for not only has there been a phenomenal increase in the number of cars on the road used for pleasure, but the railways and other means of conveyance can all testify to the development of the open-air habit, and it is natural that portable sets should share in this popularity.

The portable set will undoubtedly come into its own to an even greater extent as soon as the high power regional scheme giving alternative programmes is in operation.

Post Office Regulations.

An issue largely devoted to Summer Wireless is an opportune occasion to remind readers of the Post Office attitude towards the use of portable receivers. Under ordinary circumstances a licence for the use of a portable receiver is granted only to persons who are already holders of a licence for a fixed station. Where a person has no permanent address an exception is usually made, but application must then be made to the G.P.O. for the special licence. A fixed station licence only covers the occasional temporary use of apparatus at another address. If, therefore, regular use of portable apparatus is desired, an additional portable licence will be necessary. Receiving apparatus may not be used simultaneously at more than one place under a single licence.

CONTENTS.



Portable Sets: Their Applications and Limitations.

By N. P. VINCER-MINTER.

THE spiritual future of those portable set designers who have the temerity to call a receiver weighing as much as a hundredweight of coal (which does not, in these days, mean anywhere near as much as 112 lb.) by the name of "portable" was always a subject of considerable conjecture by the writer until he happened to look up the word "portable" in a dictionary, when he found that "portable" meant anything "that may be carried." With regard to the method in which the carrying is to be done the dictionary emulates the example of many home constructed sets, and is silent. The writer, therefore, desires to offer his sincere apologies to the designers and others unwittingly wronged through his literary ignorance, but at the same time thinks that it should be compulsory for all journalistic designers of portable receivers to include some suitable method of transport in their "list of parts" and to indicate whether the estimated cost does or does not include this all-important item, whilst manufacturers should be compelled to do likewise in the list of accessories required.

Portables and Transportables.

Surely, although the word "portable" is, grammatically speaking, equally applicable to the 60 lb. and 12 lb. receiver, it would be far less misleading if the word "transportable" were used in conjunction with the former. This plea is strongly reinforced by the dictionary, which *inter alia* ascribes to the verb "transport" the meaning of "to carry away with strong emotion," a thing which the writer has many bitter recollections of doing with certain portable receivers; the dictionary gives yet another meaning, which is also astonishingly applicable to the circumstances under discussion (applicable in this case, perhaps, both to the designer and to the set), namely, "to carry away into banishment." The adoption of such a suggestion would instantly banish about ninety-nine per cent. of "portable" receivers to the new classification of "transportable."

Contradiction Invited.

So far as the writer is aware, there has been only one receiver described in any British radio journal which comes under the heading of "portable," and that one was described by himself[1] (cries of "Shame!" and "No, no!"). This is, of course, exclusive of portable crystal receivers designed for use "in a certain Oxford Street store," the exact whereabouts of which no journal or member of the public seems to be aware. The receiver designed by the writer had a very conservatively estimated "R7" range of fifteen miles from any main station, the Daventry range being, of course, greater. Needless to say, this instrument was for telephones only and used only one valve. Its weight was under 10 lb. complete with all accessories, including licence and

[1] "Everyman's Portable," *The Wireless World*, July 21st, 1926.

Summer Wireless.—

station-logging chart pasted inside the lid. The dimensions were only 12in. × 8in. × 4in., and it could be used with the lid closed. Such an instrument could really be carried by a pedestrian without either fatigue or risk of dislocating his arm.

It may be said that limiting the weight of "portables" to 12 lb. is rather taking the line that they are intended for invalids only. This is by no means the case, as anyone who pauses to reflect will readily see, and, indeed, the writer has doubts whether he has not been unduly generous in the matter, as even 12 lb. is quite enough for even the "strong, silent man" to carry *with comfort* for any distance. Since it is obviously impossible even for an experienced wireless engineer to construct a loud-speaker receiver which, inclusive of loud-speaker, batteries, etc., could give good loud-speaker results at fifteen miles (the range of the "Everyman's Portable") from a main station, even though "small cell" batteries and "Antiron" transformers be used, it will at once be perceived that a portable loud-speaker receiver can never exist until some revolutionary invention comes about.

From Derision to Triumph.

It is absolutely necessary, then, that portable receivers be capable of loud-speaker operation? The answer is emphatically, yes. The portable wireless receiver has to compete with the portable gramophone, which one constantly hears, on the river, at tennis parties, at picnics, etc., bellowing forth its tempestuous tintinnabulations. A good transportable loud-speaker receiver will put the average *portable* gramophone out of business any day, such instruments being only comparable to an inferior receiver designed and operated by the local plumber. It would be ridiculous, however, for a "headphones only" receiver to attempt to justify its existence in places where a portable gramophone is habitually used. A real portable receiver, which, as we have seen, means headphones only, has a certain very definite field of usage as we shall see later, but it will never be able to compete with an instrument, be it gramophone or wireless receiver which is capable of being used without headphones.

We have decided, then, that a really portable loud-speaker receiver is out of the question until some revolutionary invention enables us to bring the weight of a good loud-speaker receiver to a figure not exceeding 12 lb. But is it necessary that a receiver be really "portable" before it can attempt to compete with the "portable" gramophone? Most decidedly not. Who ever heard of a really portable gramophone? One must not fall into the error of weighing the actual gramophone alone in order to make it come into the "portable" category. This would be no better than weighing the wireless set or estimating its cost without taking into consideration batteries or other accessories. No, the gramophone must be weighed with its records, and the fact that records are heavy enough to necessitate taking a few only is amply exemplified by the monotonous repetition of the same old round of negro noises that pollute the air on the river or elsewhere during summer days and evenings.

It is this mistake of imagining that a portable receiver must necessarily be portable in the popular sense of the word that has made the so-called portable wireless set an object of derision, and has given birth to such foolish journalistic *clichés* such as "the first essential of a portable set is that it should be portable." The primary essentials of a portable receiver are good volume coupled with good quality of reproduction, reasonable compactness, and ample battery power; but, of course, of an unspillable and not of an *unnecessarily* heavy type. Above all, the instrument should operate from its own frame and built-in loud-speaker, and should not need that portable set users run the risk of being apprehended by the Commissioners for lunacy by throwing stones over trees and driving stair-rods into the ground. The writer well remembers the same derision greeting the "portable" gramophone when it first made its appearance, due to a popular misconception of the true meaning of the word portable. The portable gramophone appears to have outlived this derision, and to have still retained the title of portable, chiefly owing to the fact that it is possible to make a truly portable headphone wireless receiver, which is and will always be impossible in the case of a gramophone until some revolutionary recording process is invented, and partly because the portable wireless receiver has not yet, like the gramophone, lived down the word "portable." The writer suggests the use of "transportable," or some more suitable word for all those instruments unable to "weigh in" at 12 lb.

Who wouldn't own a portable set?

The sooner the public realises the fact that at present a truly portable loud-speaker receiver is a technical impossibility, and learns to appreciate the wide and manifold uses of the transportable receiver, the better it will be for all concerned.

Now let us dismiss this aspect of the question, and see if we cannot investigate the *true* possibilities of both the "portable" and the "transportable" receiver apart from such freak suggestions as using it on the tops of 'buses, at football matches, in the bath, and in other positions so beloved of the daily Press. Apparently from what one reads a wireless receiver of the portable type is indispensable in all walks of life, which is obviously nonsense; such inane suggestions do more harm than good to the cause of wireless. One cannot imagine Thomas Gray sitting in Stoke Poges churchyard committing to

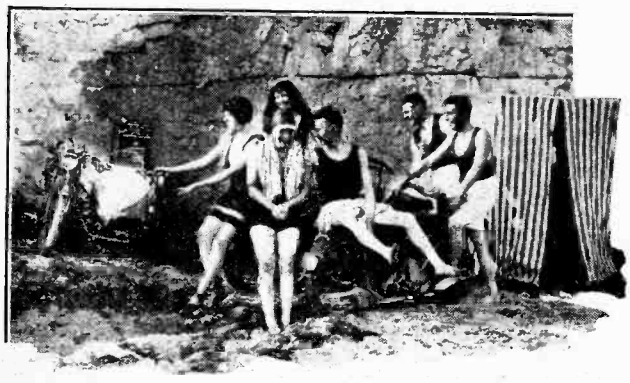
Summer Wireless.—

paper his immortal words to the accompaniment of "Yes, sir, that's my Baby," bawled from the loud-speaker of Messrs. So-and-So's "Portdeluxe" receiver, price 60 guineas, grid bias 2s. 6d. extra. We will take the case of the transportable receiver first, as it is mentioned last, for no other reason than to be contrary.

A Sure Cure for Pneumonia.

The first horrible thought which occurs to us is "Picnics." Ugh! What scenes of martyrdom does not this word conjure up; what mental nightmares of sitting on damp grass with a plate balanced on one knee, containing bread, butter, jam and wasps, and on the other a teacup containing lukewarm tea with an admixture of grasshoppers, a strong nor'-easter meanwhile finding the vulnerable parts in one's summer clothing. Think what a long way a good wireless receiver will go towards mitigating these horrors until one can return once more to civilisation and sanity. In such circumstances a wireless receiver would be worth its weight in gold, would it not? even though it weighed sixty pounds, and was found to be all covered in jam afterwards. The necessity for washing the jam off the receiver after the picnic naturally turns one's thoughts to water, and one thinks of long, lazy summer afternoons spent in a punt in a shady backwater with a good loud-speaker set and enjoyable music.

Passing on down the river to the sea, we find the portable receiver in evidence on the beach, valiantly keeping its end up amid the raucous cries of the rock sellers, the screaming of children, the hoarse cries of the char-



Selections on the seashore.

a-banc touts, the clangour of the local band, and all the myriad noises which go to make up the local colour of the beaches of popular seaside resorts. Along the quieter sections of the beach we find it well in evidence among bathing parties, where the well modulated tones of the 5XX announcer in the dressing tent has frequently nipped pneumonia in the bud by bringing a warm blush to the skin of members of the less radio-active sex. A picnic on a lonely part of the coast with, of course, a car for transport purposes, is another suggested venue for the portable set. These functions are usually more tolerable than their countryside counterpart, owing to the absence of some of the concomitant annoyances mentioned earlier in this article; sand among the eatables can, however, be very indigestible and unpleasant.

Leaving the sea coast we now pass inland again, where a fleet of passing char-a-bancs or chars-a-banc (pronunciation, Oxford or Cambridge as desired) covers us with dust and reminds us that here again is admirable scope for a portable receiver of the largest and heaviest type it is possible to obtain. Hurtling swiftly and noisily through the country roads on this mechanical monstrosity, we presently spy through the trees, amid the deepening shadows of twilight, a caravan drawn up in some neighbouring grassland, with a cheerful camp fire glowing, while music emanates from a portable set, and hastily we descend to pay our respects to the occupants.

Where my Caravan has Rested.

Here surely we have stumbled upon the ideal situation for a portable receiver. We are not unduly restricted as to weight, as we have such admirable means of transport, whilst what better way of spending an evening than with a caravan far from the madding crowd and with congenial entertainment supplied direct from the metropolis even though it be a talk on "The Habits of Insects" with which our caravanning experience has made us perfectly familiar, more familiar probably than the man who is addressing us. Here, too, we learn from our host that during the day-time when on the road, passing through sleepy old world villages, where old and young folk alike gape at the wonder of the present century, and children follow awhile, anxious to learn where the music is coming from, a constant and enjoyable programme is available all day from 11 a.m. onwards with no interference from the "magneto" of the caravan.

But come, while we have dallied awhile in this backwater of the main road both time and our char-a-banc have passed, and we must take leave of our host and hostess and return to the main road, where we speedily pick up a motor 'bus and, climbing to the top, find our old friend the freak, struggling with a crystal set, using the framework of his umbrella for an aerial and the framework of the motor 'bus as "earth," surely bringing home to us how summer wireless should *not* be attempted. Summer wireless we say aloud ("and some are not" rejoins the freak, giving a vicious jab at the crystal with a spearpoint catwhisker).

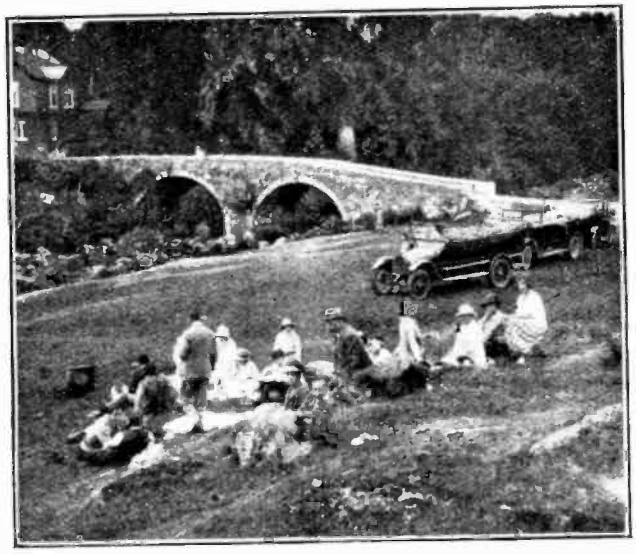
Wireless Awheel.

We are now entering the outskirts of town, and here and there we meet a cyclist with a suspicious looking object covered with a waterproof cover strapped on to his carrier. Can it be a portable receiver of the head-phone type? Yes, surely, for farther on we meet another resting by the roadside and intently listening to the first news bulletin. A few miles farther and a raucous roaring informs us that the evening programme is being used for demonstration purposes by some wireless engineer-cum-plumber, who points out proudly to his prospective customer how merrily the plate-circuit milliammeter dances and pirouettes in the glare of the electric light, unlike that of his rival which remains

Summer Wireless.—

steady except on Thursday evenings following the second news bulletin. Finally, we reach home, and, thankfully sinking into the comfort of an armchair, switch on our permanently-installed quality receiver, and drawing at our pipes, reflect lazily on the potentialities of the wireless set and in particular those of the transportable type.

But stay, what of the real lightweight portable? Has that no further use than that of providing extra weight for cyclists, which we have already noticed. Most



An *enjoyable* picnic.

assuredly it has. What of the invalid in his bath-chair spending monotonous summer days in a sunny part of the public park or being slowly propelled along by a lugubrious attendant. What better use can one think of for a portable of this type, for, needless to say, in an invalid chair of any description, a big, heavy receiver is totally out of the question. It is, of course, necessary in the case of such a receiver that the user be at a not greater distance than 25 miles at the very outside from some broadcasting station, and preferably within the 15-mile limit.

Whiling the Weary Hours Away.

Within these approximate limits a receiver of this description is also invaluable to commercial travellers and other people compelled to spend a great part of their lives in hotels. In such cases the range can be increased to well over 30 miles, since this extra range can always be obtained in the seclusion of the hotel room by the attachment of a small temporary indoor aerial consisting of a length of ordinary electric light flex. Various other uses for such a receiver can be imagined, although even in the centre of London one can scarcely credit that any enjoyable results could be obtained from the top of a 'bus.

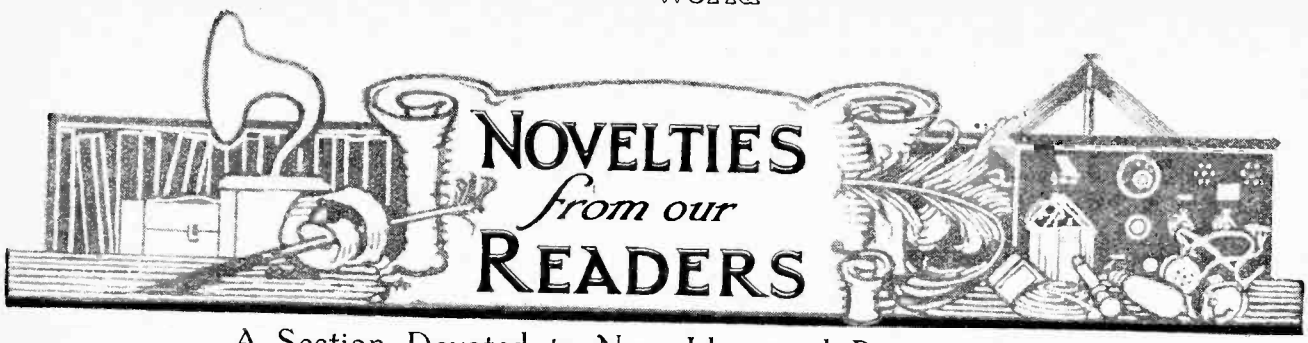
Surely, however, if a holiday caravan is the ideal place for a transportable receiver, the theatre queue is the ideal place for the true portable. One can imagine how much less wearisome would be the waiting hours of those camp-stool martyrs if they could don a pair of phones and while away some of the tiring hours by listening to the local programme. We cannot help thinking as we gaze at the theatre queues of the unique opportunity that is presented for the enterprising seller of these small "twelve-pounders" to take his place in the queue himself. How his immediate neighbours would respond, would they not, to his kindly invitation to listen awhile, and how the fame of the receiver would spread to the far end of the queue with many eager queries as to where such a boon could be obtained?

Mr. Pickwick's Portable.

Presently, as we still sit meditating over these things, after our day investigating the possibilities of a portable, the voice of Sir Ernest Wild, emanating from our big moving coil loud-speaker, ceases, and gives place to the noisy and pompous meeting of the Pickwick Club, and we see once more in our drowsy imaginings the ghostly figure of the benevolent old gentleman driving on the top of the coach in great haste towards Bury St. Edmund's on his world-famed mission to deliver certain young ladies of that town from the awful wiles of that rascal Jingle. But with him on the coach top is the latest transportable receiver which, since the children's hour is now on, is giving much scope for the comments of the redoubtable Mr. Weller.

A riverside rhapsody.

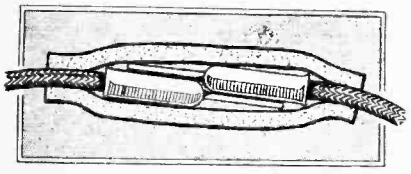
In conclusion it should be mentioned that the golden rule to bear in mind when building or purchasing a "portable" receiver is first to make up one's mind whether we require a portable or a transportable receiver, and if the latter, to bear in mind that it can never be, to quote the words of Gilbert, "light and airy, like a fairy," and any attempt to use a heavy transportable receiver as a portable leads sooner or later to the appearance of a brief insertion in the Miscellaneous columns of *The Wireless World*, "For sale, large portable set; owner buying harp."



A Section Devoted to New Ideas and Practical Devices.

PHONE CONNECTIONS.

As a substitute for the conventional type of connector consisting of a metal sleeve with set screws at each end, it would be difficult to find anything better than a piece of thick-walled rubber tubing. Ordinary gas tubing is quite satisfactory, and rubber tubing of suitable diameter and thickness is obtainable from dealers in chemical apparatus.



Connecting phone tags in series.

The method has two outstanding advantages. First, the constant pressure exerted by the rubber ensures a noiseless contact, and, secondly, the rubber itself insulates the tags from possible contact with other parts of the circuit. L. C. H.

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ENAMELLED PANELS.

In a large number of sets nowadays all the components mounted on the panel touch it at places which are at zero H.F. potential, and hence, as has been mentioned in this journal, three-ply wood can be used.

The disadvantage is that the colour of the wood does not generally match the cabinet. This may be avoided by enamelling the panel, and the colour need not be restricted to the usual black. Royal blue, for instance, is most effective.

The enamelling should be done after the panel is drilled and before mounting the components. Two coats should be given and the panel polished, when dry, with a little Mansion polish followed by dry rag. A really fine, even polish is thus obtained. Needless to say, the enamel tends to improve the insulating property of the panel. F. H. L.

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L.S. DIAPHRAGM.

A really light and rigid free-edge loud-speaker diaphragm may be readily adapted from a child's toy Japanese paper sunshade, which should be glued and doped in the open position after cutting away the handle and all unnecessary wood from the hub.

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TRANSFORMER SPACERS.

When constructing the H.F. transformers for the "All Wave Four," difficulty may be experienced in filing the V-shaped groove on the underside of the spacing strips.

To obviate this, the strips can be made from ebonite tubing cut in halves lengthwise with a fine hack-saw.

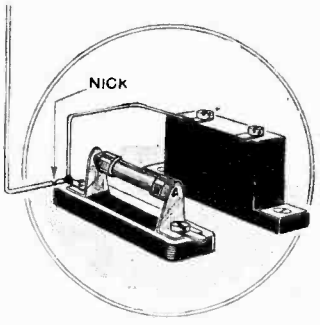
Tubing about $\frac{5}{16}$in. diameter with a 5-32in. bore is a suitable stock size, and before cutting it will be found convenient to screw-cut the outside of the tubing with 32 threads per inch. G. C. W.

Valves for Readers.

For every practical idea submitted by a reader and accepted for publication in this section the Editor will forward by post a receiving valve of British make.

WIRING HINT.

Although wiring can frequently be simplified by leaving out certain components until wiring is completed in obscure corners of the baseboard, this is a risky procedure since it is very easy to forget the missing parts and run wires through the space they should occupy.



Wiring awkward connections.

A better plan is to screw down all components and then make awkward connections by the method shown in the diagram. The end of a fairly long piece of wire is bent to the shape required and then nicked so that it may be broken off when the soldered joints have been made. The extra length serves as a handle when manipulating the wire in position.

A. E. C.

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PROTECTING CABINET POLISH.

In some types of receiver cabinet there is a polished fillet running along the front parallel with the bottom edge of the front panel. Frequent withdrawal of the set from the cabinet will scratch the polish. To prevent this the underside of the baseboard should be covered with thin felt or baize which should be fixed with glue. R. N. B.

A NEW TALKING FILM SYSTEM.

Cinematograph and Sound Records on the Same Film.

By A. DINSDALE.

IN the issue of this journal for September 15th, 1926, the writer described a very successful talking moving picture system which had just then been demonstrated in New York. In the following article it is proposed to describe another system of talking "movies" which has just been developed by a different group of engineers belonging to the General Electric Company.

Cinematograph performances, or "movies," as they are called in America, have been developed until they have now reached a very high pitch of perfection. The same applies to sound reproduction, whether through the medium of the gramophone or by means of electrical apparatus; and the present-day perfection in the latter direction owes much to broadcasting, for many of the methods used in broadcast transmission and reception have been adapted to mechanical and electrical sound reproduction.

The problem to be solved in the development of a successful talking moving picture system, therefore, is simply one of accurate synchronisation of a visible record (the cinematograph film) with a record of the accompanying sounds. Efforts to do this date back about twenty years.

In the article referred to above, the writer described the Vitaphone productions, in which simultaneous records of scenes and sounds are made on a film and a gramophone record respectively. During this and the subsequent process of reproduction, synchronism is obtained by electro-mechanical means.

The New System.

In the General Electric Company's system both records are made on the same medium—a standard width cinematograph film. A standard motion picture camera is used for making the picture, and a standard projector, with an attachment for the sound reproducer, is used for the presentation of the two effects.

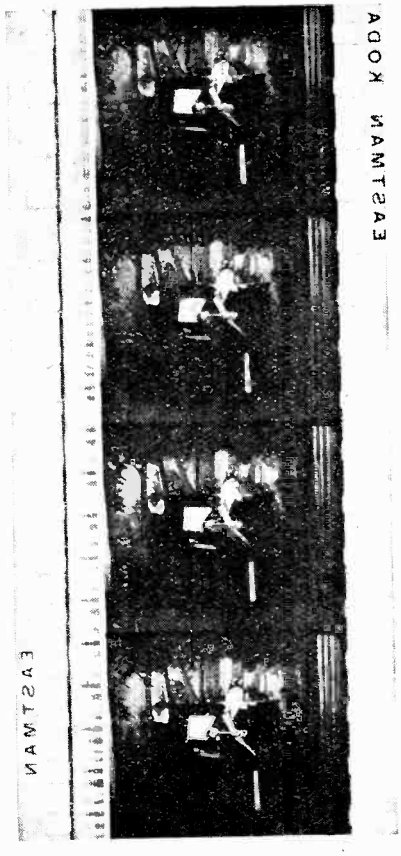
The sound record is made along the margin of the film, where there is a strip a small fraction of an inch wide upon which can be seen a series of horizontal light and dark bands and lines, of varying widths and intensities. It is this series of bands and lines which produces the sound.

In making the new films the scene is "shot" in the usual manner with an ordinary cinematograph camera. Somewhere out of range of the camera is mounted a suitable form of microphone, the output current of which is suitably amplified by means of ordinary L.F. amplifiers.

The amplified current is caused to actuate a tiny vibrating mirror, which reflects a tiny spot of light through a lens and on to the margin of the film. The result is, therefore, an oscillograph record of the sounds.

This sound record can be made in different ways. Both the picture and the accompanying sounds can be simultaneously recorded on the same film by mounting the two recording elements as a unit, with the sound recorder uppermost. The two recorders can also be mounted separately, and the sound and picture film negatives made as individual units, such an arrangement being preferable when the pictures are being made in studios and when the camera is being shifted constantly. In this case the cameras making the two records must be driven by synchronous motors to ensure synchronism between the two records.

Again, as in the case of music to accompany an important feature film, the picture film can be entirely finished and titled, the record of the music then being made on a separate film and the two combined on the finished positive.



A specimen film showing sound record on left-hand side of visual images.

The Projector and Reproducer.

The only modification from standard in the projector is the attachment which can be seen just below the upper drum which holds the films.

This attachment consists simply of a small electric lamp and a photoelectric cell. The former, together with a suitable lens, is placed in front of the film, while the latter is placed behind it. As the film is run through the projector a small spot of light is caused to shine upon the margin of the film, and the intensity of light which ultimately reaches the photoelectric cell depends upon the density of the oscillograph record on the edge of the film.

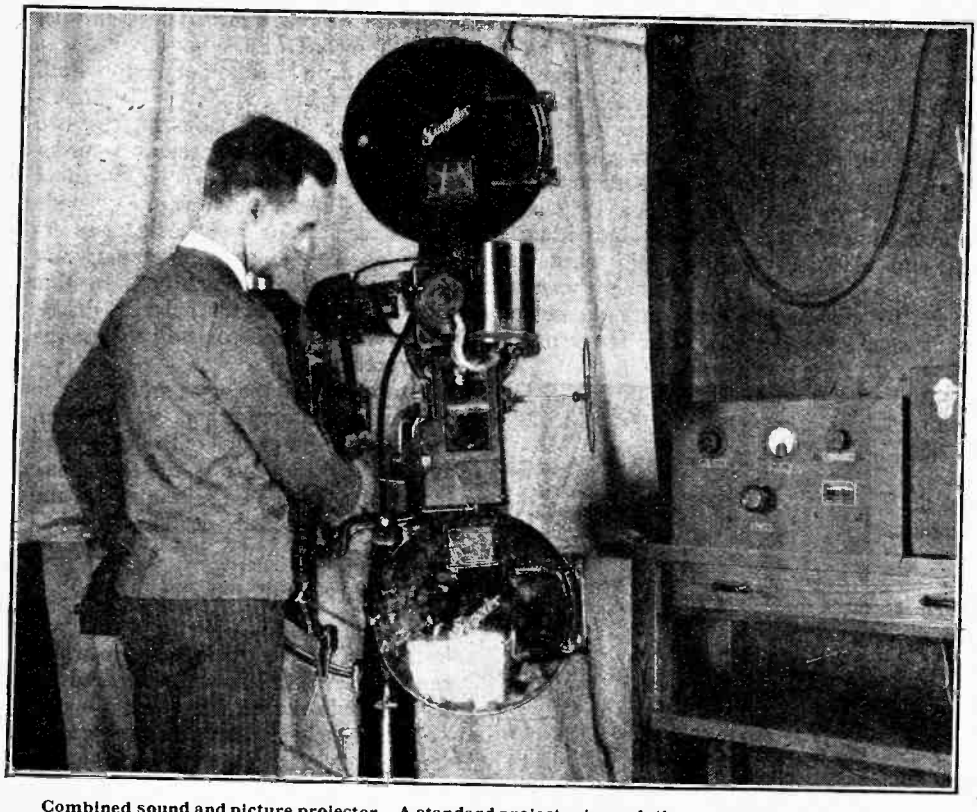
The result of this action is that a very minute and varying current, an exact replica of the sound wave, is produced in the output circuit of the cell. This tiny current is then amplified by means of ordinary L.F. amplifiers and fed to a loud-speaker which reproduces the sound in sufficient volume to fill the auditorium.

A New Talking Film System.—

Any suitable loud-speaker can be used. The one for large auditoriums which has been used in the demonstrations is a Hewlett loud-speaker, chosen because of its ability to give the necessary volume, and because of the quality of tone reproduction of which the device is capable.

Synchronism Assured.

Cinematograph films are extremely fragile things. Before they have been exhibited very many times they commence to tear at the edges and even break. Such damage makes it necessary to cut out as much as six or eight feet of film before a satisfactory repair can be made.



Combined sound and picture projector. A standard projector is used, the sound reproducing element being mounted directly below the upper film drum.

Ordinarily the amputation of such small sections of film in this manner is unnoticeable when the picture is next exhibited, unless the film is very old and has suffered many breakages. Any system of talking films which employs two separate records for the scenes and accompanying sounds immediately comes up against a serious problem of synchronisation when the film breaks. Obviously, if a portion of the film is cut out without a similar portion of the sound record being eliminated, the delicate timing of the entire system is bound to be thrown out of gear.

In the system under review, however, the timing cannot be thrown out, for the sound record is on the edge of the film. Consequently if the film breaks the appropriate part of the sound record comes out along with the picture record.

Although the picture does not suffer to any noticeable extent when a few feet of film are cut out, it might be thought that the sound reproduction would suffer. Experience has proved that such is not the case, however, for as a rule only a letter or two of a word is lost.

Another point in favour of the system is that if the film should happen to break during exhibition—not an infrequent occurrence—it is impossible for the sound reproduction to continue. It must stop simultaneously with the reproduction of the scene.

The System Demonstrated.

The new apparatus was demonstrated in New York recently before an audience of radio engineers and moving picture theatre owners. While the demonstration was confined to orchestration, singing and a few introductory remarks by an announcer who appeared in the films, the results obtained were exceptionally good. The films were very good and very well presented, and the quality of the sound reproduction left little to be desired.

Those who are accustomed to attend the presentation of big feature films in the largest cities know that a suitable orchestral accompaniment is of vital importance if the film is to be followed and appreciated to the fullest extent. One has only to witness a presentation of the same film in a small town, where the picture-house "orchestra" consists merely of a decrepit piano, indifferently played, to appreciate this point.

By means of a talking movie system the necessary orchestral accompaniment, played by a first-class orchestra, can be recorded on the film, circulated round the provincial theatres, and properly presented there, so that the small town picture goer can enjoy the benefit of a performance equal to that possible to the city dweller.

Fields of Application.

A feature of the General Electric system is the extreme rapidity with which the photographic records of sound and action can now be made. A demonstration of this was given when the orchestra of the Capitol Theatre, New York, commenced at midnight to play music to accompany "The Flesh and the Devil."

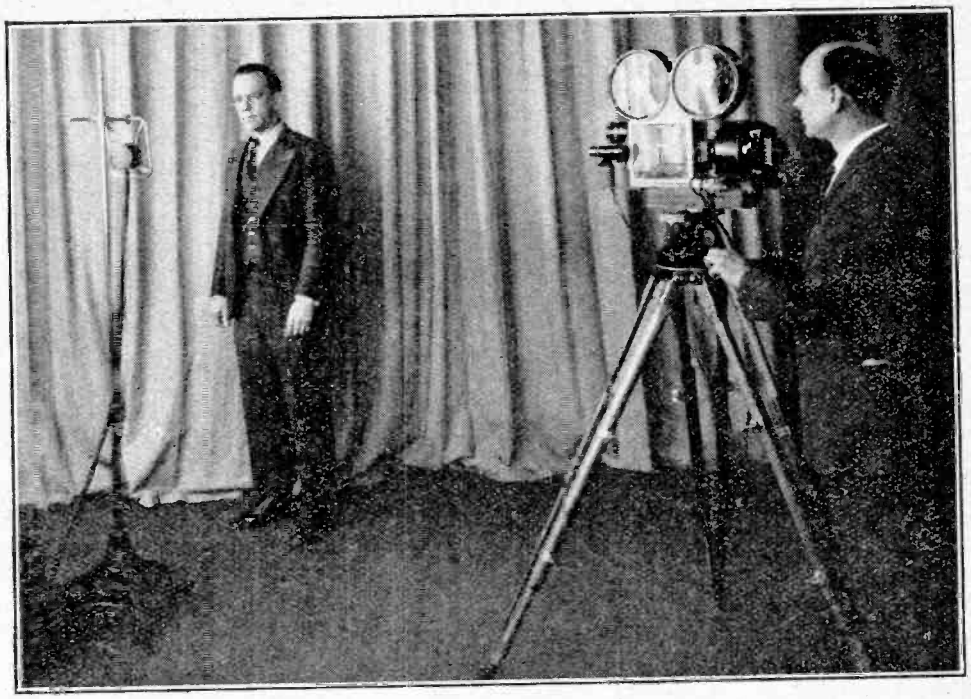
Synchronism in this case was obtained by making both records simultaneously on the same film, and the entire film was complete and ready for presentation by noon the next day.

Another field of application is in connection with news

A New Talking Film System.—reels. Not only will it be possible to show important personages when they attend public functions; they will also be able to address a few words to the audience, and visiting notables will be able to extend their greetings.

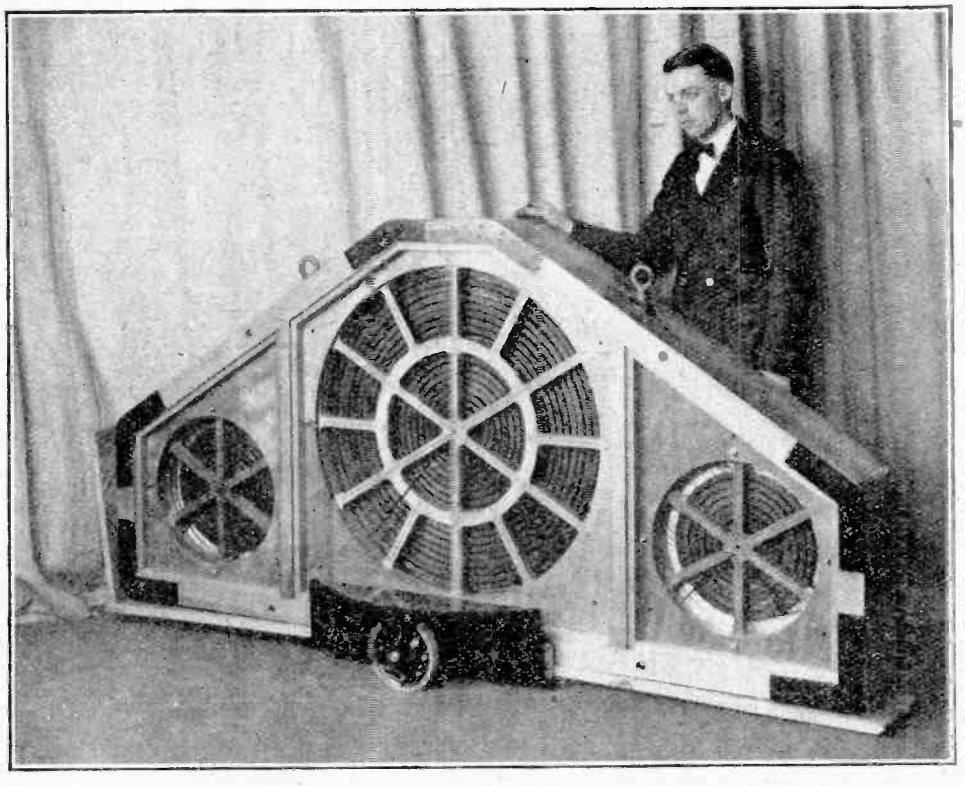
It is not usually possible for famous musicians and orchestras to appear in small communities. Talking motion pictures will permit them to be both seen and heard in the most remote corners of the country.

From an educational standpoint there are also many ways in which the new development will be of service. Many schools and colleges are now equipped with cinematograph apparatus as an aid to class-room work, and the new films will be found of even greater assistance.



A scene in the G.E.C. experimental laboratory studio during the simultaneous recording of voice and gesture.

In America broadcasting has been called in to aid education, and by this means it has been found possible for eminent lecturers in certain subjects to reach remote class-rooms and thus enabled them to benefit students who could not possibly have hoped to hear such masters of their subject in any other way.

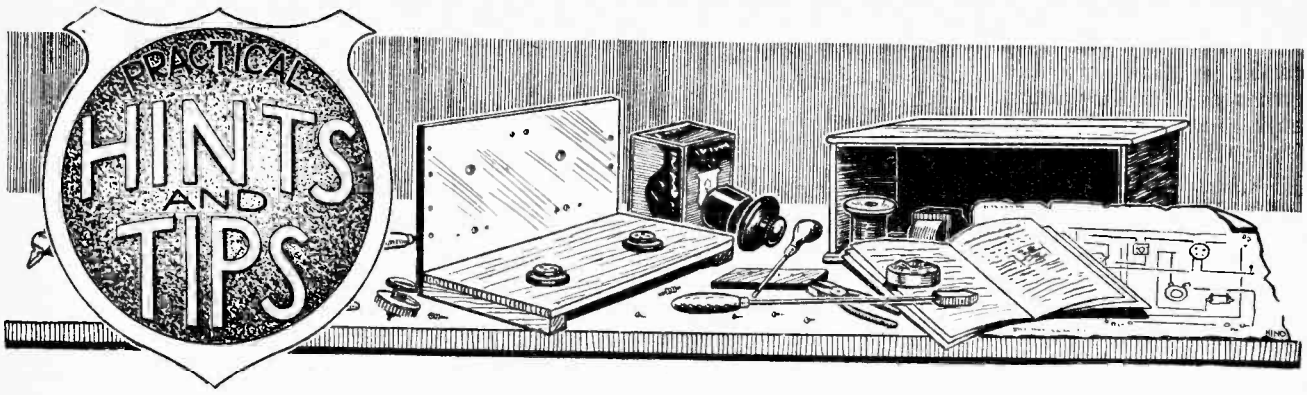


Hewlett loud-speaker used for reproducing the sound film in large auditoriums.

Where demonstrations are necessary concomitants to a lecture, however, broadcasting cannot be employed, and this is where the talking film can step in and supply the want. In the case of professors from abroad, it will be possible to record their lectures and demonstrations simultaneously, and thus render their lectures of the greatest possible value by the circulation of the film to colleges and universities throughout the country.

These are but a few of the possible fields in which the new talking motion pictures will find applications. The list can and will be extended.

Thus we have one more development to add to the rapidly growing list of inventions which depend for their successful operation upon apparatus which was originally developed for use in connection with radio communication, the foundation stone being that modern Aladdin's lamp, the thermionic valve



A Section Mainly for the New Reader.

SIMPLIFYING THE D.C. ELIMINATOR.

There is a tendency to introduce unnecessary complications into a short-range receiver designed to be fed, as far as the H.T. supply is concerned, from the D.C. supply. It may be pointed out that if the circuit is suitably chosen it is possible to supply all the valves with a common voltage, which, moreover, may be that of the mains—possibly over 200 volts. It is admitted that the life of the valves will be reduced by the application of high voltages, but only very slightly if ample negative bias is applied to their grids; in any case, the improved power-handling capacity and better quality of reproduction will, in the opinion of many listeners, be ample compensation for this small increase in upkeep cost. At the same time the initial expense involved in the construction of the amplifier will be reduced, as no potential-dividing or voltage-reducing devices will be necessary.

When using exceptionally large H.T. values, it is advisable to include resistance-coupled low-frequency amplification, and the resistances should be large. If this practice is followed, the anode current will be reduced, and the remarks made above regarding valve life—as far as those actually having resistors in their anode circuits are concerned—will no longer apply.

The circuit diagram of a suitable arrangement for operating direct from 200-240-volt D.C. mains is given in Fig. 1; suggested values for the coupling components are indicated, while the tuning circuits may follow conventional practice. The receiver, which includes neither H.F. amplification nor reaction, is intended purely for local station work, up to distances of about thirty miles, with perhaps alternative reception of the high-power station under favourable circumstances.

It will be noticed that a coupled direct circuit has been included; this allows the filaments to be earthed only through the mains, and reduces the possibility of the introduction of "hum" due to the existence of a probable difference of potential between the "set earth" and the "mains earth." Where reception on the normal broadcast band only is desired, the set may be simplified by the substitution of an "untuned aerial" coupler.

Modern "high magnification" valves may be used as detector and first-stage L.F. amplifier, although in the immediate vicinity of a station almost any valve will give sufficient amplification in the latter position. A power or super-power valve will naturally be required in the last stage, depending on the sensitivity of the loud-speaker and the volume required.

The output choke L_1 (which is not absolutely necessary) may have an inductance of from 15 to 30 henries, while the smoothing choke, L_2, should be of from 30 to 50 henries.

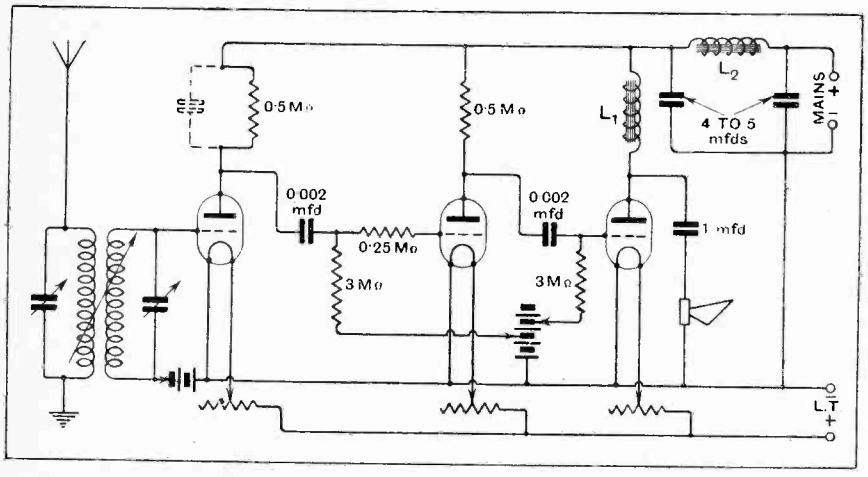


Fig. 1.—A simple local-station receiver drawing H.T. current direct from D.C. mains.

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A CURE FOR NOISY CONTACTS.

Rubbing contacts in receiving circuits, such as switches, plug-in coils, friction contacts to moving vanes of variable condensers, etc., are often imperfect, and give rise to scraping sounds. An excellent remedy for this is to apply a spot of lubricant such as vaseline or oil to the rubbing surfaces of the contacts. Not only does this improve the smoothness of the mechanical action of the contact, but greatly improves the certainty of electrical contact—a rather extraordinary fact when it is remembered that most lubricants are in themselves excellent insulators. Only a bare minimum of lubricant should be used, as an excess tends to collect dust.

SOME "REFLEX" CONSIDERATIONS.

The beginner is apt to lose sight of the fact that the reflex or dual amplification principle, by means of which a valve is made to amplify at both high and low frequency, was devised purely as an economy measure. The most fervent advocate of this system could hardly affirm that a reflex receiver is better than a "straight" circuit, in which the same operations are carried out by separate valves. Indeed, most of them would be ready to admit that it is not *quite* as good.

Bearing this fact in mind, it will be realised that the introduction of better, cheaper, and, above all, more economical valves (upkeep is even more important than initial cost) tends to discount the previous advantages of the reflex receiver, and to account for its present decrease in popularity. It must be admitted, however, that these circuits are interesting, and for this reason will probably have a following for some time to come. Furthermore, it cannot be denied that a reflex receiver can give amplification, from the point of view of quality, indistinguishable from that obtainable from a "straight" set under average working conditions. Such results, however, will only be obtained when the "dual" receiver is really well designed, well constructed, and, generally speaking, operated by someone with considerable theoretical knowledge of the subject.

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TONE CONTROL OF LOUD-SPEAKERS AND SETS.

If broadcast transmissions, receiving sets, and loud-speakers were all perfect tone control devices would not be permissible. As things are, we often find circumstances, both at transmitter and receiver, which tend to exaggerate unduly either the upper or lower extremities of the audible range. Somehow, the only method of loud-speaker tone control which has gained much prominence so far is the simple use of a condenser across the loud-speaker. This is really a very poor method of control, and should be used as little as possible, since by shunting a capacity across a highly inductive instrument like a loud-speaker we are likely to defeat our own ends by introducing electrical resonance. In Fig. 2 (*a*) and (*b*) we show a method of controlling tone entirely by the use of a choke L having a large value of inductance but a low resistance. By placing the choke L in series with the loud-

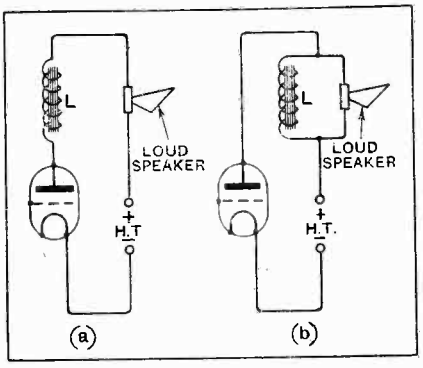

Fig. 2.—Series and parallel connections of choke for tone control.

speaker, as in Fig. 2(*a*), the higher-pitched sounds are suppressed, while by connecting the choke in parallel with the loud-speaker, as in Fig. 2 (*b*), the higher-pitched sounds are favoured and the low frequencies suppressed. The actual number of turns, etc., required on the choke L depends upon the loud-speaker in use and the amount of correction required. Some interesting experiments in this connection can be performed using various small-power 50-cycle transformers as chokes. The important thing is that the resistance of the choke should be small compared with its inductance.

Where a resistance-capacity coupled amplifier is used, a better and more convenient form of control may be effected in the amplifier itself, as

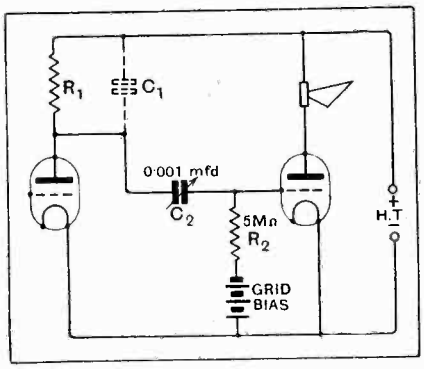

Fig. 3.—A resistance-coupled circuit in which tone control is effected by varying condensers C_1 and C_2.

shown schematically in Fig. 3. To suppress the low frequencies and favour the high frequencies the condenser at C_1 is left out, and a variable condenser of 0.001 mfd. maximum is used for coupling at C_2. The grid leak R_2 should be about 2 megohms. The smaller the capacity of C_2 is made the larger will be the proportion of bass frequencies cut out. If it is wished to reduce the higher frequencies with respect to the lower ones, C_2 is replaced by a larger capacity fixed condenser of anything between 0.01 and 0.1 mfd., while a condenser C_1 is shunted across the anode resistance R_1. According to the degree of suppression required on the higher frequencies, C_1 will need to have a capacity somewhere between 0.001 mfd. and 0.01 mfd.

One must naturally sacrifice a certain amount of signal strength with almost any form of tone control, since the correction is made by weakening the unwanted frequencies and not by strengthening the required ones

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SAFEGUARDING THE VALVES.

It has been noticed that the average amateur, before making internal adjustments to his receiver (with the batteries connected) almost invariably switches off the filament current. Of course, the correct practice is to disconnect all batteries, but it is realised that there is a natural tendency to save time by ignoring this precaution. It should be pointed out, however, that it is much safer to leave the valves "on," as the voltage developed across their filaments by an accidental application of the H.T. battery pressure will be automatically limited by the presence of the L.T. accumulator, and in the majority of cases no serious harm will be done to the valves.

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CORRODED ACCUMULATOR TERMINALS.

The incrustation which forms on the positive terminal of badly designed accumulators should be removed as soon as it begins to make its appearance, or the terminal will be quickly ruined. The cleaning is very easily effected by pouring hot water from a kettle over the terminal to be cleaned, when the incrustation becomes rapidly washed off. There is no need to remove the acid from the accumulator, but the operation should be conducted over a sink or drain of some sort.

WINDING FRAME AERIALS.

Although the calculation of suitable windings for the type of frame aerial usually included in a portable receiver is a matter of some difficulty, it is a fairly easy matter to get a good idea of the number of turns required.

To cover the normal broadcasting waveband it will be found, if a fairly conventional method of winding is used, that a total length of about 80ft. of wire will be required. Thus, if the frame has 2ft. sides, ten complete turns should be used.

For the long-wave stations, about 250ft. of wire will give approximately the right inductance value.

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THE NEON LAMP AS A POLARITY INDICATOR.

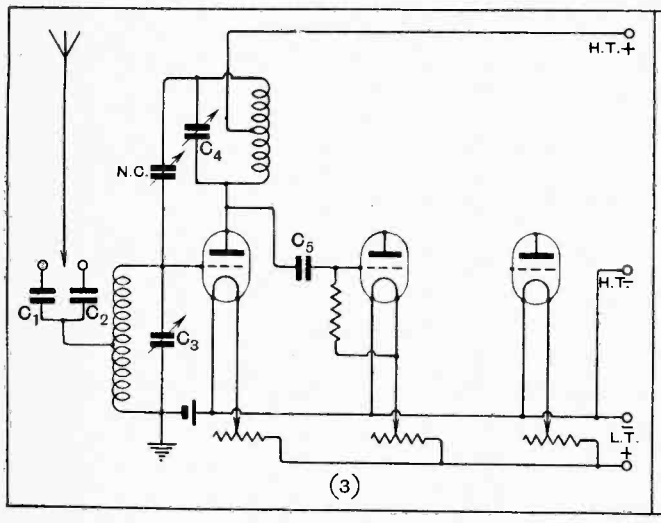
A glow-discharge lamp, such as the familiar "Osglim," is very handy for determining which are the positive and negative wires of a D.C. supply of 200 volts or more. The only thing to remember is that the pink glow covers the negative electrode. Of course, it is essential in the first instance to find which lamp contact goes to which electrode. The simplest way of doing this is to give the lamp a preliminary test on a 200-volt supply of known polarity. If this cannot be done the alternative is to remove the brass base from the lamp and get at the wires, which can be followed to the electrodes. A word of warning is necessary here, however, as the little series safety resistance incorporated in the cap is fragile. A neon lamp should never be connected straight across the mains without a series safety resistance, so if the original safety resistance is scrapped a 40-watt lamp or similar resistance should be placed in series with the neon lamp.

DISSECTED DIAGRAMS.

Practical Points in Design and Construction.

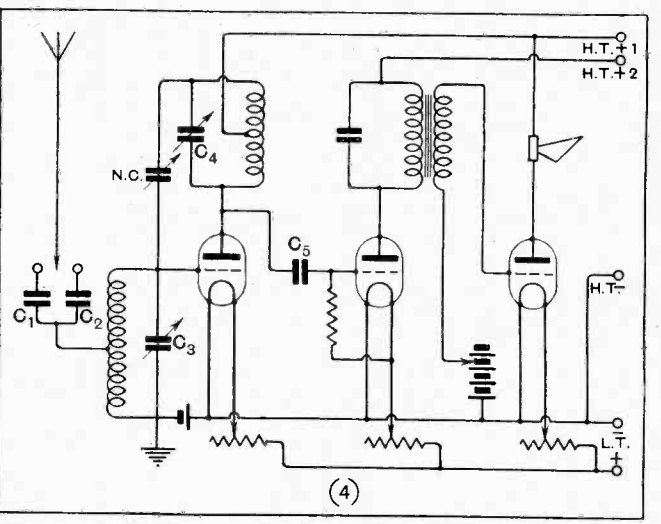
No. 71 (a).—A Neutralised Tuned Anode Receiver.

(Concluded from last week's issue.)



(3)

Amplified H.F. voltages developed across the anode coil are applied to the grid of the detector through a small condenser. A leak is inserted between grid and the positive side of the filament, in order that rectification effects may be obtained.



(4)

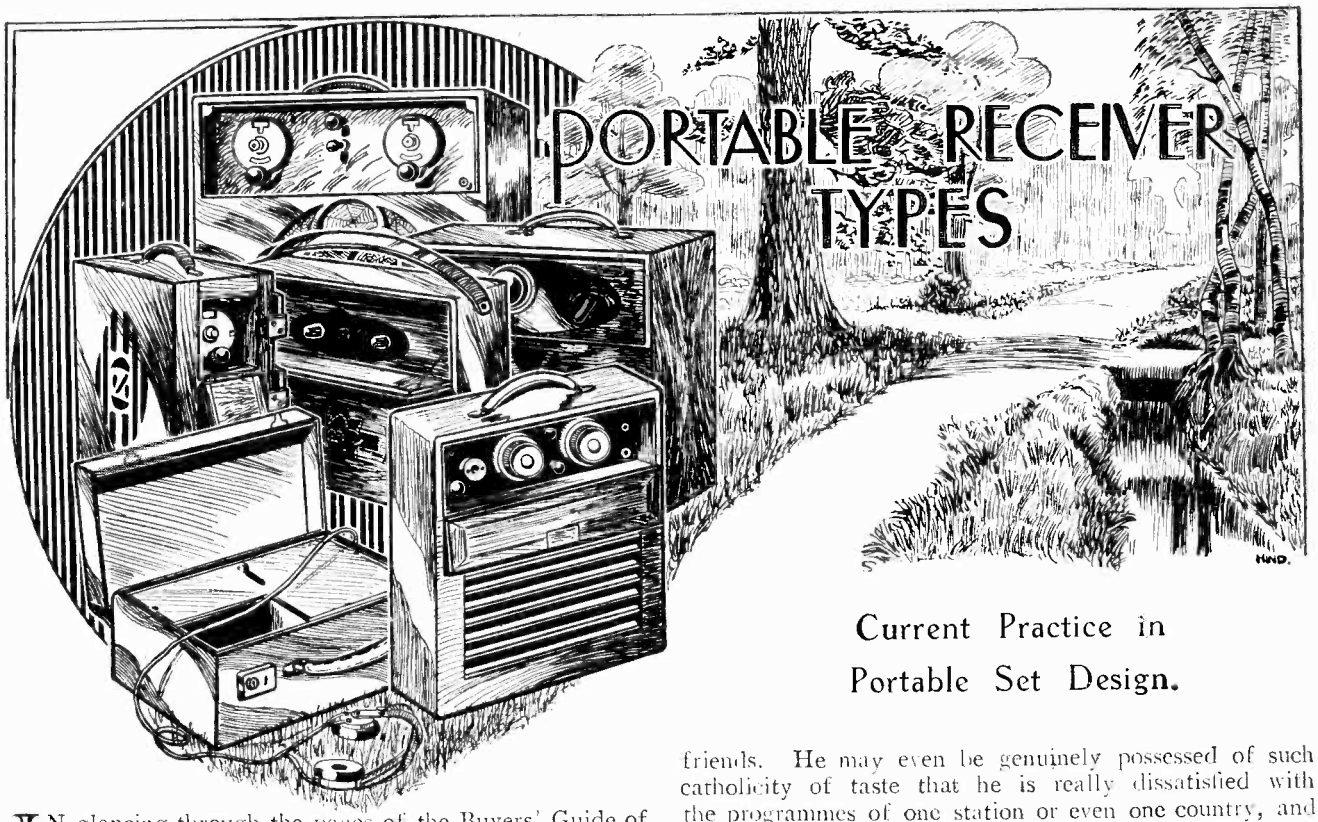
The anode circuit of the detector is completed through the primary of an L.F. transformer, the secondary of which is joined between grid and filament of the output valve, with bias battery interposed. Phones or loud-speaker are inserted in the anode circuit.

THE grid condenser (C_5) and the leak may have the conventional values of 0.0003 mfd. and 2 megohms respectively. There will, as a rule, be some slight gain if the lower end of the grid leak is connected to the slider of a potentiometer, the windings of which are joined across the L.T. leads. This refinement is generally recommended for grid detector circuits, but its advantages are less pronounced in receivers like that under discussion, as reaction between anode and grid circuits is not used.

If good quality reproduction is an important consideration, it is recommended that the detector valve should have an impedance not greatly in excess of 20,000 ohms; this, if of modern design, will have an amplification factor of about 20, or rather less if the filament is rated at only 2 volts.

The above recommendations regarding the detector valve presuppose that the L.F. transformer will have a high primary inductance, and consequently a low ratio of from 2 : 1 to $3\frac{1}{2}$: 1. The capacity of the shunting condenser across its primary winding should be chosen in accordance with the manufacturers' specification; failing any instructions on this matter, one of from 0.0003 to 0.0005 mfd. should be tried.

With only a single stage of low-frequency amplification, an ordinary power valve should be able to handle the signal voltages to be dealt with in the L.F. amplifier. A grid bias voltage of $7\frac{1}{2}$ or 9 volts is generally suitable for this type of valve, with 120 volts of high tension. As a high-magnification, high-impedance valve is recommended for the H.F. amplifier, it is permissible to apply the same voltage to both first and last valves.



PORTABLE RECEIVER TYPES

Current Practice in Portable Set Design.

IN glancing through the pages of the Buyers' Guide of Portable Receivers in this issue, the first impression is one of wonder at the variety of circuits and methods of construction. The student of design will, no doubt, hold very definite opinions as to what constitutes the ideal portable receiver, and will marvel that manufacturers should waste time and money on the production of receivers so manifestly inferior to his own favourite type. But let him reflect that other experts may hold with equal sincerity diametrically opposite views, and, further, that whatever form the final product may take it will fulfil the ideal of a section of the public however small.

Supply and Demand.

For instance, there are still some strong silent people who are not afraid to run counter to prevailing fashion by proclaiming (by the purchase of a set for Daventry only) that there is nothing seriously amiss with the B.B.C. programmes. They are met on equal terms by those designers who argue that whereas the genius is not yet born who can produce a set to cover all wavelengths with maximum efficiency, the present state of high-frequency technique does enable a qualified engineer to design a really fine set for *one particular wavelength*. When that wavelength happens to be used by a station of exceptional power served by programmes from the capital, and to be particularly free from interference, what possible argument would deter a man with creative instinct from setting to work?

At the other extreme there is the inveterate "knob-twiddler" who is oppressed by a sense of social inferiority unless he can demonstrate alternative reception from at least a dozen stations to a circle of admiring friends. He may even be genuinely possessed of such catholicity of taste that he is really dissatisfied with the programmes of one station or even one country, and will go to the trouble of mastering the intricacies of any number of controls in order that he may be able to draw on foreign countries for his amusement and instruction. The demand created by this class of listener is supplied by those manufacturers who believe that the secret of success in the wireless business is to produce a *universal* receiver for all wavelengths, and for use under any set of conditions.

Limitations of Space and Weight.

Between these two extremes will be found the majority of sets on the market, but for whatever object they may have been designed all are subject to the limitations of space and weight. For instance, 2-volt valves are almost universal because a 2-volt accumulator has one-third of the weight and occupies one-third of the space of a 6-volt accumulator of the same ampere-hour capacity. At one time it might have been worth while to incur the extra weight for the sake of the superior performance of 6-volt valves, but to-day the 2-volt valve has reached such a high state of efficiency that this measure is unnecessary.

Next to the L.T. accumulator in order of weight comes the H.T. battery, and here we are limited to the small type dry cell battery. This is unfortunate because, for a given volume of sound from the loud-speaker, a portable set makes greater demands on the H.T. battery than a receiver working off a standard outdoor aerial. Large type dry cells and accumulator batteries are out of the question unless four-electrode valves are used,[1] so that frequent renewal of the H.T. battery must be regarded as a matter of course.

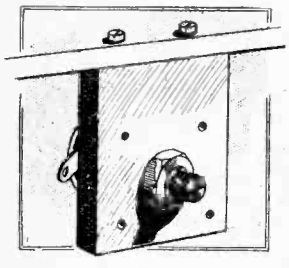
[1] See *The Wireless World*, May 11th, 1927, page 595.

Portable Receiver Types.—

The method of mounting valves must receive special consideration. Not only will the set be subject to jolts and jars during transport, but trouble from microphonic noise must be guarded against, since loud-speakers are generally mounted inside the cabinet itself and will transfer acoustic vibrations to the set as a whole. Sponge rubber is freely used in valve mountings, and if in some cases H.F. and L.F. valves are rigidly supported, spring mounts for detector valves are almost universal.

The Pye 5-valve portable for Daventry only.

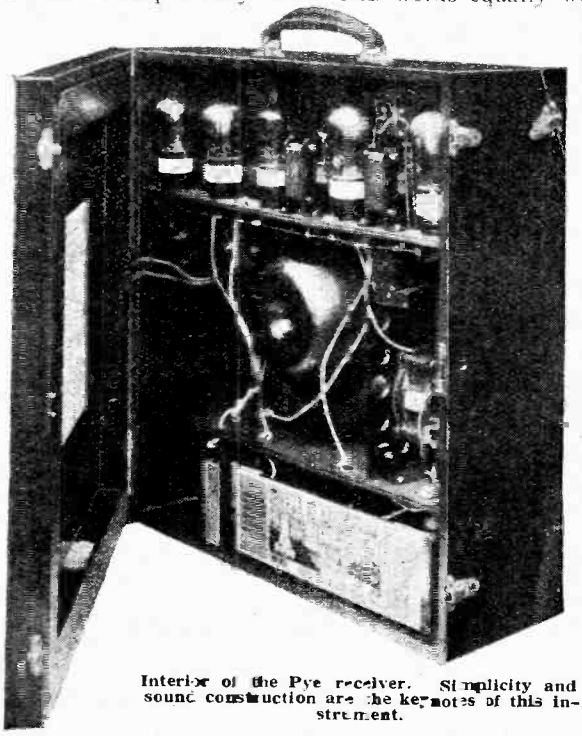
There remains one other factor peculiar to portable sets which must be taken into account by the designer. This is connected with the frame aerial which is wound round the outside of the set or in the hinged back of the cabinet. The field associated with this coil permeates the whole of the set, and it is difficult to avoid stray couplings with other tuned circuits in the receiver. When the direction of the field is variable, as in the case of the hinged frame, the difficulty of dealing with stray couplings is greatly increased.



Balancing condenser used in the Pye portable. Note the split bush and locking nut.

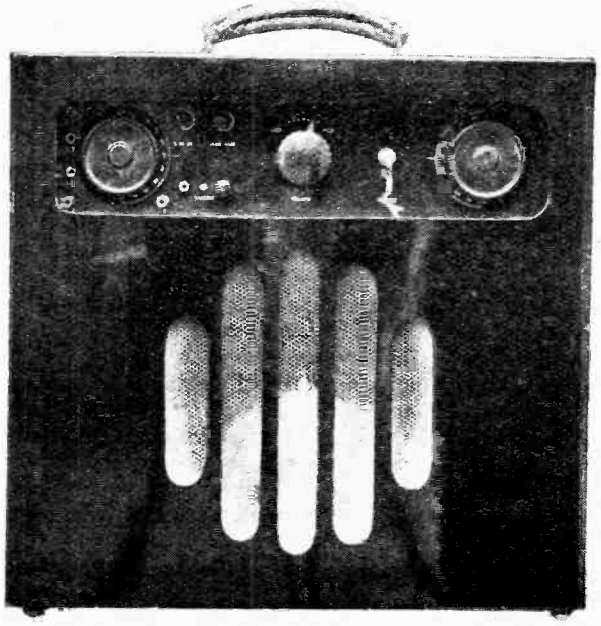
So much for generalities: let us now consider one or two representative types in further detail.

The Pye 5-valve portable receiver is an excellent example of a single-station receiver. There are two stages of high-frequency amplification, coupled with neutralised H.F. transformers tuned and balanced on a wavelength of 1,600 metres. The frame aerial is wound on a former fitting in the hinged door at the back of the cabinet. The receiver is perfectly stable and works equally well



Interior of the Pye receiver. Simplicity and sound construction are the keynotes of this instrument.

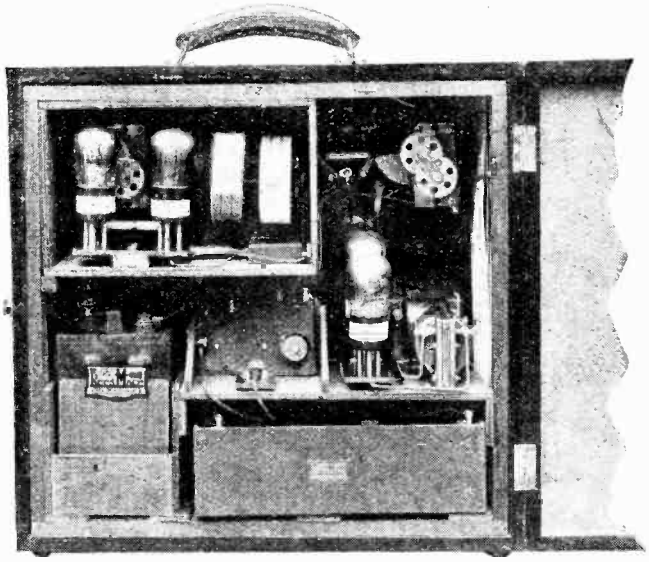
with the door open or closed, but due to such masses of metal as the loud-speaker horn in the interior of the set the tuning of the frame aerial depends on the relative position of frame, and must be allowed for by some suitable control. This takes the form of a compensating condenser, which is the right hand of the three controls



The Rees Mace "All-in" receiver for use with or without an external aerial.

Portable Receiver Types.—

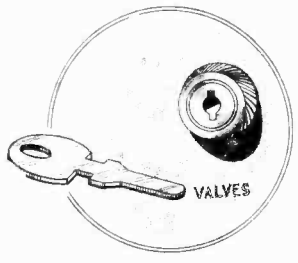
seen in one of the photographs. The left-hand control is a combined on-and-off and change-over switch, by means of which one of the L.F. amplifying valves may be cut out of circuit. The central knob operates a continuously variable volume control—a feature which should be regarded as essential in any receiver, but which is all too rarely seen at the present time. If the amplification is made sufficiently high for reception in any part of the country, it stands to reason that at close ranges overloading will occur without some form of volume control.



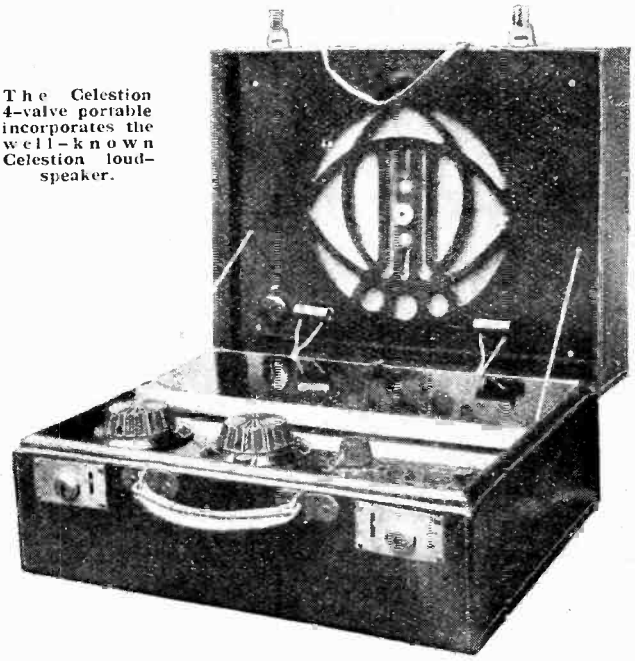
Interior of the Rees Mace set. H.F. components are assembled in a screened compartment in the top left-hand corner.

The workmanship throughout is excellent, and the receiver taken as a whole is a thoroughly sound and reliable proposition.

Although the appearance of the Rees Mace "All-in" receiver immediately classes it as a portable, the makers emphasise that it is a general-purpose receiver, suitable for use in the home as well as out of doors. It may be used with the frame aerial incorporated in the set or with external aerials of varying lengths, four aerial sockets being provided to suit aerials of any given capacity. With interchangeable plug-in coils the wavelength range of the receiver is 250 to 600 and 1,100 to 2,600 metres. There are two push-pull switches associated with the frame aerial, one to alter the wavelength range, and the other to vary the degree of reaction in the circuit. A continuously variable reaction control is also provided and is the centre control marked "Volume." Incidentally, the reaction is negative, that is to say, the set oscillates when the coils are apart and ceases to oscillate when they are brought together. The arrangement of components is interesting, and is shown in the back view of the instrument. The H.F. and detector valves, together with the plug-in coils and variable coil holder, are housed in a separate compartment in the top left-hand corner. The sides of this compartment are covered with

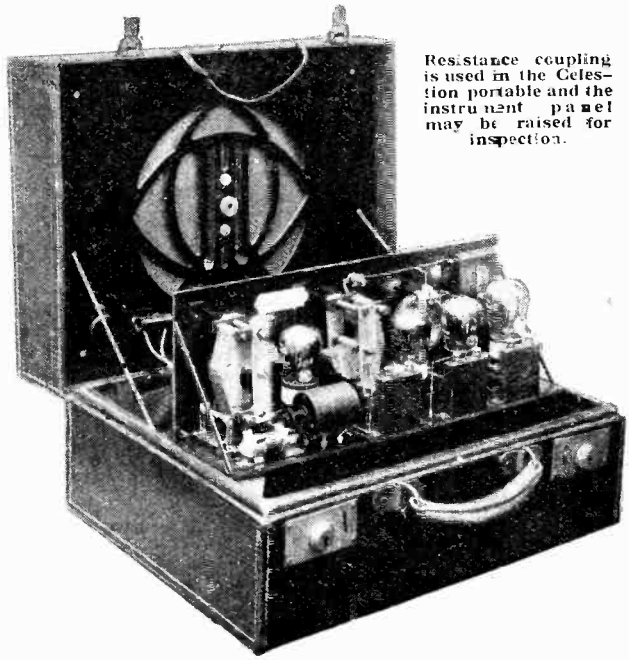


Key switch used in the Rees Mace portable.



The Celestion 4-valve portable incorporates the well-known Celestion loud-speaker.

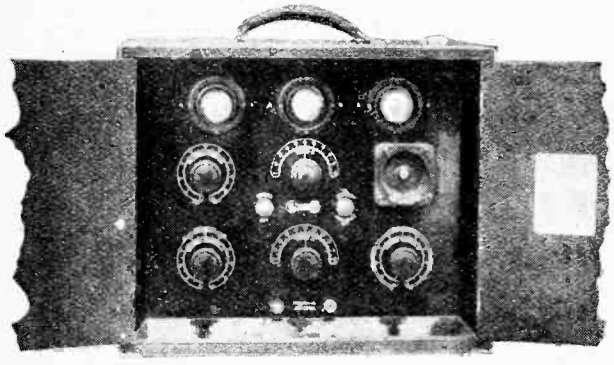
thin sheet metal, presumably for screening purposes. On the right-hand side of the set will be seen the L.F. valves and their associated transformers. In the centre is the adjusting screw for the loud-speaker, and a little to the left a flash-lamp bulb H.T. fuse. An interesting feature of the set is the key switch for the filaments, which effectively prevents unauthorised persons from using the set. The makers give a year's free service with each set, excluding valve and battery failure.



Resistance coupling is used in the Celestion portable and the instrument panel may be raised for inspection.

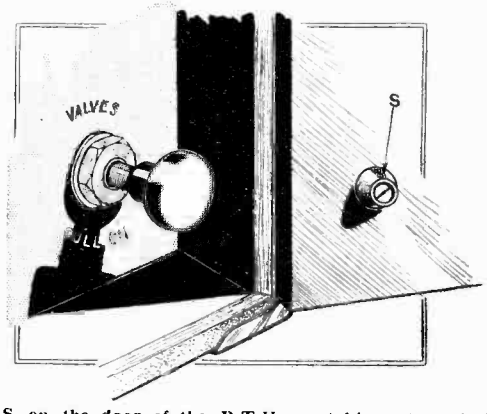
Portable Receiver Types.—

In the Celestion portable receivers resistance-coupling is used for the low-frequency stage—a very shrewd idea since it materially reduces weight and also gives excellent quality of reproduction, especially when combined with the Celestion loud-speaker, which is incorporated in the



B.T.H. portable 3-valve superheterodyne.

lid. A single stage of H.F. amplification is used, coupled with interchangeable neutralised transformers for long and short waves. Separate neutralising condensers are incorporated in each transformer, and these can be adjusted once for all, so that the wavelength range may be changed with the minimum of delay. All components are mounted on a hinged panel, which may be raised for inspection and for changing the H.F. transformer, which



A stop S on the door of the B.T.H. portable automatically switches off L.T. current when the set is packed up.

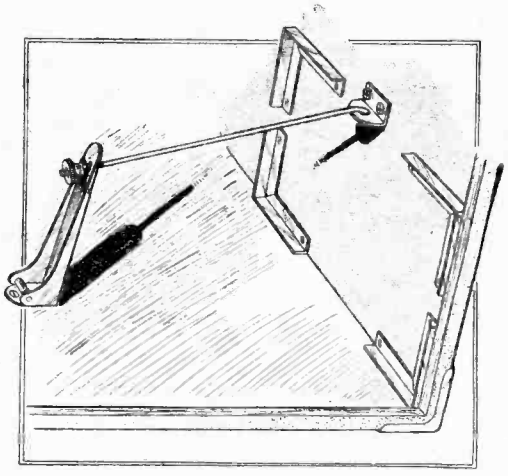
is the barrel-shaped component at the left-hand end of the panel.

The B.T.H. portable receiver (Type VR3) is a *three-valve* receiver employing the superheterodyne principle, and as such is probably unique, at least as far as commercially produced sets are concerned. The first valve acts as oscillator-detector, the second as intermediate-frequency amplifier, and the third as second detector. Needless to say the receiver as it stands is intended for telephone reception, but a portable combined amplifier-loud-speaker unit is available for those who desire loud-speaker reception.

The number of controls looks rather forbidding, but only two of these are used while searching for stations, the others being of subsidiary importance—such as volume controls, wavelength range switches, etc.

Considerable ingenuity is shown in the construction of components. The valves are guided into their sockets by funnel-shaped mouldings, the grid and anode sockets being marked on the front of the panel. Provision is made for the use of an external collapsible frame, or the range may be increased by using an elevated aerial in conjunction with a special coupling coil, which is placed near the back of the receiver.

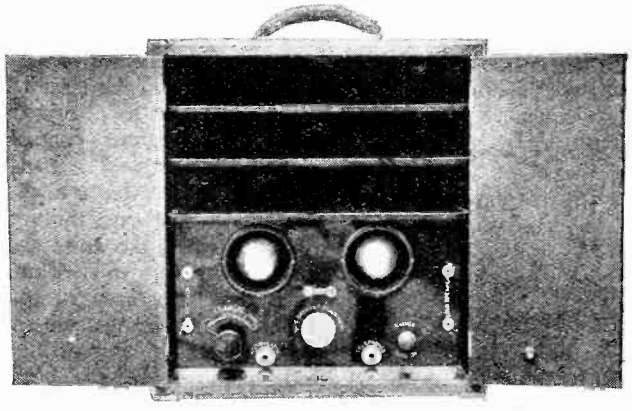
Not the least noteworthy feature of the B.T.H. equipment is the excellent instruction book issued with each set.



Battery clamp used in the B.T.H. portable amplifier.

Finally, we come to the aristocrat of portables, namely, the multi-valve superheterodyne. In this class may be placed such sets as the "Neutrosonic Seven," which was reviewed in some detail in the April 13th issue of this journal. Sets of this type are necessarily heavier and more bulky than their humbler relatives, but are quite suitable for motoring expeditions or other occasions when adequate transport facilities are available.

An interesting receiver in this class is the "Liberty" eight-valve portable superheterodyne. Although a continuously variable wavelength range of 200-2,000 metres is available, the tuning controls are extremely simple, the change-over from short to long waves being effected by a single switch. There are no interchangeable units, and

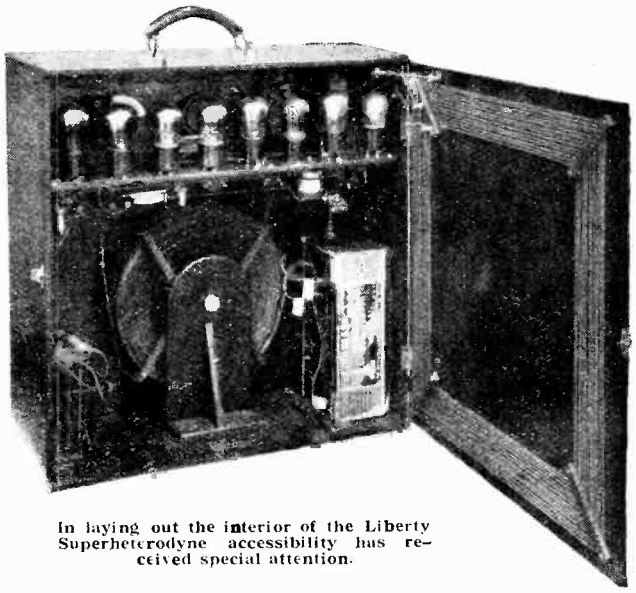


Portable power amplifier and loud-speaker designed for use with the B.T.H. 3-valve superheterodyne.

Portable Receiver Types.—

the switch alters the range of the oscillator as well as the detector circuits. In addition to the usual tuning controls there is also a volume control and an on-and-off switch. The volume control is really a potentiometer controlling the grid potential of the intermediate frequency valves, which oscillate when the grids are made sufficiently negative. By operating just off the oscillation point a high degree of sensitivity is obtainable, while the application of a more positive bias results in a diminution of volume. That the simplification of controls results in no reduction of efficiency is evident from the number of stations logged on the calibration chart supplied with each set.

The Liberty 8-valve Super-heterodyne



In laying out the interior of the Liberty Superheterodyne accessibility has received special attention.

In conclusion it may be said that the trend of design of portable sets seems to be towards two extreme types: on the one hand, the simple robust single or two-station set, and on the other the superheterodyne. Frame aerials are now almost universal, as the addition of external aerials introduces an extremely variable and incalculable factor into design. By concentrating on a frame aerial, however, it is possible to produce a single-station set of high sensitivity for use in any part of the country, or a superheterodyne with almost unlimited range, both types being unequalled for stability and ease of control.

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.

The Super-heterodyne.

The super-heterodyne receiver formed the subject of an absorbing lecture given by Mr. H. S. Walker at the last meeting of the Hounslow Wireless Society. After dealing with the difficulties of amplification at extremely high frequencies and how they are overcome or partly overcome by the neutrodyne system, the lecturer explained how, in the super-heterodyne system, the frequency of the incoming signal is reduced to a lower and more manageable frequency, when amplification becomes a comparatively easy matter. After an interesting discussion, Mr. Walker demonstrated a super-heterodyne receiver of his own design which worked exceedingly well, bringing in many distant stations on the loud-speaker with good strength and quality.

Hon. Secretary: Mr. W. R. Collis, 7, Algar Road, Isleworth.

5KL Demonstrates.

The difficulties encountered by the novice who tackles short waves were described by Mr. O. B. Kellett (G5KL), in a lecture before the Southport and District Radio Society on May 2nd. Besides elucidating many of the common troubles met with, the lecturer described the relative merits of a number of short wave circuits and demonstrated his own transmitter which was on view.

The Hon. Secretary of the Society, Mr. E. C. Wilson, "Lingmell," Kirklees Road, Birkdale, Lancs, will be pleased to forward particulars of membership to experimenters in the district.

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Institute of Wireless Technology.

The annual general meeting of the Institute will take place this evening (Wednesday) at 7 p.m. at 71, Kingsway, London, W.C.2 (members and associate members only).

Information respecting the activities of the Institute may be obtained from the hon. secretary at the above address.

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At the "Osram" Valve Works.

Members of the Western Metropolitan Radio Societies spent a profitable morning recently when they visited the M.O. Valve Co.'s works at Hammersmith, where they were enabled to see

"Osram" valves in process of manufacture. Over fifty members were present, representing the following societies:—

Golders Green and Hendon.
Hounslow.
Inland Revenue.
Lyons.
Muswell Hill.
Tottenham.
Wembley.

Very capable guides escorted the party over the works. The cleanliness, airiness, and lighting of the factory impressed everyone, as did the ingenuity displayed in the design of the various labour-saving machines.

Space forbids a full description of all that was seen, but several features deserve special mention.

Great interest was aroused by the spectacle of the tungsten powder being pressed into blocks and finally being drawn out into lengths of various diameters. The highly important process of exhaustion was carried out in progressive stages by means of a mercury pump and gas oven. The stage of exhaustion obtained, however, was not sufficient, so a piece of magnesium which had previously been attached to an electrode was volatilised by means of a coil carrying a high frequency current placed round the valve. This produced eddy currents in the metal electrodes, raising them to a very high temperature. The vapour produced removed any gas still left and condensed on the glass wall of the valve, producing the silvery effect noticeable in dull-emitter valves.

THREE MEN IN A BOAT. The Tottenham Wireless Society spent a highly successful field day on Sunday, May 15th, when wireless telephonic communication was maintained between a car station, a boat station and a fixed station near Hoddesdon. The photographs show the boat station 5TT.

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False Economy.

An exceedingly interesting demonstration was afforded to one of the parties, consisting of the "sealing-in" of one of the largest rectifying valves, viz., the CAR.4, an enormous cooled anode valve of exceptional power.

Amongst so many labour-saving devices it appeared that much of the work now done by hand could be more economically accomplished by machinery. It was pointed out, however, that new and improved types of valve were so frequently designed that it was found to be an uneconomical proposition to erect special machinery for certain classes of work. Every individual valve is carefully tested; it was then given a serial number, stamped, and put into its box and sealed. These processes are all done by hand so that the possibility of any damage after test is reduced to a minimum.

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Loewe Valve Set Demonstrated.

At a meeting of the Golders Green and Hendon Radio Society held on May 5th, Mr. D. F. Scanlan, B.A., demonstrated one of the Loewe multiple valves. This contained three complete valve systems, viz., detector and two resistance-coupled amplifier stages. The filament voltage was 4, and the total filament current 0.3 amps., while the anode current was 2-3 milliamps. The valve was used on a set of Mr. Scanlan's own construction. As practically all the connections are inside the valve the set was very simple and compact, consisting of a coil holder and leads for L.T. and H.T. No reaction was employed, and the aerial system was semi-aperiodic. The valve gave ample loud-speaker volume with excellent quality.

At the same meeting Mr. W. J. T. Crewe exhibited an interesting five-valve Henderson portable set with two stages of H.F. The frame aerial, wound round a small "Celestion" loud-speaker, was very efficient.

Hon. Secretary: Lt.-Col. H. A. Scarlett, 357a, Finchley Road, N.W.3.

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L.F. Transformers.

At the last meeting of the Wireless Society of Ireland held at 12, Trinity Street, Dublin, Mr. R. Garside, of Messrs. Ferranti, Ltd., gave an instructive lecture and demonstration of the amplification of speech and musical sounds, utilising transformer coupling. The lecturer dealt with his subject in a practical manner and carried out a number of interesting tests with special sets of transformers in the reception of 2RN.

Hon. Secretary: Mr. H. Hodgens.

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The Winning Lecture.

The last meeting of the Tottenham Wireless Society was mainly devoted to a discussion of the field days which the society will hold this summer.

It was announced that the cup presented by the president, Prof. A. M. Low, for the best lecture given by a member during the past winter session had been won for the second time by Mr. R. F. G. Holness. The result was arrived at by means of a ballot taken at each meeting.

Hon. Secretary: Mr. A. G. Tucker, 42, Drayton Road, Tottenham, N.17.

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Radio Society of Great Britain.

The Incorporated Radio Society of Great Britain will hold an ordinary meeting this evening (Wednesday) at 6 p.m. (tea at 5.30) at the Institution of Electrical Engineers. The lecturer will be Mr. G. G. Blake, M.I.E.E., who will take as his subject: "The Hot Wire Microphone and Audio Resonant Selection." A number of original experiments will be performed.

FORTHCOMING EVENTS.

WEDNESDAY, MAY 25th.

Radio Society of Great Britain.—Ordinary meeting. At 6 p.m. Tea at 5.30. At the Institution of Electrical Engineers, Savoy Place, W.C.2. Lecture: "The Hot Wire Microphone and Audio Resonant Selection" (accompanied by original experiments), by Mr. G. G. Blake, M.I.E.E.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove. Lecture: "Wireless and the Eclipse," by Mr. E. S. Usher.

Institute of Wireless Technology.—Annual general meeting. At 7 p.m. At 71, Kingsway, W.C.2. (Members and Associate Members only.)

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration by Mr. P. K. Turner (Chief of Research Department, Messrs. Burndept, Ltd.) on "Modern Broadcast Receivers."

THURSDAY, JUNE 2nd.

Golders Green and Hendon Radio Society.—At 8 p.m. At the Club House, Willifield Way, N.W.11. Exhibition of Members' Apparatus.

CURRENT TOPICS

News of the Week in Brief Review

U.S. TRANSMISSIONS FOR BRITISH AMATEURS.

In order to enable British amateurs to hear American short-wave transmissions early in the evening the General Electric Co. of Schenectady has arranged a special schedule of regular transmissions on 22 metres from 2NAD every Tuesday from 4 to 5 p.m. E.S.T., *i.e.*, 10 to 11 p.m. B.S.T.

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AN ILLICIT AERIAL.

Residents in the Irish Free State are confronted with an unpleasant restriction, judging from the experience of Mrs. Bridget Garry, of Clontarf, who it is reported was fined 5s. and 2s. costs at the Dublin District Court last week for having an aerial erected without a licence.

This is rather like fining a man for not possessing a car licence when he owns a starting handle.

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TRACKING THE CANADIAN OSCILLATOR.

Canada appears to be emulating the example of the British Post Office in instituting anti-oscillation patrol vans. Government depots for the purpose are situated in Ottawa, Toronto, Winnipeg, Vancouver, Montreal and Halifax, and residents troubled with oscillating neighbours merely report the trouble to the nearest depot. The Government does the rest.

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AMATEURS IN COMMAND.

According to a report from the American Consul-General at Algiers, a local society of amateurs, the "Amicale of Radio Station P.T.T.," has been awarded the Government contract for the construction of a large broadcasting station.

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AMERICAN TELEVISION WAVEBAND.

The U.S. Federal Radio Commission has definitely assigned the wavelengths lying between 150 and 200 metres for television experiments, writes a New York correspondent. These wavelengths have been practically abandoned by American amateurs. Another announcement of some interest is the decision of the Commission to recognise the right of local authorities to regulate stations, prescribe hours, and prohibit the use of excessive power in congested districts.

MIRACULOUS WIRELESS.

"Wireless is the doctor who is curing us of our habit of incessant chattering."—Mary Glynne, *The Star*, Women's Page.

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WIRELESS AT SOUTH KENSINGTON.

The wireless section of the Science Museum at South Kensington now includes among its 200 exhibits the models of a broadcasting studio and a control room which were on view at the Ideal Home Exhibition.

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ESPERANTO BROADCASTING.

Following upon its meeting at Lausanne from May 11th to 13th, the Union Internationale de Radiophonie has decided to recommend that all broadcasting stations endeavour to arrange regular transmissions in Esperanto of from 10 to 15 minutes once a week.

Stations are to be asked to announce their identity in Esperanto at least once every evening.

TRANSATLANTIC TELEPHONY TIME EXTENSION.

The Transatlantic Telephone Service is now available from 12.30 p.m. to 11 p.m. (B.S.T.) daily, including Sundays. This extension of the hours of service should be of particular interest to American visitors to this country.

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KILL OR CURE BY CODE.

The practice among ships at sea of asking for medical aid from other vessels carrying doctors is becoming so common that an American concern is compiling a special code book for the purpose.

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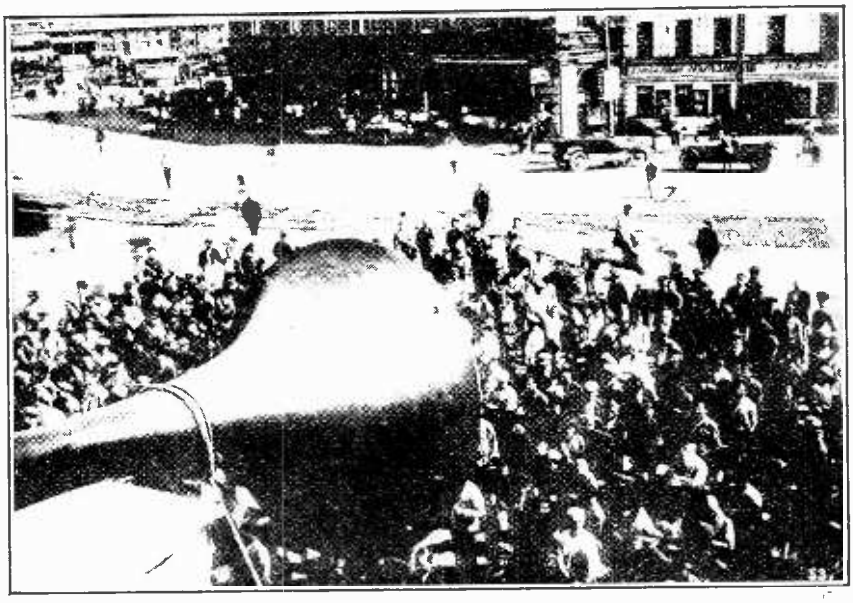
MUSIC WHEREVER SHE GOES.

A Marconi band repeater has been installed on the well-known liner *Otranto*. This equipment reproduces the music of the ship's orchestra through loud-speakers in various parts of the vessel. A small motor generator set, run from the ship's power supply, renders batteries and accumulators unnecessary.



THE OPEN-AIR "NEWSPAPER." Broadcast news bulletins have largely supplanted newspapers in Soviet Russia. This photograph, taken in a Moscow square, shows the crowd eager for the latest intelligence concerning the world's affairs.

ECONOMICAL BROADCASTING.

At Poynette, Wisconsin, the local broadcasting station derives its power from two windmills, which charge the accumulators operating the transmitter.

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TELEPHONY TO CANADA?

In the near future the province of Manitoba may be linked up with the transatlantic telephony system, according to the commissioner of the telephone system in Winnipeg.

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BOMBAY CALLING IN AUGUST.

The Indian Broadcasting Company hopes to provide the Bombay district with regular programmes early in August. Transmission will be for a minimum period of three hours daily.

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MOST NORTHERLY STATION?

What is stated to be the most northerly wireless station has been erected at Cape Desire, west of Archangel, by the Soviet Government. The station is intended for communication with aircraft.

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AIRSHIPS AND THUNDERSTORMS.

A radio weather map receiver of the Jenkins type, similar to that experimented with by the U.S. Navy last year on two of its ships, has been fitted aboard the American dirigible *Los Angeles*. It is expected that this provision will be effective in preventing a repetition of the disaster which destroyed the *Shenandoah*, which was wrecked in a thunderstorm.

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TRANSATLANTIC TELEPHONY RECEIVER.

The newly erected Post Office receiving station at Kemback, Fife, is now in frequent use as the receiver for transatlantic telephony. On enquiry at the General Post Office *The Wireless World* was informed that the Wroughton station is still in fairly regular use, but it is hoped that in the near future all traffic will pass through Kemback.

Owing to its northerly position the Fifeshire station gives superior reception over the Atlantic, especially when atmospheric conditions are bad.

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BROADCASTING FROM CANBERRA.

We regret that a paragraph entitled "Australia's Mystery Station," appearing on p. 633 of last week's issue, was likely to give a mistaken impression regarding the arrangements made by *The Daily News* in collaboration with the Broadcasting Company of Australia, for the short-wave reception in this country of the Duke of York's speech from Canberra on May 9th.

The Daily News received cabled information from Major Conder, of the Broadcasting Co. of Australia, that a transmission would be made on 33.4 metres; on this information the B.B.C. was approached and arrangements were made to attempt reception. That the transmission was a special one accounts for the fact that the 33.4 metre wavelength does not figure on official Australian lists at the present time.

NEW DUTCH BROADCASTING STATION.

Within three or four months Holland will own a new long-wave broadcasting station which will work on 1870 metres. The station will be owned by a limited liability company formed by the Netherlands Christain Society and the Catholic Radio Broadcasting Company. The station will be known as the "Nederlandsche Draadlooze Omroep." It is interesting to note that the station will be installed under the direction of an Englishman, Mr. G. W. White, who has been associated with Dutch broadcasting for many years.

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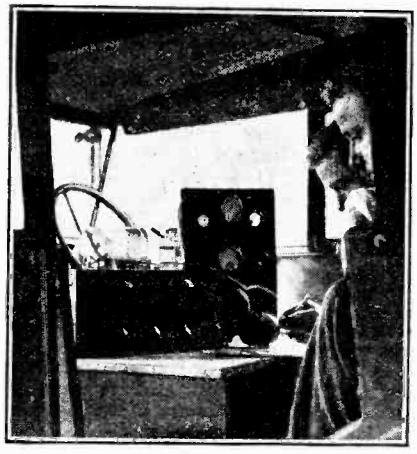
LOCAL NEWS BULLETINS.

Mr. Scrymgeour asked the Postmaster-General in the House of Commons last week whether he was aware that the broadcasting of the regular supply of



SHORT WAVES FROM A CAR. An amateur transmitter and receiver in use on a car in the northern suburbs of London.

local news in the respective districts of the country had been discontinued, to the disappointment of listeners; and whether he would in such circumstances make representations to the Broadcasting Corporation in support of the appeals that were being made for the renewal of the localised news service.

Sir William Mitchell-Thomson said that this was a matter within the responsibility of the British Broadcasting Corporation, which, he had no doubt, would consider any representations on the subject.

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TECHNOLOGY RESEARCH SCHOLARSHIP.

A limited number of Research Scholarships in Technology are being offered by the governing body of the Manchester Municipal College of Technology (University of Manchester). The scholarships, which will not exceed £100 each in value, will be tenable during the session 1927-28 in the College. Among the departments in which research may be undertaken are Electrical Engineering, Mechanical Engineering, Applied Chemistry and Textile Industries.

TRADE NOTES.

R. I. and Varley, Ltd.

Last week we referred to the important amalgamation of Messrs. R.I., Ltd., and the wireless section of Messrs. The Varley Magnet Company. In this connection readers will be interested to note that R.I. and Varley, Ltd., as the new company is called, combines the resources of the two firms in the manufacture of *all* classes of components hitherto produced separately. These include, among others, anode resistances and H.F. chokes, H.T. eliminators, besides L.F. amplifiers—both transformer and resistance capacity coupled.

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American Radio Gear.

Bearing the alluring title "A Buried Billion at Your Doorstep," the new 1927 catalogue and circuit supplement issued by the Rothermel Radio Corporation of Great Britain, Ltd. (24-26, Maddox Street, Regent Street, London, W.1) contains a mine of useful information for those who seek to keep in touch with the progress made in American component design. The catalogue, which is well illustrated, covers a number of the principal American lines and deals with constructional kits, transformers, condensers and other indispensable components. An interesting article is included on "How and Why the Infradyne Works." The catalogue is supplied to dealers free of charge, but a nominal charge of 9d. is made to amateurs.

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New Address.

We learn that the Walter R. Bottomley Private Telephone Co., which undertakes all classes of radio work, is now installed at the Providence Electrical Works, Luck Lane, Marsh, Huddersfield.

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General Radio Co.'s New Showrooms.

On May 10th the General Radio Co. opened their new Radio Display and Demonstration Rooms at 105, Regent Street, London, W.1. An interesting feature of the new headquarters is the "Dome Room," where school and public hall radio reception conditions are demonstrated. In addition luxurious private demonstration rooms are provided.

An entirely separate section is devoted to supplying the needs of the amateur and the man who makes his own set. Specially designed testing equipment provides a visual or oral indication of the quality of any components in which the visitor is interested.

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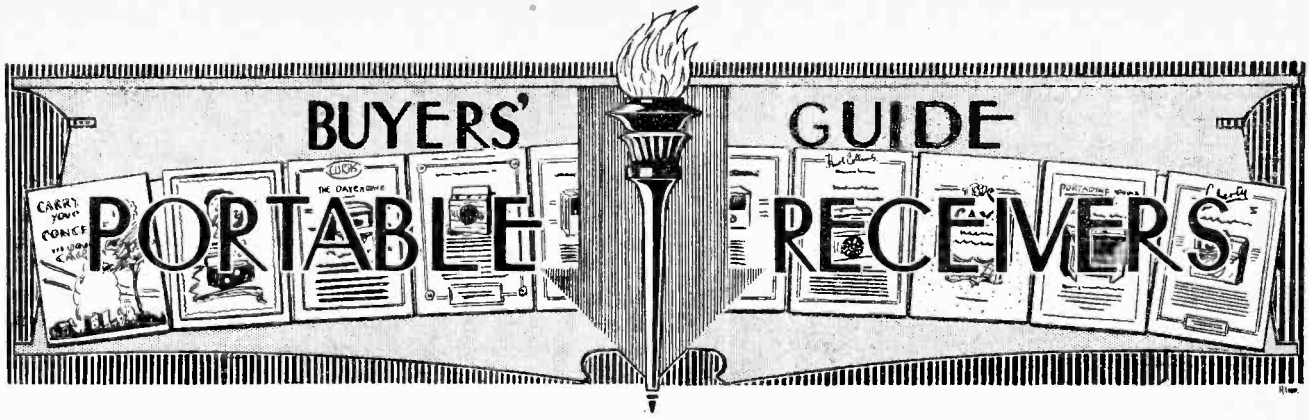
The Brown Budget.

A special "Overseas Number" of the Brown Budget has just been issued by Messrs. S. G. Brown, Ltd., North Acton. Special articles are included dealing with the radio markets in different countries throughout the world, and they serve to show that the "Brown" loud-speaker has made its influence felt over a large portion of the globe.



Brief Specifications of this Season's Portables.

Big-Ben.

A SIX-VALVE superheterodyne incorporating three intermediate H.F. amplifiers and a single L.F. stage. The first valve is a combined detector and oscillator, the associated tuning circuit covering the wave-bands 30 to 600 and 1,000 to 2,000 metres by means of interchangeable units. The frame aerial is enclosed in the lid of the case, together with a Celestion loud-speaker, and a break jack is provided to permit of the use of head telephones. The batteries are contained in a separate case and connected by a multi-lead cable fitted with a plug-in connector. Price £35.*

Stockall, Marples and Co. (1912), Ltd., 6-10, Clerkenwell Road, London, E.C.1.

Brunswick.

Five 2-volt valves are used to give two stages of H.F. amplification, valve detection, and two L.F. stages. The self-contained loud-speaker is an Amplion Radiolux. Filament heating is provided from a 2-volt 30 ampere hour accumulator, and the H.T. battery is a 108-volt Ever Ready. A frame aerial is enclosed in the cabinet, which is of mahogany. Price £28 2s. 6d.

M. Foster and Co., 64, Brunswick Street West, Hove, Sussex.

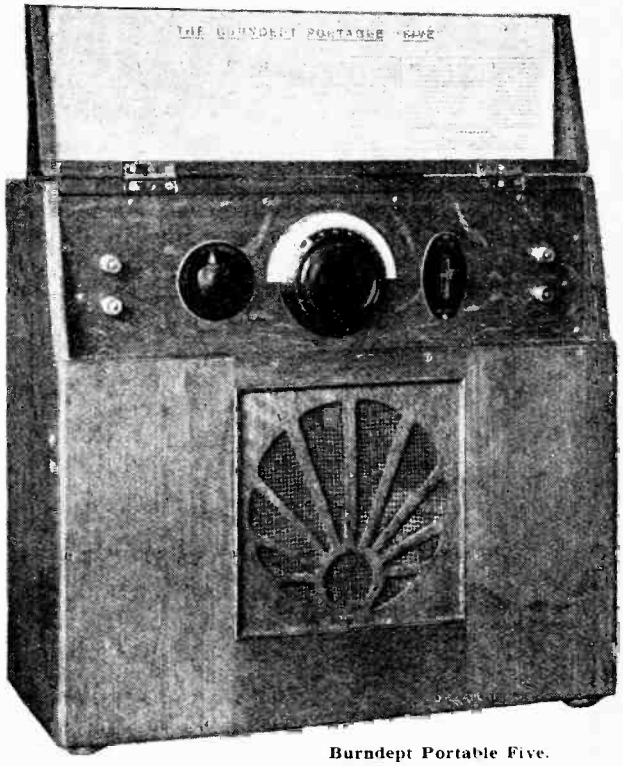
B.T.H. Superheterodyne.

The circuit arrangement consists of three valves arranged as a superheterodyne. Reception is intended on head telephones. The manufacturers state that the range of reception is 30 to 40 miles from a main broadcasting station and approximately 100 from Daventry. A self-contained frame aerial is provided, though by means of a coupling coil connections can be made to an ordinary aerial and earth system. A compass is mounted on the top of the case to facilitate the determination of the best directional position for reception from any particular station. The standard receiver is finished in leather cloth and measures 13in. by 16in. by 6in. The weight is 23 lb. Price, including one set of head telephones, £20.

B.T.H. Portable Amplifier and Loud-speaker.

Although designed as a companion for the B.T.H. portable receiver, this loud-speaker amplifier is useful with other sets which are normally intended to give reception on head telephones only. It is a two-valve transformer-coupled amplifier, the loud-speaker opening being immediately above the control panel. The outfit weighs 27 lb. and measures 15in. by 14in. by 8in. Price £10.

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.



Burndept Portable Five.

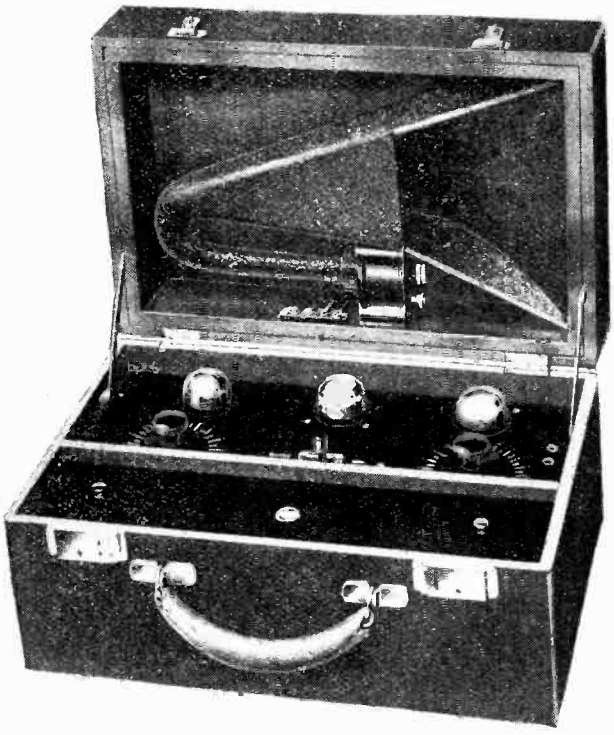
Burndept.

A five-valve set, including two high-frequency stages tunable over the wave ranges 250 to 550 metres and 1,000 to 2,600 metres, change of wavelength being effected by

* Prices, unless otherwise stated, include loud-speaker (or head telephones), valves, batteries and patent royalties.

Buyers' Guide : Portable Receivers.—

a three-position switch which in the central position switches off the set. The coiled horn of the loud-speaker is of papier mache and measures no less than



C.A.V. Three-valve Portable.

3ft. in length. Separate output terminals are provided so that an external loud-speaker can be fitted if required. Terminals also provided for the use of a mains unit or batteries. The tuning panel is under a hinged cover and

The Davenset for Daventry reception with telephones

immediately over the loud-speaker. Dimensions, 18in by 16½in. by 8in Weight, 40 lb. Price £30.

Burndept Wireless, Ltd., Eastnor House, Blackheath, London, S.E.3.

Cantophone.

The four-valve portable which is fitted with a frame aerial is built in an attache case measuring 16in. by 6in. by 11in. A high-frequency amplifying stage is provided, and the tuning dials are marked with actual station call signs. A self-contained loud-speaker is fitted, and within the case also is a 102-volt high-tension battery and a 2-volt 20 ampere hour unspillable accumulator. Weight, 20 lb. Price £26 5s.

The Cantophone Wireless Co., Remo House, 310-312, Regent Street, London, W.1.

The Davendyne Five-valve set by Peter Curtis, Ltd.

C.A.V.

Three valves are used, one of the stages being reflexed. The receiver, together with H.T. and L.T. batteries, is housed in the lower part of the case, the batteries being covered by a removable panel. The lid carries the frame aerial and loud-speaker. The valves are set up in special holders to guard against microphonic effects and mechanical shock. The cabinet is finished in maroon or black morocco. Dimensions, 16½in. by 11in. by 3in. Weight, 26 lb. Price £21 17s. 6d.

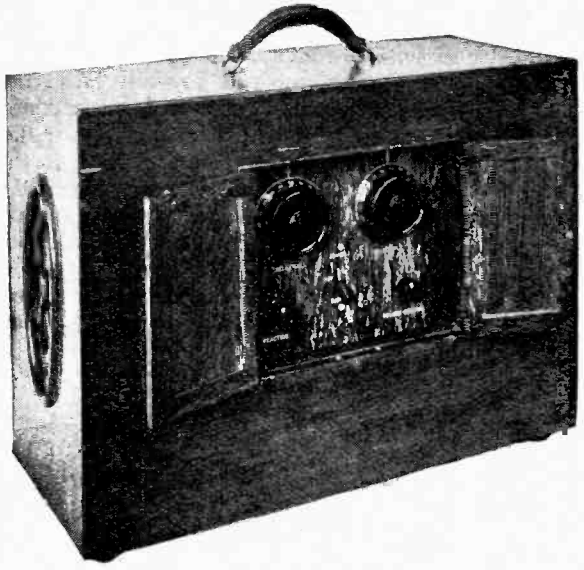
C. A. Vandervell and Co., Ltd., Acton Vale, London, W.3.

Celestaphone.

The five-valve model is fitted with a single high-frequency amplifying stage and three resistance-coupled L.F. stages. There are two tuning controls, and an easy

Buyer's' Guide : Portable Receivers.—

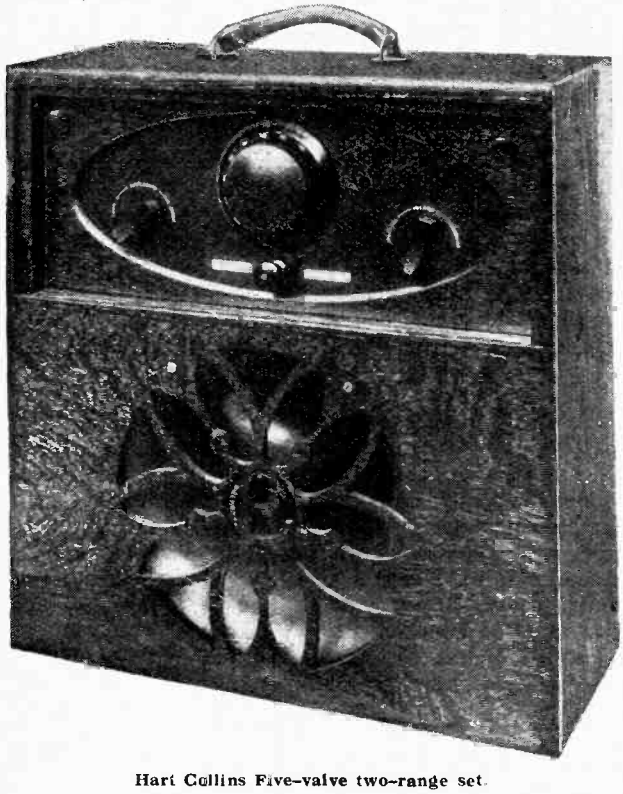
change-over is provided from the local station wavelength to Daventry. Three aerial terminals are arranged so that the set can be used with an improvised elevated



The Gecophone Seven-valve Superheterodyne.

aerial. Supplied in an oiled mahogany or rexine-covered cabinet, as well as in an aluminium container. The loud-speaker, which is included among the accessories, is external to the set. Price £45 10s.

Denison Bros., Stonecliffe Works, Wakefield Gate, Halifax, Yorks.



Hart Collins Five-valve two-range set.

Celestion.

This four-valve set includes a high-frequency amplifier and makes use of 2-volt valves working from a non-spillable accumulator of 25 ampere hours capacity and a 108-volt H.T. battery. The H.F. stage is neutralised, and no intentional reaction is introduced. The L.F. stages are resistance-coupled, and a Celestion loud-speaker, as well as frame aerial, are included in the cabinet. Two tuning ranges are provided for local station and Daventry. The control panel carries the tuning dials of the two condensers, master rheostat, and on-and-off switch. Price £39.

Celestion Radio Co., 29, High Street, Hampton Wick, Kingston-on-Thames.

Halcyon Five-valve Portable.

Chakophone Super.

A superheterodyne circuit is employed with eight valves. Three intermediate H.F. amplifying stages are provided, together with a two-valve L.F. amplifier. Wave ranges covered are 280 to 540 metres and 1,400 to 1,800 metres. The set is calibrated on actual station settings, and the readings recorded on a chart. Plug-in oscillator and tuning units are used for covering the two wave ranges. The tuning controls are carried on a recessed panel at one end of the cabinet and covered by a lid. The frame is hinged to the cabinet, and when swung open reveals the diaphragm of a hornless loud-speaker. One charge of the accumulator gives twenty hours' con-

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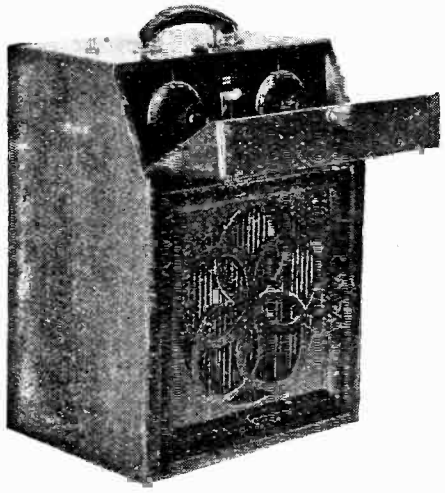
tinuous use, and the 90-volt H.T. battery has an estimated life of two to three months. A 9-volt grid bias battery is fitted. The manufacturers state that practically all European stations can be tuned in on the loud-speaker. A small voltmeter is enclosed in the cabinet for testing the batteries. Dimensions, 22in. by 16in. by 8¾in. Weight, 40 lb. Price £56.

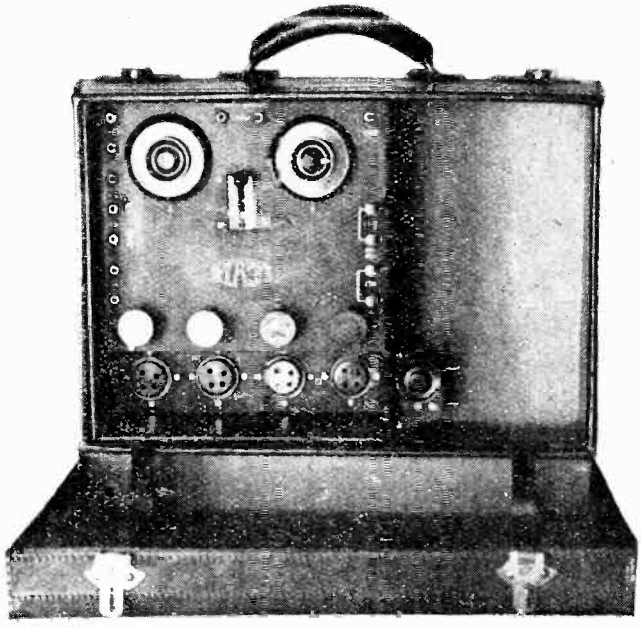


Henderson Five-valve Portable.

Chakophone Five-valve.

The circuit arrangement incorporates two H.F. stages, valve detector, and two L.F. stages. Essentially a local station loud-speaker set, or if Daventry reception is required frame and H.F. transformers can be changed, being fitted with pin mounts. Contained in a dull polished walnut cabinet with canvas cover. Price, including all necessary equipment, £28.

The Eagle Engineering Co., Ltd., Eagle Works, Warwick.

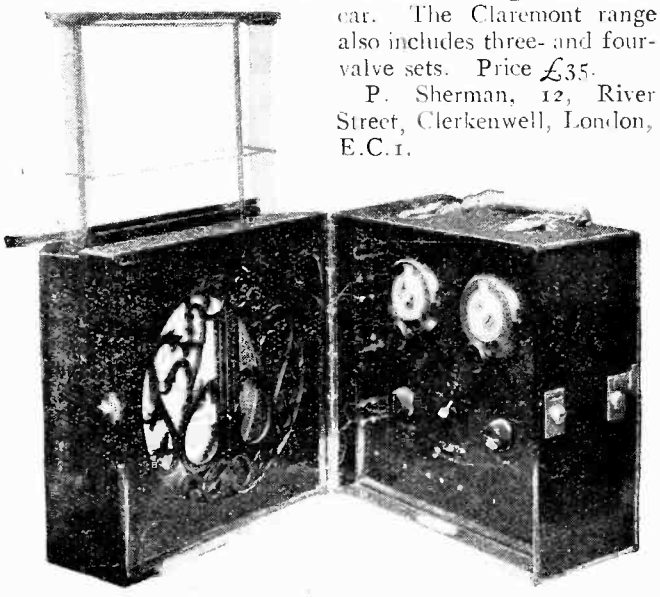


The Levis Four-valve Portable.

Claremont Five.

A five-valve set with two H.F. amplifying stages working from a 2-volt accumulator and 120-volt H.T. battery. The controls, which are illuminated, are mounted on a metal panel. Self-contained loud-speaker is supplied with portable aerial. Shock absorbers are fitted so that the set can be accommodated on the running board of a car. The Claremont range also includes three- and four-valve sets. Price £35.

P. Sherman, 12, River Street, Clerkenwell, London, E.C.1.



M.P.A. Five-valve Portable with cone loud-speaker and elevated frame aerial.

Claude Lyons Portable.

This compact long-range receiver measures 24in. by 5½in. by 7½in. and weighs only 12 lb. It is built as a complete receiver, and for use as a portable it is housed in a separate carrying case with a collapsible aerial having 24in. sides. Space is provided for one pair of telephones, and a small loud-speaker is fitted. The tuning range is 50 to 2,500 metres.

Claude Lyons, 76, Old Hall Street, Liverpool.

C.W.C.

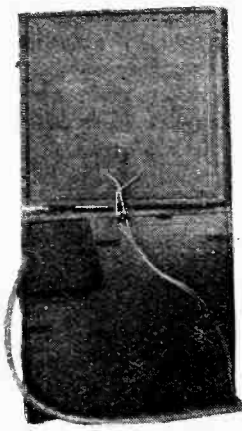
Three L.F. stages are provided in this set, in addition to H.F. and detector valves. Both frame aerial and loud-speaker are included in the oak case, together with a Columbia super H.T. battery and 2-volt 30 ampere hour accumulator. A jack is provided for using an external loud-speaker, as well as a terminal for making connection to an elevated aerial. Plug-in H.F. transformers cover the wave bands 300 to 600 metres and 1,100 to 2,100 metres. Price £28 10s.

Cook's Wireless Co., Ltd., C.W.C. Works, 23, St. Helen's Street, Ipswich, Suffolk.

Davendyne.

A five-valve receiver making use of two high-frequency stages tuned for the reception of Daventry. No tuning

Buyers' Guide : Portable Receivers.—



dials appear on the operating panel, which accommodates a volume control. The frame, which is tuned by a variable condenser, is enclosed in the hinged back of the cabinet. Supplied with a 2-volt dry charged battery. The controls are revealed under a hinged cover at the top of the cabinet, beneath which is the loud-speaker. The cabinet is of polished oak. Price £31 10s.

Peter Curtis, Ltd., 11, Red Lion Square, London, W.C.1.

Ediswan Toovee.

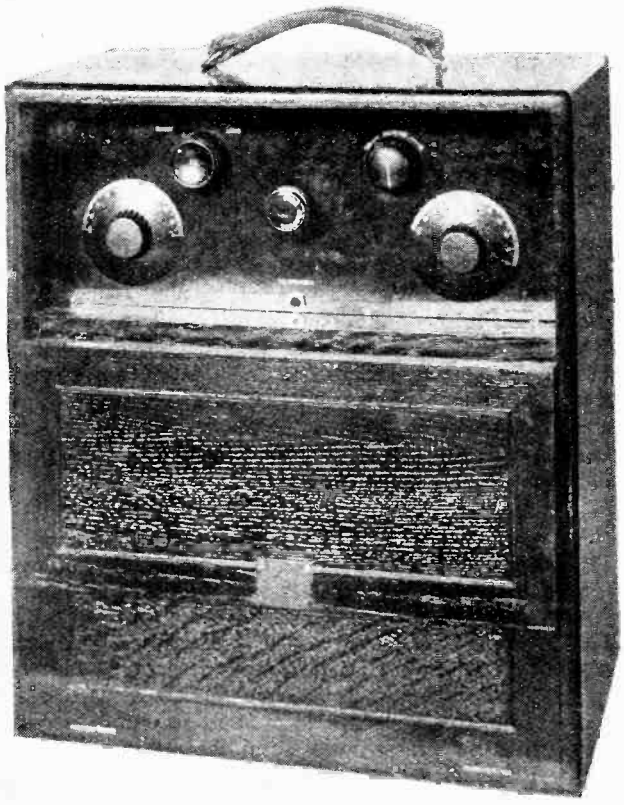
Two valves are used in a reflex circuit with valve detection. An aerial wire is supplied for suspending from a tree or other convenient point, and the equipment includes H.T. and L.T. batteries and two pairs of headphones. The case is of hard wood and covered with black leatherette. Price £11 5s., excluding valves.

Edison Swan Electric Co., Ltd., 122-125, Queen Victoria Street, London, E.C.4.

Eureka Orthodyne.

Two stages of high-frequency amplification are provided, with valve detector and two L.F. stages. The frame aerial and loud-speaker are self-contained, as well as the filament-heating accumulator, H.T. and grid-biasing batteries. Price £35.

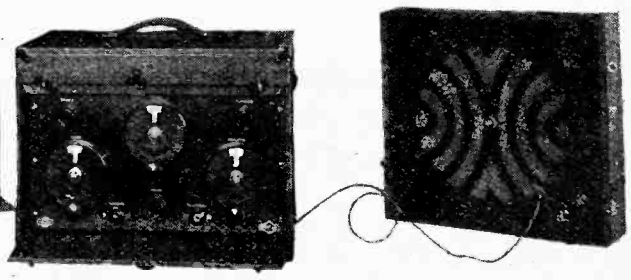
The Portable Utilities Co., Ltd., 8, Fisher Street, Holborn, London, W.C.1.



Nulli-Secundus Five-valve set. A cone loud-speaker is at the back.

Galloway.

A lightweight superheterodyne, batteries and loud-speaker being a separate unit. The circuit arrangement and general design are unique, inasmuch as that tuning is carried out on a single dial. Three intermediate H.F. amplifying valves are used, as well as two L.F. valves after the second detector, eight valves in all being fitted. The frame aerial is enclosed in what is normally the lid of the set, and is arranged to stand up vertically and swing about on its hinges. Dimensions, 19in. by 10in. by 8in. Price £39, exclusive of accessories and loud-speaker.



The Neutrosonic Seven of the Igranic Electric Co., Ltd.

J. and L. Galloway, Ltd., 38, Mair Street, Plantation, Glasgow, Scotland.

Gecophone.

A seven-valve superheterodyne, including batteries and loud-speaker and contained in a cabinet measuring 21in. by 9¼in. by 15in. Wave ranges of 250 to 650 metres and 800 to 2,800 metres are provided by means of a change-over switch which also serves as a "battery-off" key. The two tuning dials are recessed behind a double-door opening. The frame aerial is contained in a hinged door forming the rear part of the set, and with the self-contained loud-speaker arranged behind a grating no external connections of any kind are required. The cabinet is polished a medium dark oak. 6-volt Osram valves are employed, working from a 30 ampere hour accumulator and two 66-volt high-tension batteries. Price £50.

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

Gillan.

The apparatus is enclosed in a solid hide suit case and consists of a four-valve set incorporating one high-frequency stage. The equipment includes unspillable accumulator, internal frame with provision for external aerial connections, built-in loud-speaker with connecting points for external telephones or loud-speaker. Tunes to both local station and Daventry. Weight about 21 lb. Price £25.

Gillan Radio-Electric, Ltd., 63-64, High Holborn, London, W.C.1.

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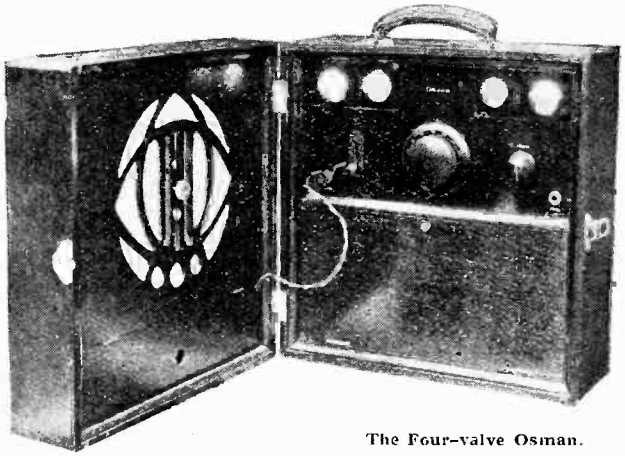
Halcyon.

A five-valve arrangement is adopted, comprising two H.F. stages, one of which is untuned, followed by a valve detector and two transformer-coupled L.F. stages. The operating panel is behind a hinged cover immediately over the loud-speaker opening. Filament current is supplied by a 2-volt 40 ampere hour non-spillable accumulator. A 99-volt high-tension and 9-volt grid battery are provided. Dimensions, 18in. by 14in. by 8in. When the receiver is in operation a red pilot lamp glows on the panel. Price £35.

Halcyon Wireless Supply Co., Ltd., 110, Knightsbridge, London, S.W.1.

Hart-Collins.

A five-valve set complete with loud-speaker is housed in a carrying case measuring 16in. by 16½in. by 6½in., weighing about 30 lb. when fitted with batteries. The change-over switch gives the wave ranges of 300 to 500 metres and 900 to 3,000 metres. As well as the self-contained frame, provision is made for the use of



The Four-valve Osman.

a conventional aerial; 2-volt valves are employed. The set is operated with a single tuning dial and is provided with a volume control. Price £31 10s.

Hart Collins, Ltd., 38A, Bessborough Street, London, S.W.1.

Henderson.

Two high-frequency amplifying stages, followed by a valve detector and two L.F. stages, are used. The set is completely self-contained, including frame aerial and loud-speaker. The cabinet is of oak or mahogany. Price £30.

W. J. Henderson and Co., Ltd., 351, Fulham Road, London, S.W.10.

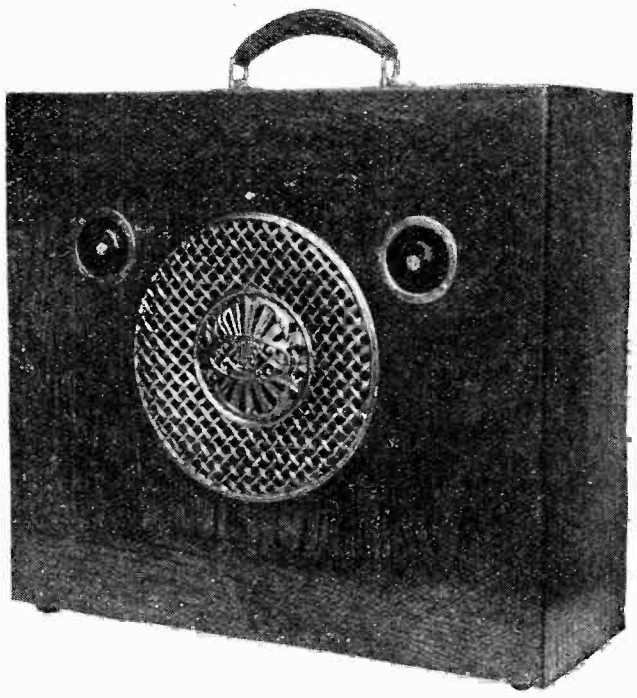
J. and P. (Mark II).

Four valves are used, giving one stage of high-frequency amplification operating from a 2-volt accumulator and 108-volt Ever Ready high-tension battery. The cabinet is of walnut or oak, and fitted with a built-in frame aerial. Tuning range, 250 to 550 metres. Price £20.

J. and P. Manufacturing Co., 50-54, King Street, Cambridge.

Levis.

A four-valve receiver incorporating a tuned high-frequency amplifier. The set is mounted in a leather attaché case with a separate compartment for batteries. Plug-in coils are used for tuning to cover all wavelengths. Dimensions, 11in. by 10in. by 5½in. Intended



The P.D. Five of Automobile Accessories (Bristol), Ltd.

for use with a small temporary elevated aerial. Price £21 10s., exclusive of valves and batteries.

Butterfields, Ltd., Albert Road, Stechford, Birmingham.

Langham.

A four-valve set incorporating two high-frequency amplifying stages. Filament current is obtained from a 2-volt non-spillable 25 ampere hour accumulator, and the high-tension battery is an Ever Ready giving 84 volts. The frame aerial is enclosed in the lid, and the entire equipment, which includes loud-speaker, is housed in a leather attache case. Price £31 10s.

Langham Radio, 9-11, Albion House, New Oxford Street, London, W.C.1.

Liberty.

The circuit arrangement is a superheterodyne employing eight valves. The aerial is self-contained, together with a cone loud-speaker and H.T. and rechargeable L.T. batteries. The wave range is from 200 to 2,000 metres, the necessary circuit changes being effected by a two-position change-wave switch. Dimensions, 20in. by 20in. by 7in. A compass is fitted to assist in correctly setting the frame aerial, and the receiver is calibrated. Price £35.

Radi-Arc Electrical Co., Ltd., Bennett Street, Chiswick, London, W.4.

Buyers' Guide: Portable Receivers.—

Merritone.

The four-valve model consists of a valve detector, followed by three low-frequency stages. A polished case encloses a built-in frame aerial, loud-speaker, 2-volt accumulator, and 108-volt H.T. battery. Price £16 15s.

Merritone Radio Supplies, 35, Bownes Road, Catford, London, S.E.6.

M.P.A.

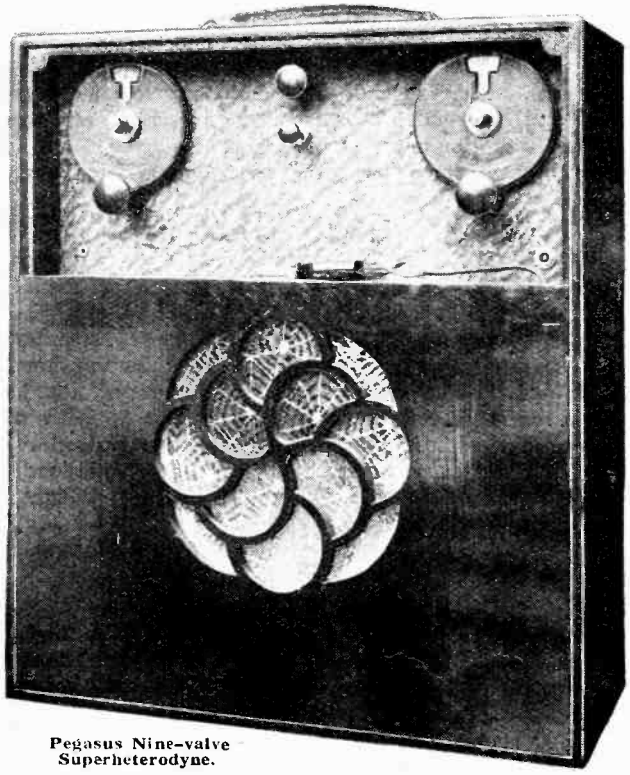
The circuit arrangement consists of two H.F. stages, one of which is tuned, a detector valve with magnetic reaction on the tuned H.F. intervalve coupling and followed by two transformer-coupled L.F. stages. A potentiometer is fitted, together with a volume control and push-pull change-over switch for long or short wave reception. The frame is loaded by means of a plug-in coil. Provision is made for an external aerial and earth. The H.T. battery is a 72-volt unit and the 2-volt L.T. accumulator has a capacity of 20 ampere hours. The grid bias is a 4½-volt battery. The hinged lid carries an M.P.A. sprung diaphragm loud-speaker behind a grill and an extending frame aerial supported on rods. Dimensions, 14½in. by 14½in. by 11in. Weight, 32 lb. Price £33 12s.

M.P.A. Wireless, 62, Conduit Street, London, W.1.

Neophone.

Two valves are used in combination with a crystal detector in a reflex circuit. A frame aerial is contained in the lid of the set. The equipment includes loud-speaker unit and wooden horn. Dimensions, 15in. by 15in. by 9in. Price, in birchwood case, £6, exclusive of valves and batteries.

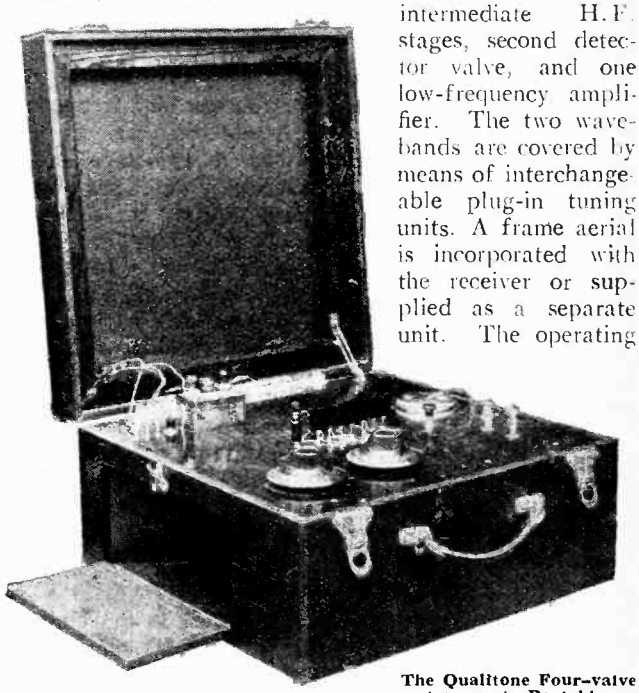
Neophone Radio Manufacturing Co., 9 and 10, Little Saint Andrew Street, St. Martin's Lane, London, W.C.2.



Pegasus Nine-valve Superheterodyne.

Neutrosonic Seven.

A superheterodyne receiver consisting of a high-frequency amplifier, oscillator valve, first detector, two intermediate H.F. stages, second detector valve, and one low-frequency amplifier. The two wave-bands are covered by means of interchangeable plug-in tuning units. A frame aerial is incorporated with the receiver or supplied as a separate unit. The operating panel carries the three tuning condensers, a balancing condenser for the H.F. stage, volume control, filament switch, filament rheostat, and output jack. The receiver, which is finished in black leatherette, measures 16¾in. by 12in. by 10½in. and weighs approximately 24 lb. Batteries are in a separate box measuring 14¾in. by 13¾in. by 9in. Price £66 17s. 6d.



The Qualitone Four-valve two-range Portable.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, London. E.C.4.

Nulli-Secundus.

The set is contained in an oak cabinet measuring 15½in. by 18in. by 10½in., and weighs approximately 40 lb. Two H.F. stages are provided, though only one is tuned, so that two tuning dials are needed, one of which tunes the frame aerial. The small knob in the centre of the operating panel is a fine-tuning control and the main controls have no slow-motion adjustment. Reception on long and short wavelengths is obtained by means of a change-over switch, while a master rheostat serves as an on-and-off switch. A valve detector is employed, followed by two L.F. stages. The batteries consist of a 99-volt H.T. unit, grid bias battery, and a 2-volt non-spillable accumulator. The enclosed loud-speaker is of the cone type. Price £33 2s. 6d.

C. Creswick Atkinson, 48, Kimbolton Road, Bedford.

Osman IV.

Local and Daventry reception is obtained by means of a change-over switch. Four valves are used with one dial tuning. A Celestion loud-speaker and frame aerial are enclosed in the hinged lid. A volume control is fitted. The 2-volt valves derive filament current from a 30

Buyers' Guide : Portable Receivers.—

ampere hour accumulator, and the H.T. battery is a 99-volt Hellesen used with a 4½-volt grid battery. Dimensions, 16in. by 16in. by 9in. Price £35.

Osman Radio Co., 27-28, Harcourt Street, Marylebone, London, W.1.

Oxford.

Five valves are arranged either as one high-frequency stage, valve detector, and three low-frequency stages, or, in an alternative model, as a two-stage high-frequency amplifier, valve detector, and two low-frequency stages. The frame aerial is enclosed in the door of the set, and the Amplion type A.R.61 loud-speaker is built into the cabinet. Provision is made for the use of an external loud-speaker or telephones, and connecting points are available so that the set can be used with an elevated aerial. Filament current is obtained from a 2-volt unspillable accumulator in celluloid case, and the H.T. battery is a 99-volt Hellesen. The frame aerial is wound in three sections, which, by means of a switch, is suitably connected for either long- or short-wave reception. Dimensions, 15in. by 17in. by 9in. Price £37 10s.

Oxford Wireless Telephony Co., Ltd., Titmouse Lane, Oxford.

The P.D. Five (Mark 18).

Designed to receive Daventry anywhere in the United Kingdom. Although fitted with H.T., L.T., and grid-biasing batteries, provision is made for connecting up external batteries when used as a home portable, connection being made by means of a ten-way cable and connector. Provision is also made for using an elevated aerial. Five valves are used. An unusual feature is the absence of a tuning panel. The cabinet is protected by a waterproof covering, a flap being provided to expose the grille of an Amplion loud-speaker. Size of cabinet, 17in. by 18½in. by 7in. Price £30 12s. 6d.

Automobile Accessories (Bristol), Ltd., 93, Victoria Street, Bristol.

Pegasus.

A superheterodyne circuit is employed, incorporating four intermediate high-frequency amplifying stages and three resistance-coupled amplifiers following the second detector valve, so that there are nine valves in all. The total filament current is about 1 ampere, and is supplied from a 2-volt 20 ampere hour accumulator. The H.T. battery potential is 160 volts, and the maximum grid biasing potential 18 volts. A push-pull switch is used to change over from short to long waves. The loud-speaker is contained within the cabinet. Dimensions, 19½in. by 16¾in. by 7in. Price £63.

A. G. Franklyn, 95, Woodhouse Lane, Leeds.

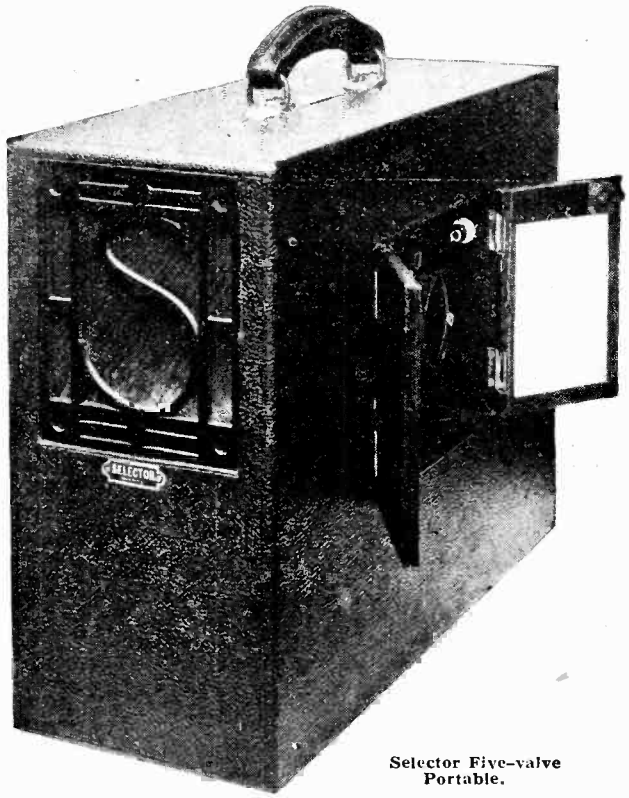
Pelican Five.

Five-valve portable, including two high-frequency stages with one dial tuning. The operating panel is behind double doors at one end of the cabinet, the flare of the loud-speaker being immediately below the panel. Price £40. One, two, and four-valve portable sets are included in the Pelican series, the four-valve set being provided with an A.C. mains battery eliminator supplying H.T., L.T., and grid biasing potentials.

Cahill and Co., Ltd., 63, Newman Street, W.1.

Portadyne Five.

A five-valve set with self-contained frame, batteries and loud-speaker. Two tuning ranges for local and Daventry reception. The operating panel and loud-speaker opening are covered by a pair of doors on the front of the cabinet. Tuning is effected by a single dial. The range of Portadyne receivers includes three- and four-valve sets, also a five-valve set for Daventry reception only. Price £35.



Selector Five-valve Portable.

Whittingham Smith and Co., 110, Kew Green, Kew, London.

Pye.

A five-valve receiver with two tuned high-frequency stages stabilised by neutralising. There are no actual tuning controls, one of the operating knobs serving as a fine-tuning adjustment. Designed to tune to Daventry only. A three-position switch serves as a battery key, as well as for taking one of the L.F. stages out of circuit. Volume control is provided. The set, which is enclosed in a polished walnut case, is entirely self-contained as regards all necessary batteries, frame aerial, and loud-speaker. Dimensions, 18in. by 16¾in. by 7in. Weight, 32 lb. Price £30 12s. 6d.

W. G. Pye and Co., "Granta" Works, Montague Road, Cambridge.

Qualitone.

Four-valve receiver, comprising a tuned high-frequency stage, valve detector, followed by two transformer-coupled L.F. stages, using Mullard valves throughout. The H.F. stage is stabilised by the use of a neutralising condenser, and detection is by leaky grid condenser. Tunes to both the local station

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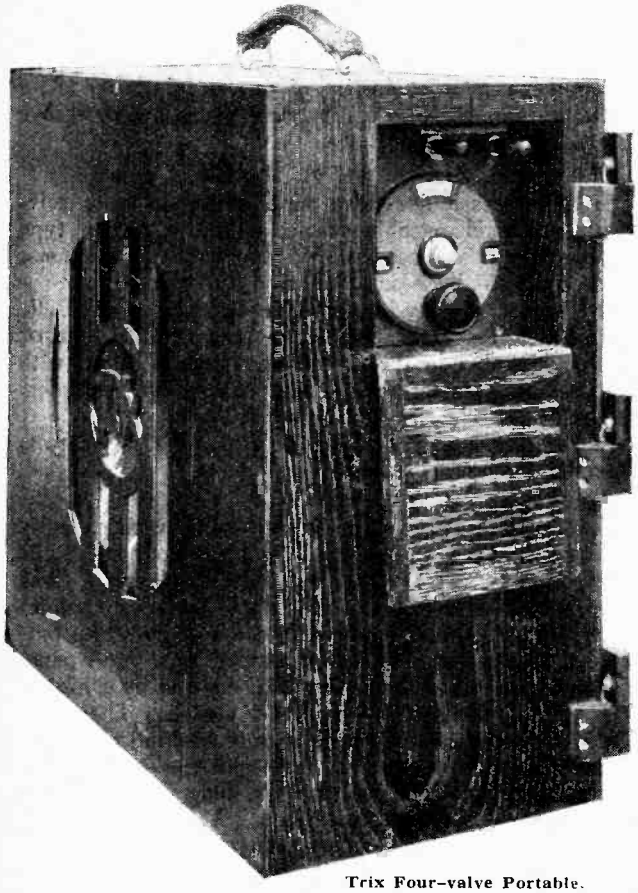
and Daventry, the wavelength change being effected by a strip of plug-in connectors. The H.T. battery is a Hellesen 99-volt, and grid bias is obtained from a 9-volt battery. A 2-volt Exide unspillable accumulator is used for filament heating. Can be used with an elevated aerial if desired, additional terminals being provided for this purpose. The last L.F. stage is optional and is



Trix Four-valve Portable.

taken out of circuit by means of a switch. The self-contained loud-speaker operates through an aperture on the side. Approximate weight, 28 lb. Dimensions, 15in. by 15in. by 7½in. Price £25.

B. and J. Wireless Co., 2, Athelstane Mews, Stroud Green Road, London, N.4.

Radiocraft Ideal.

A five-valve receiver consisting of two high-frequency stages, valve detector, and two L.F. stages using 2-volt P.M. valves. Filament current is supplied from a non-spillable accumulator, and the high-tension supply is a 60-volt Hellesen battery. The loud-speaker, which is detachable and can be used separately if desired, is a Crossley Musicone. A change-over switch gives reception either from the local station or Daventry. Price £25.

Radiocraft Supplies, Ltd., 9, The Arcade, Walsall.

Rayol Four.

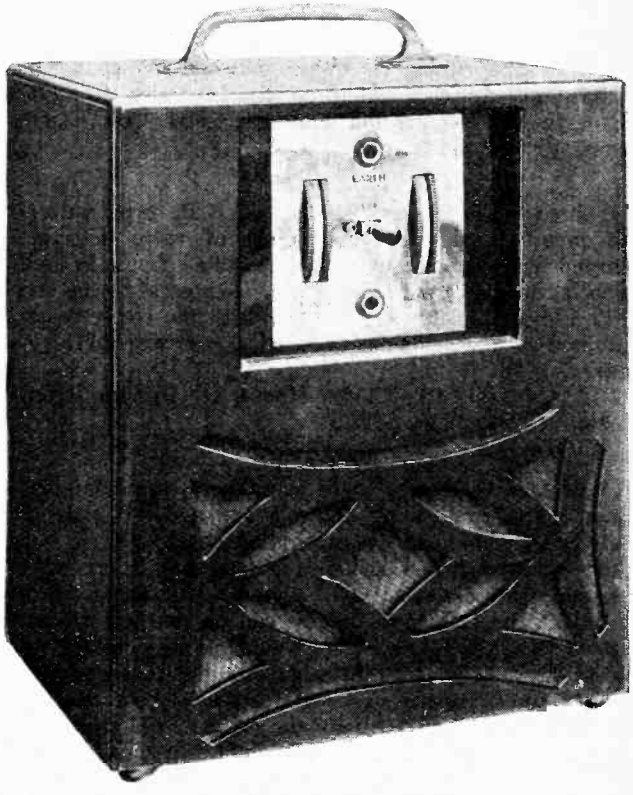
A high-frequency amplifier is provided, followed by detector valve and two L.F. stages. Tuning is carried out on two dials, and the change-over switch provides for local and Daventry reception. The frame aerial which is fitted around the lid is arranged on a pivot so that it can be rotated apart from the remainder of the receiving equipment. The loud-speaker, which is of the cone type, folds down flat against the tuning panel when the set is closed, and a hinged arm provides for readily bringing it into use when the lid is open. Terminals are provided for external loud-speaker, head telephones, and, when required, external aerial and earth. 2-volt valves are used operating from a non-spillable accumulator, and 82.5-volt H.T. battery. The case is covered with real hide. Price £32 10s.

Engineering Works (Electrical and General), Ltd., 7 and 8, Great Winchester Street, London, E.C.2.

Real.

The four valves are arranged as high-frequency amplifier, valve detector, and two low-frequency amplifiers. The set is complete with self-contained horn type loud-speaker, 2-volt valves, frame aerial, and batteries. The frame aerial is enclosed in the hinged lid, and a two-position switch provides for either local station or Daventry reception. The high-tension battery is 60 volts and is used with a grid bias battery of 4½ volts. Dimensions, 14in. by 13in. by 6½in. The single tuning control and change-over switch, together with the loud-speaker opening, are covered by a hinged door at one end of the case, which is of polished mahogany, leather, or "camera finish." Price £26 10s.

Read Radio, Ltd., 67, Newman Street, Oxford Street, London, W.1.



Truphonic Five-valve Portable.

Buyers' Guide : Portable Receivers.—

Rees-Mace.

The Super Four model comprises one high-frequency amplifying stage, valve detector, and two L.F stages. Transformer coupling is used in the L.F. amplifier. Self-contained frame aerial and cone type loud-speaker. Tunes to both local station and Daventry. Filament current is supplied by a 2-volt non-spillable accumulator. Dimensions, 18in by 17in. by 8in. Price £36 15s.

Rees, Mace Manufacturing Co., Ltd., 39A, Welbeck Street, London, W.1.

Rolls.

This set differs from the usual form of cabinet construction, the receiver and batteries being housed in an attache case the lid of which accommodates both frame and Celestion loud-speaker. Five valves are used, incorporating two H.F. stages, filament current being supplied from a non-spillable accumulator giving approximately fifty hours' working on each charge. Tunes to both Daventry and local station. Two controls are provided for tuning and reaction. A switch removes two of the valves from circuit. Dimensions, 14in. by 11½in. by 7in. Weight, 23 lb. Price £31 10s.

Hoare and Jagels, 28-29, Great Sutton Street, Clerkenwell, London, E.C.1.

Runnymede.

A five-valve self-contained set fitted with two high-frequency amplifying stages. Filament current from the 2-volt valves is supplied by a Certax non-spillable accumulator. The high-tension battery potential is 120 volts obtained from two 60-volt H.T. units. Liberal grid biasing is provided by an Ever Ready battery. The frame aerial is self-contained, together with the loud-speaker. The cabinet is either polished mahogany or can be supplied with a waterproof finish. Price £34 13s.

Runnymede Engineering and Electrical Co., Dacre House, Victoria Street, London, S.W.1.

Salient.

A three-valve set making use of S.P. type valves. The circuit arrangement makes use of valve detection followed by two L.F. stages. A portable frame is used which, as well as the loud-speaker, is external to the set. H.T. and L.T. batteries, together with the receiver, are contained in a despatch case. Price, exclusive of loud-speaker, £18.

S. A. Cutters, Ltd., Clutha House, 10, Princes Street, Westminster, London, S.W.1.

Selector.

The circuit is a supersonic heterodyne employing five valves. The two tuning controls are under a pair of small doors which carry a calibration chart. There is a volume control and a switch for long and short wave reception with a central off position. By means of a break jack the L.T. accumulator can be charged without removal from the set, while another jack provides for the use of head telephones in place of the loud-speaker, which is an Amplion unit with a short horn opening behind a grill at one end of the cabinet. Dimensions, 16¾in. by 12¾in. by 6¼in. Weight, 28 lb. Price £38 1/s.

Selectors, Ltd., 1, Dover Street, London, W.1.

Stratton.

Three valves are used, the circuit arrangement consisting of a Reinartz tuned frame, detector valve, resistance-coupled L.F. stage followed by a transformer-coupled stage. The double-wound frame, which is rotatable apart from the set, tunes to wavelengths of 250 to 600 metres. A grid bias up to 10 volts is provided, with an H.T. battery of 90 volts. The loud-speaker horn has a flare measuring 7in. by 5½in. Tuning controls are on the end panel, so that the receiver can be operated when closed. The wooden cabinet is covered with Rexine cloth and measures 16½in. by 16½in. by 7½in.

Stratton and Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.

Symphony Dual Range.

The circuit is a five-valve superheterodyne with self-contained interchangeable frame aerial. A cone type loud-speaker is enclosed within the set. Dimensions, 17⅞in. by 19in by 8¼in.

Five valves arranged to provide two stages of H.F. amplification for Daventry reception is another type of portable included in the Symphony range. Fitted with self-contained frame, cone loud-speaker, and batteries. Dimensions, 14⅜in. by 16in. by 8⅝in.

A. J Stevens and Co. (1914), Ltd., Walsall Street, Wolverhampton.

Trix.

The circuit consists of a detector valve with capacity reaction followed by three resistance-coupled L.F. stages, a power valve being used in the last stage. The batteries consist of a 2-volt 20 ampere hour accumulator and two 60-volt H.T. units with a 9-volt grid bias battery. The single tuning dial is carried on a small panel sunk into one end of the cabinet and covered by a hinged door which operates the on-and-off switch. The loud-speaker is an Edison-Bell cone mounted behind a grill on one side of the case, and on the opposite side is hinged the centre-tapped frame aerial. For long wave reception it is necessary to change the frame. A jack is provided for connecting head telephones or external loud-speaker. Dimensions, 18in. by 18in. by 9in. Price £20 7s.

Eric J. Lever, 33, Clerkenwell Green, London, E.C.1.

Truphonic.

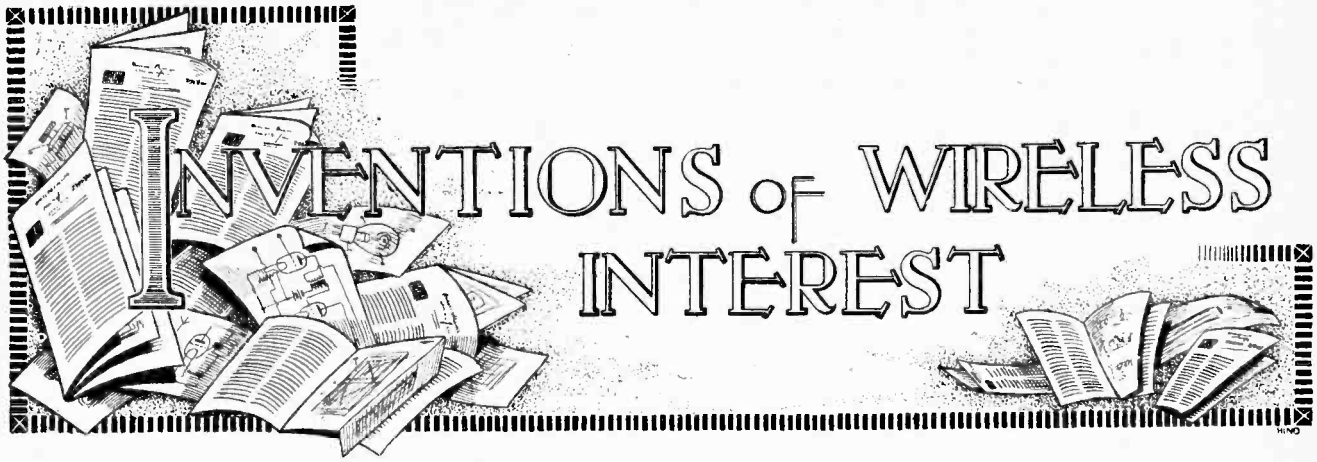
The tuning controls are mounted on a metal plate carrying edgewise-operated dials with loud-speaker opening immediately below. The receiver is a five-valve arrangement with frame aerial, plug and jack connectors being provided for making connection to an elevated aerial. The carrying handle can be removed to modify the set for home use. Dimensions, 11¼in. by 13in. by 8¼in.

The Truphonic Wireless Co., Triumph House, 189, Regent Street, London, W.1.

W.L.L.

This receiver, in which four valves are used, is designed for reception on the lower B.B.C. wave range. The equipment includes a self-contained aerial in the lid, grid bias and high-tension batteries, 2-volt accumulator, and loud-speaker. The containing case is of cowhide mounted on fibre. Dimensions, 14in. by 15in. by 5¾in. Weight, about 24 lb. Price £27.

Western Laboratories, Ltd., 11, Hanbury Road, Acton, London. W.3.

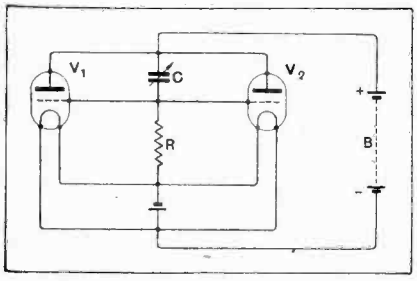


The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, Southampton Buildings, London, W.C.2, price 1s. each.

Short-wave Oscillator.
(No. 261,350.)

Confirmation date (Germany): Nov. 10th, 1925.

A very interesting form of short-wave oscillator is described by Dr. A. Esau in the above British patent. The accompanying diagram, which illustrates the invention, shows a pair of valves V_1 and V_2 with their anodes connected together and joined through a source of positive potential B to the filament. The two grids are also joined together and connected to the filament through a resistance R. The specification mentions that the wavelength of the oscillations can be still further shortened by connecting a condenser C between the two anodes and the two grids. The system functions by virtue of the provision of two similar oscillatory circuits constituted by the grid-anode capacity, the variable capacity, and the leads connecting the anode



Circuit diagram of short-wave oscillator. (No. 261,350.)

and grid to the condenser C. It is stated that an aerial system may be either directly or inductively coupled to the valves.

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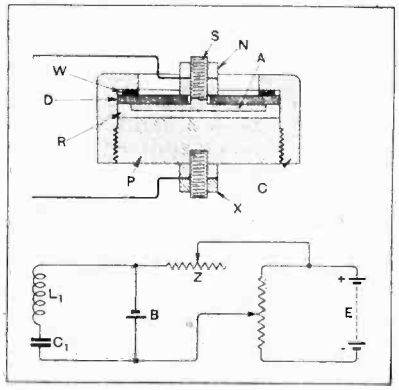
An Interesting Rectifier.
(No. 265,652.)

Application date: Oct. 9th, 1925.

A very interesting form of rectifier and device which can be used for other purposes is described in the above British patent by L. Levy. The rectifier is of the aluminium and sulphide contact variety. The invention will be best understood by referring to the sectional drawing of one form of construction. The rectifier consists of a copper or aluminium cup C provided with a screwed copper plug P



Contact rectifier and circuit used in generating oscillations. (No. 265,652.)

Inside the cup there is an insulating disc D of bakelite and attached to the disc D is an aluminium disc A located by means of a stud S and nuts N for the purpose of making connection. A similar connecting means is attached to the plug P and is shown at X. The space R between the two portions is filled with the rectifying compound, which is made in the following manner: Copper sulphide is first made by heating finely divided copper with sulphur, and the resulting sulphide is then ground in a mortar until the powdered grains have diameters of the order 0.2 mm. Any traces of metal are removed by sieving the grains. The granular powder is then made into a paste by mixing it with a liquid such as ammonium hydrosulphide. Before the rectifier is assembled the aluminium disc A has to be made perfectly clean and free from oxide, and this is accomplished by carefully polishing the disc. It is also very important to keep the device gastight. This is accomplished by including an annular washer W which prevents the gas which is liberated by the vaporisation of the liquid from escaping from the rectifier. The specification shows several familiar circuits in which the rectifier is included for supplying high- and low-tension current to a receiver. It states that high voltages are preferably obtained, not by connecting a number of cells in series, but by providing each cell with a separate transformer winding. Another use of the device is as an oscillator, since it exhibits a negative resistance characteristic. The diagram shows a suitable circuit, and is similar to an arc generator. Here a rectifier B is connected in shunt with a tuned circuit L_1, C_1, and is provided from a source of potential E through an impedance Z. In another modification the device can be used as an ordinary crystal detector in a wireless receiver, when a fine aluminium wire is used as one of the elements.

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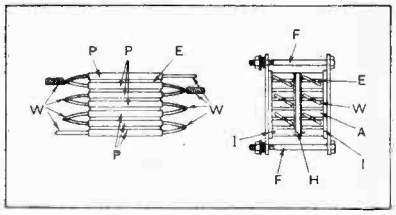
A Thermoelectric Generator.
(No. 265,519.)

Application date: Aug. 11th, 1926.

A thermoelectric generator is described in the above British patent by H. A. Roberts, and the accompanying diagram



Thermoelectric generator for H.T. and L.T. supply to receiving sets. (No. 265,519.)

should illustrate clearly the arrangement of the device. The elements consist of alternate plates of positive and negative thermoelectric active metals P. The plates have wires W cast into the ends of them for the purpose of making connection. These wires are twisted together so

as to connect a number of elements either in series or parallel, according to the relative voltages or currents which may be required. The plates are separated from each other by means of washers E, which are of heat-resisting material such as asbestos paper. The illustration shows one assembly of plates clamped together by means of a framework F. The edges of the plates are insulated from the framework by means of strips of insulating material I. The portion H represents a heater which may be an electric element, or, alternatively, this may be dispensed with and substituted by a series of gas flames.

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Multiple Plug-in Coil. (No. 265,301.)

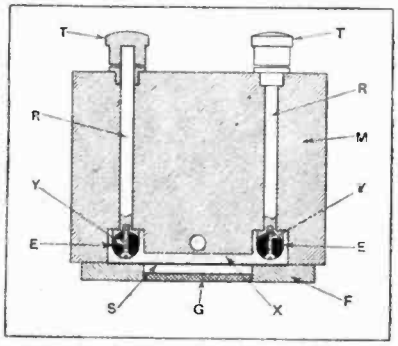
Application date: Nov. 6th, 1925.

A multiple plug-in coil is described in the above British patent by G. W. Melland, the arrangement being shown in the accompanying diagram. It will be seen to consist of four inductances L having different values, fixed as shown, to a centre support S. Each inductance is connected to brushes B fixed in insulating supports I. The centre portion S is mounted on a rod R fixed to a circular insulating plate P, provided with the usual plug and socket members N. The plug and socket are respectively connected to two contacts X. Thus it will be seen that by rotating the centre portion S the ends of one of the inductances L may be connected with the plug and socket by virtue of the brushes B co-operating with the contacts.

Another Reisz Microphone. (No. 258,542.)

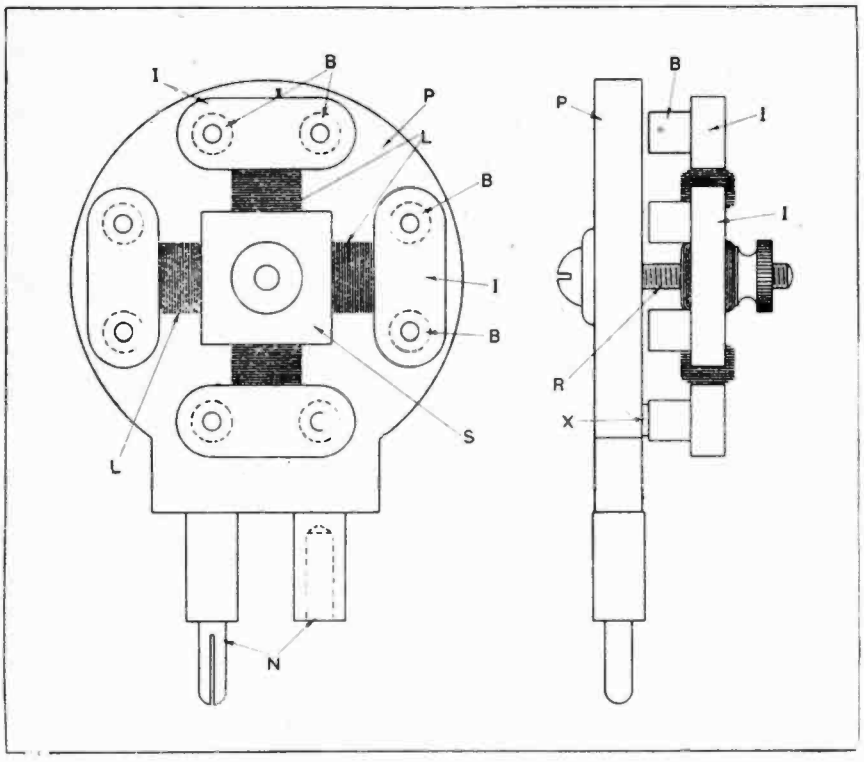
Application date: Aug. 11th, 1926.

E. Reisz describes in the above British patent a modification of a microphone which he has described previously and is no doubt familiar to readers. It is mentioned that the response is very materially affected by the size of the granules.



Cross-section of the Reisz microphone. (No 258,542.)

If the granules are large there is a considerable space between them which allows the sound waves at higher frequencies to be absorbed, thereby materially lowering the efficiency at such frequencies. The thickness of the layer of carbon also has a marked effect upon the frequency characteristic. These difficulties are overcome in the present invention by using a mixture of granules of various sizes. For example, very fine dust is mixed with granules of two different types. One mixture, which is stated to be satisfactory, consists of a mixture of 22 per cent. of dust not exceeding 0.0015 mm. diameter, and 47 per cent. of grains of 0.07 mm. diameter, the remainder consisting of grains of intermediate sizes. The accompanying diagram shows a cross-section of a microphone using a layer of the carbon mixture. The microphone itself is composed of a block of marble M or other very solid material, and a portion of the front is removed at X and provided at the sides with two recessed portions. These portions shown at Y contain electrodes E of carbon or non-oxidisable metal connected by rods to terminals T located at the back of the microphone. The portion X is filled with the carbon mixture, and the carbon is held in position by means of a thin sheet of rubber S stretched so that the natural period is below 50 cycles per second. The front of the rubber is then protected by a thin gauze shield G fixed to a frame F. The dimension of the frame is such that it lies in front of the carbon or other electrodes so that sound waves cannot impinge directly upon them. This prevents any resonance of the rods occurring.



Multiple plug-in coil. (No. 265,301.)

BOOKS AND CATALOGUES RECEIVED.

"La T.S.F. des Usagers," by P. Hémardinquer, with preface by L. Lumière. A simple description of various types of receiving apparatus, with instructions for their installation and upkeep. Written for the benefit of the non-technical listener. Pp. 136, with 80 illustrations. Published by Masson et Cie, Paris. Price 10 francs.

W. H. Agar, 19, Whitecross Place, London, E.C.2. Leaflet describing high-class cabinets designed for the Mullard P.M. Master Receivers.

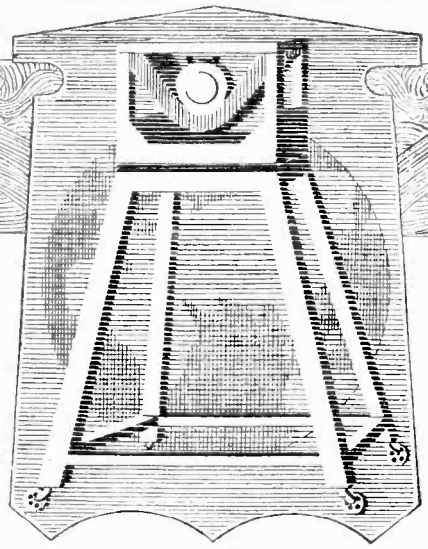
W. and T. Lock, St. Peter's Works, Bath, and 95, Victoria Street, London, S.W.1. Supplementary List, April, 1927, relating to "Cabinola," pedestal and other cabinets for wireless receivers.

A. F. Bulgin and Co., 9-11, Cursitor Street, Chancery Lane, London, E.C.4. Folder containing complete set of revised price lists of *Deckorem*, *Competer* and other radio products.

Philip's Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Leaflet No. 81, giving particulars of the new Philips D.C. High-Tension Supply Unit.

Burne-Jones and Co., Ltd., 288, Borough High Street, London, S.E.1. Leaflet dealing with the "Cube" 3-valve self-contained receiver. Pamphlets relating to "Magnum" wireless products including calibrated rheostat, screened coils, valve holders, etc., etc.

BROADCAST BREVITIES



NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

Tests from "Daventry Junior." — The B.B.C. Referendum. — Portable Platitudes.

5GB Awakes.

"Daventry Junior," or, to give the new station its correct title, 5GB, has burst into spasmodic life.

The first transmission occurred on May 7th, and a *Wireless World* reader, Mr. Richard C. Le Mare, of Heaton Chapel, Stockport, tuned it in forthwith. In his report Mr. Le Mare writes: "The signal strength on a set using 1-v-2 was a little weaker than 5XX. The signal would offer an excellent alternative programme. Crystal reception was possible, but only very faint. The quality of modulation was very good indeed." The transmission was received between 11.0 and 12.0 (noon) and consisted of pianoforte music and reading.

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"Stronger than 2LO."

5GB was also testing last Wednesday morning (May 18th) between 9.30 and 11.0 a.m. The wavelength is between 300 and 400 metres, and there is no law to prevent listeners from calibrating the signals with a wavemeter. I understand that the new station has already been reported as "stronger than 2LO" by a listener at Dover.

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Why Not July 27th?

Now that the first regional station has been coaxed into activity, it seems rather a long time to wait for regular transmissions until November, the month which has frequently been mentioned in connection with the inauguration of the first regional programmes.

Provided that the tests are successful—and there is no indication of failure—there should be no insuperable obstacle in the way of a much earlier start.

The second anniversary of "Daventry Senior" occurs on July 27th. Why not celebrate this auspicious occasion by the initiation of alternative programmes on that date? What about it, B.B.C.?

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The B.B.C. Referendum.

The B.B.C. are at present busy receiving postcards in connection with the referendum which they have instituted in an endeavour to obtain information regarding the effectiveness (or non-effectiveness) of the different stations.

From four to five persons in each household probably listen at some time or other to items in the broadcasting programmes. How is this vast concourse divided in the matter of time spent in listening to the programmes from any one of the twenty-one stations of the B.B.C.? How many of the twenty-three to twenty-five millions of the population within 100 miles' radius of Daventry are broadcast listeners, and how many listen regularly to their local station, or to any other B.B.C. station?

OUTDOOR BROADCASTING. A banjo solo from 5VY, an amateur station which took part in a recent field day of the Tottenham Wireless Society. The transmissions on 45 and 90 metres were picked up by many amateurs in the neighbourhood

What's Yours?

All that listeners are being asked to do is to let the B.B.C. know to which of its stations they listened wholly or mainly during last winter. Listeners need only address their postcards "B.B.C., London," "B.B.C., Daventry," "B.B.C., Manchester," etc. It is, however, essential that postcards should be sent to the particular station with which the listener is more intimately concerned, and not to London, unless that is the station to which the information on the reverse side of the card refers. On the top left-hand corner on the address side the letter "R" should be written plainly.

The special request is made that listeners to Leeds or Bradford should be careful to address their postcards either to the Leeds or to the Bradford station, whichever they support, and not to "Leeds-Bradford," although the two transmitters have the same address.

The only information required on the postcards is (*a*) the approximate distance of the receiver from the station, and (*b*) whether a valve or a crystal set is used. The facts can be given thus: 15/V. Postcards should reach the B.B.C. stations by May 30th.

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Questions Which Will be Answered.

This referendum is the first of its kind to be conducted in this country, and will probably reveal some interesting figures.

How many people listen to Bournemouth as compared with Birmingham? Does Dundee speak to thousands, or tens of thousands? Is Swansea wasting its fragrance on the desert air?

These are some of the questions to which the referendum may find an answer. And I should not be surprised if its revelations form the basis of calculation when the Corporation tackles the problem of regional distribution.

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A Musical Event.

The accession of Sir Henry Wood to the ranks of broadcast conductors as from June 1st represents an important step in the musical history of the B.B.C.

I understand that, for a few months at all events, Sir Henry will be mainly associated with "outside" concerts, and in this connection it is interesting to note that the B.B.C. contemplate making a further offer to Mr. Boosey in regard to the lease of the Queen's Hall.

Portable Platitudes.

Many writers on wireless topics (not in *The Wireless World*) appear to experience at this period of the year a priceless and peculiar urge. Fortunately, its manifestation is confined to cold print, otherwise we might all go mad and gnaw batteries. The point is, the urge *must* manifest itself, or assuredly the writers would die.

Bubbling forth pretty much like sulphate on an old accumulator, it sounds like this: "Now that summer is here, dear reader, let us direct our attention to portable receivers and all the delights which they hold in store. In the first place, a portable receiver must be really portable. . . ."

And so on. And the amusing point is that amidst a welter of facts and fancies the chances are 1,000 to 1 against the writer observing the *real* reason why the poorest portable has, in one respect, a crushing superiority over every other type of broadcast receiver.

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Those Endearing Young Charms.

He will tell you that the charm of a portable receiver is its portability, suitability, respectability. He will impart the information that it can be disguised as a suitcase. And when it is time to go home (and he has still half a column to fill) he will rhapsodise on the fact that a baby portable is more musical and less irksome than a portable baby.

And still he will have missed the main point.

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The Blissful Illusion.

The main point is that a portable receiver, operated in the open air, nourishes far more effectively than does the best parlour set that blessed, if inaccurate, reflection that you are getting something for nothing.

The most awe-inspiring receiver, ensconced in its niche in the dining-room, with connections to batteries or eliminator, gives a subconscious impression of contact with the transmitter. In appearance it is no more independent than the ordinary telephone.

But hike out the portable and pull in the music from 5NO in the silence of a lonely moorland, and . . . weel, ye ken it's grand, mon!

It's very easy to believe that the music is really free for the asking—until the batteries run out, or a Post Office official taps you on the shoulder and asks to see the jolly old licence.

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A Peculiar Noise.

The departure from 2LO of Mr. Alfred Whitman, the "noise expert," is a reminder of the progress made in the last few years in the manufacture of what may be termed "artificial noise."

It was Mr. Whitman who was largely responsible for the introduction of those weird and wonderful creations capable of producing anything from the whisper of sad sea waves to the sound of riveting in a Tyneside shipyard. Mr. Whitman has returned to his first love, the films, but the good work will go on.

A novel sound experiment will be conducted on Friday next, May 27th, at the broadcast performance of "R.U.R.," in which the noise of the Robot factory will be produced by means of orchestral instruments. That anything approaching realism can be achieved by this method seems rather unlikely, but, fortunately, a Robot factory is itself unreal.

FUTURE FEATURES.

London.

MAY 29TH.—Orchestral and Vocal Programme.

MAY 30TH.—Act. III. of "The "Huguenots," relayed from Covent Garden.

JUNE 1ST.—Running Commentary on the Derby, relayed from Epsom.

JUNE 2ND.—Elgar Birthday Concert conducted by Sir Edward Elgar.

JUNE 3RD.—Trooping the Colours.

JUNE 4TH.—Printers' Pension Fund Concert, from the Royal Albert Hall.

Birmingham.

JUNE 4TH.—Military Band Concert, relayed from Royal Leamington Spa.

Bournemouth.

MAY 31ST.—Speeches at Banquet given by the Mayor of Portsmouth to Officers and Men of the French Naval Squadron, relayed from the Guildhall, Portsmouth.

Cardiff.

JUNE 3RD.—Harpers and Chanters —a Celtic Salute from Wales to the West of Scotland.

Manchester.

MAY 29TH.—Hymn Singing Festival, relayed from the Pavilion, Buxton Gardens, conducted by Sir Ivor Atkins.

JUNE 3RD.—Municipal Orchestral Concert, relayed from the Royal Hall, Harrogate.

Newcastle.

MAY 31ST.—Unfamiliar Works by Great Composers.

JUNE 4TH.—North of England Musical Tournament: Community Songs relayed from the Town Hall.

Glasgow.

MAY 31ST.—"Twopence all the Way," a programme by The Corporation Tramways Department.

Belfast.

JUNE 1ST.—"Too Many Cooks"—a Revue by Numerous Authors.

A Central Listening Station.

To establish a permanent central listening station to check the wavelength of European broadcasting stations was an interesting decision of the Union Internationale de Radiophonie at its recent sitting at Lausanne. Something of the sort has been badly wanted ever since the Geneva scheme came into being. Up till now, in the absence of such an official and minatory eye, the various stations have followed the principle of picking out the mote from anybody's eye but their own.

The official listening station will at least be unprejudiced in its findings.

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Service from the Cenotaph.

An impressive broadcast will take place on Whit Sunday, June 5th, viz., the British Legion Memorial Service at the Cenotaph at 5 p.m., to be conducted by the Dean of Westminster. Familiar hymns will be sung, and listeners will also hear the sounding of the "Last Post."

The microphone will be slung from one of the adjacent buildings.

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Who is "Harold"?

A new party of mirth-makers will broadcast from 2LO on May 28th. The nucleus of this party consists of Geoffrey Gwyther, Donald Calthrop, Rex Evans, Ethel Baird, and Carmen Hill. Donald Calthrop, acting as *compère*, will treat the microphone as a telephone to call the World and his Wife to a wireless entertainment. The feature of the broadcast will be the introduction of a new character in broadcasting, who will be known as "Harold." There never has been a wireless mascot. If "Harold" fulfils the expectations of the broadcasting officials, it is not improbable that those who favour mascots will adopt him as their own, for it will be made clear after the broadcast that "Harold" is physically suited to the part.

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A Useful Voice.

Miss Ruby Helder, the lady tenor, will broadcast on May 31 in songs by Ambroise Thomas, Coleridge-Taylor, Hatton, and Graham Peel. When Miss Helder was touring in America, burglars attempted to break into a friend's house where she was staying. No member of the male sex was sleeping in the house, and it was surmised that the burglars had knowledge of the fact, but Miss Helder shouted out in her best masculine voice: "What do you want? Wait until I come down." The burglars were scared away.

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"The Old Brigade."

A series of reminiscences inspired by Chelsea Hospital will constitute a broadcast entitled "Boys of the Old Brigade," by Amyas Young, to be given on May 31.

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For the Blind Listener.

Equipped with a copy of the *Braille Radio Times*, the blind listener can be said to start from scratch in the matter of broadcast reception, enjoying precisely the same facilities as those who possess their sight.

The first number of this weekly periodical has just been published by the National Institute of the Blind, and contains a summary of programmes from the English and Welsh B.B.C. stations. The price of the paper is 1d., or by post 1½d. The first issue is one of 1,250 copies, but it is expected that this number will be increased with subsequent issues.

TRANSMITTERS' NOTES AND QUERIES

From the Arctic Circle.

A correspondent in Cheshire tells us that on April 17th he received signals in the early hours of the morning from NC 5FS. which is believed to be a station at Aklavik on the delta of the Mackenzie River, in North-West Canada. The signal strength was about R4 and the wavelength 33 metres. He will be interested to know if other readers heard this station and if they can give the exact QRA.

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Among the Belgian Amateurs.

M. P. Duvignan (EB 4AC), 16, rue de l'Eglise, Antwerp, transmits daily from 5 to 6.30 G.M.T. on 31.50 metres and has been in two-way communication with OZ 4AA, the well-known station in New Zealand operated by Miss Bell, and OZ 4AC; also with NR CTO in Costa Rica, whose signals are stated to be fairly strong until 7.45 G.M.T., and various other stations in Australia, New Zealand, and South America. He uses an input of 100 watts to a Hartley circuit with a single wire aerial 40ft. long and a 20ft. counterpoise.

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Mr. Louis Era (EB 4BC) tells us that he has lately been experimenting with the Lévy type of aerial in which the down lead is in the form of a closed circuit tunable to half the wavelength and inductively coupled to the tuning coil of the transmitter; it is similar to the Alexanderson aerial but without the variable capacities which form a feature of the down leads in this system. Mr. Era adopted the Lévy aerial on the advice of Mr. Franco Marietti (EI 1NO), of Turin, and is enthusiastic over the increased range of his station. He states that he is in regular telephonic communication with stations in New Zealand and the Philippine Islands, and has worked in Morse with stations in South America, India, French Indo China, and many others parts of the world, including the 5th and 8th Districts of U.S.A.

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A Roman Amateur.

Signor Alfonso Marullo (EI 1CU) Via XX Settembre 89, Rome, is now conducting low-power telephony tests on a wavelength of 33 metres, using a Western microphone and modulating by absorption. He is generally carrying out these tests from 13.00 to 14.00 and from 19.30 to 21.30 G.M.T. He is also "on the air" every evening for D.X. work, using an input of 30 watts, and will welcome any reports of his transmission.

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Belgian Amateurs.

We are now able to supplement the list of licenced Belgian amateur transmitters published on page 551 of our issue of May 4th. The QRAs marked with a * differ from those in the previous list, and are, presumably, later corrections.

4AD	G. Harvengt, 27, rue Gust-Biot, La Louvière.
4AF	H. Stienaers, 7, rue du Tram, Hasselt.
4AG	A. Wust, 99, av. Elisabeth, Berchem, Antwerp.
4AH	R. Destrée, rue de Rivieren, Ganshooren.
***4AJ**	A. Reclemans, 150, chaus. de Charleroi, St. Gilles, Brussels.
4AN	A. Damuscau, 6, rue de Block, Machelen.
4AO	P. Tollenaere, 115, av. des Hortensias, Schaerbeek.
4AQ	G. Mareska, 66, avenue de l'Armée, Etterbeek.
4AV	O. Laroche, 617, boulevard de Smet de Naeyer, Brussels (2).
***4AX**	Fouassin, 64, rue de Serbie, Liége.
4BE	P. Cardon, de Lichtbuer, 30, avenue d'Amerique, Antwerp.
4BJ	J. Mussche, 63, boulevard Poincaré, Brussels.
4BM	E. Quitton, 17, rue de la Bravoure, 17, Jette.
4BN	B. Van Engelen, 73, rue du Moulin, Borsbeek (Antwerp).
4BO	F. Lodewijck, 18, rue de Lille, Menin.
4BP	H. Obreen, 40, Krijgslaan, Gand.
4BQ	S. Keups, 156, rue de Jumet, Marchienne-Docherie.
4BS	J. Puttemans, 14, rue de la Limite, St-Josse-ten-Noode.
***4BT**	Haillez, Manhav.
4BU	F. Vanhay, 1. 2, r. Braemt, Brussels.
4BV	A. Ressort, route de Bovenistier, Remicourt.
4BW	L. Menne, 68, rue de Joie, Liége.
4BZ	G. Janssen, Château d'Emptinne (Ciney).
4CE	E. Lucas, 3, place Albert 1er, Chatelineau.
4CH	L. Mestag, 76, av. Clays, Brussels.
4CI	L. De Pauw, 87, Gasthuisstraat, 87, Arendonck.
4CL	F. Barils, 123, rue de Dison, Verviers.
4CN	M. Libert, 18, rue des Croix, Flénu.
4CR	R. Cauwerts, 18, rue Gratès, Watermael-Boitsfort.
4CS	A. Charles, 28, avenue de Séville, 28, Grivegnée
4CT	R. Mitteau, 36, rue de Saxe-Cobourg, Brussels.
4CX	A. Rousseau, 3, place de Bayemont, Jumet-Gohyssart.
4CZ	L. Dierckxsens, 36, rue Quellin, 36, Antwerp.
4DB	X. Deparadis, 21, rue de la Brasserie, Vaulx (Tournai).
4DC	G. Demey, 22, Galeries Ensor, 22, Ostend.
4DE	M. Dieudonné, 220, rue Fidevoye, 220, Yvoir.
4DM	M. Delsemme, 110, rue Verte, 110, Brussels.
4GA	F. Ryckx, 148, chaus. de Charleroi, Brussels
4GO	G. Vanden Eynde, 22, rue du Remorqueurs, Brussels.
4GS	M. Ruth, 321, rue de la Croix Rouge, Wegnez.
4LL	L. Lelarge, 37, rue Oscar Lelarge, 37, Wanze.
4LS	A. Stainier, 85, chaus. de Tirlemont, Corbeek-Loo.
4NV	M. Navaux, 37, rue de France, Verviers.
4OA	L. Houben, 173, rue de Verviers, 173, Andrimont.
4PC	F. Parmentier, 118, rue de Dison, Verviers.
4QS	L. Henrotay, 26, rue des Carmes, 26, Verviers.
4RS	R. Pirotte, 10, rue du Parc, Verviers.
4SF	J. Mallinger, 17, rue Jos. Stevens, Brussels.
4XS	R. Parent, 183, chaus. de Heusy, Verviers.
***4XX**	M. Van Hauwermeiren, 28, rue Ch. van Lerberghe, Schaerbeek.
4YU	G. Bianchi, 34, rue de la Chaussée, Mons.
4YZ	A. Courtois, 56, rue du Pont Léopold, Hodimont.

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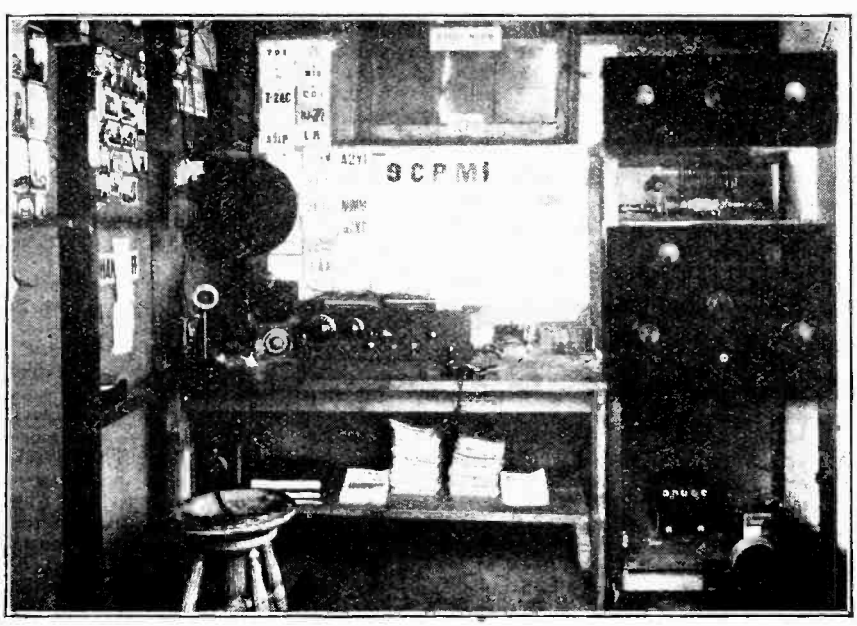
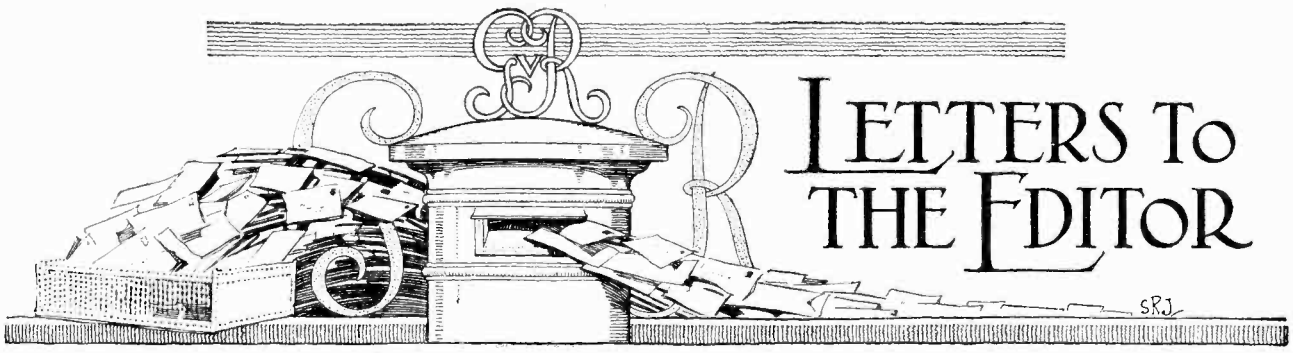
New Call-Signs Allotted and Stations Identified.

G 2TP	Lieut. C. W. Andrews, 4, White Horse Drive, Epsom. (Change of address.)
G 5PH	(ex 2BWF). B. F. Phillips, 21, Byng St., Landore, Swansea. (Transmits on 23, 45, and 90 metres.)
G 5YD	(ex 2BZD). H. C. Daynes, 15, Elton St., Stretford, Manchester. (This call-sign was formerly owned by Mr. E. R. Bridgwater, at Longton.)
G 6BY	W. R. Bottomley, Glynwood, Brighouse, Yorks. (Transmits on 8, 23, and 45 metres.)
OD PK6	(ex N OKW and EI OANÉ 2). C. J. Gouwentak, Medan, Sumatra, Dutch East Indies. (Transmits on 27 to 33 metres, usually between 1200 and 0600 G.M.T., and will welcome reports.)



NU 9CPM owned and operated by Mr. W. J. Mashek at 5032, Lyndale Avenue South, Minneapolis, Minn., U.S.A. Mr. Mashek, who transmits on 20 to 45 metres and is justly proud of his installation, would like to exchange photographs of stations with British amateurs



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,—Following my contribution to *The Wireless World* practically a year ago[1], emphasising the inestimable value of home broadcasting to colonial residents, this progressive periodical has consistently brought the subject to the fore. The result is that contemporaries have seen fit to fall into line, which should spur the authorities to consider the erection of a relatively high-power, short-wave broadcasting station in one of the London counties in the very near future.

It is a particularly opportune moment for the preliminaries to be discussed, observing that colonial representatives are now in conference in London, and it is to be hoped that every advantage will be taken with a view to gleaning the possibilities of the revenue to be obtained from local receiving licences, in order to provide funds for the maintenance of a 24-hour transmission.

Such transmissions need not consist so largely of entertainment as provided for local consumption at home, at any rate for some time to come. The essential factor to be considered would be the "Home Contact," and it is conceivable that "News" and topical events would be of the most practical and psychological value. In this connection, it would be a fairly simple matter to record special sporting events, which could be retransmitted over a period of several hours in order to ensure that the widespread Dominions and Colonies would receive either the original or record.

This gives rise to the important question of technicalities. It is taken for granted that there is a layer of ionised gas surrounding the earth for an average distance of perhaps 100 miles above the earth's surface, and that this layer is subject to complex physical and electrical changes. We have also to consider that there is a definite relationship connecting the mean position and effect of the sun with the wavelength employed, and its reflection distance. The variables involved, therefore, are considerable in the light of our present knowledge, and the difficulties of obtaining *continuous* reception as far as broadcasting is concerned are pronounced. In consequence of these somewhat conflicting factors one's thoughts naturally turn to "Beams," and were it not for the expense involved for the erection of a multiple beam station, the efficiency arising from concentration would doubtless be of a high order. In this connection the term "efficiency" can be very misleading, as the requirements of a useful broadcasting system are totally distinct from a commercial wireless telegraph or telephone system. In any case there is no reason why a commercial beam station should not superimpose a very special broadcast occasionally, in the event of a political speech concerning a particular Dominion. As the outcome of the original Colonial Station, one may visualise a beam broadcasting transmitter as concentrating the energy directly upwards to the highest stratum of the Heaviside layer, and thus conserving energy by making a "getaway" with the minimum of absorption losses.

These are matters which will have to be investigated at some future date, but the fact remains that with a station of from 20 to 50 kilowatts of high-frequency energy working on two wavelengths between 20 and 40 metres, and with duplicate plant for a 24-hour service, there should be no financial obstacle to making a start *forthwith*. An average of two hours' reception in the twenty-four would be ample, and on the short wave there should be a negligible amount of interference from atmospherics, even during bad local conditions. One must not lose sight of the fact that theorising beyond fundamentals will get us nowhere, and it is only by trial and error that we shall eventually make progress until such time as the science becomes more exact.

Looking ahead a little, it would seem that some organisation should represent the views and requirements of the exiles in the various Dominions and Colonies, from both the technical and programme sides; in a great number of instances, the *individual* would even require representation, and I have no hesitation in suggesting that my Association would gladly and efficiently undertake to act on their behalf in the event of sufficient Colonial subscribers coming forward to warrant the overhead expenditure involved. I have received many letters confirming this need, and hope in the very near future that we shall see the consummation of the scheme outlined above.

H. ANTHONY HANKEY,
Secretary The Wireless Association of Great Britain.
May 16th, 1927.

[1] *The Wireless World*, April 14th, 1926.

CERTIFICATES OF MERIT.

Sir,—With more than passing interest I have read Mr. Claude Lyons' letter in the May 4th issue of *The Wireless World* with regard to the granting, by some disinterested and unassailable authority, of certificates of merit for radio components and sets.

Mr. Lyons has promulgated, at an opportune moment, a suggestion to which I feel sure both radio trade and public will give favourable notice. While concurring in basic principle I would beg to differ in detail from Mr. Lyons' scheme.

To bestow three classes of certificates would, to my mind, present a fallacious perspective to such a proposition and tend to create an ambiguity which could too easily become a "bone of contention."

Surely it is as meritorious to produce a reliable, utilitarian article at a low figure as to create some masterpiece of workmanship, irrespective of initial or productive costs.

Providing an article fulfils efficiently and straightforwardly its correctly imposed duties, and duly justifies whatever claims may be made for it by its manufacturer, and furthermore sells at a reasonable price, I fail to appreciate why its prospective purchaser, whose pecuniary ability may not permit of some more extravagant outlay, should be debarred the satisfaction of feeling that he is obtaining something which has achieved recognition as "fully meritorious" under expert examination. Any intelligent buyer will realise that an article selling at two-thirds the price of another similar will not, in the ordinary way, attain the same level of general perfection, and that further decreases in price will indicate usually proportionate decline. To grade definitely as suggested appears to me outside the legitimate and useful scope of such a scheme, and, while quite comprehending Mr. Lyons' reasons for such action, wherein he intends each class to be designated as meritorious in degree, I would beg to suggest that it should also provide a category into which any

article may be fitted without undue elasticity, thereby allowing for the well-advertised, well-produced, but practically useless, "brilliant idea" from which we have suffered so long, to rank with its "honest to goodness" but unpretentious fellows.

Whereas my ideal would be to remove such encumbrances from the *one* class "meritorious" by the process of entire elimination.

HETHERINGTON APPLEBY.

London, S.W.19,
May 4th, 1927.

Sir,—The letter advocating the establishment of "Certificates of Merit for Components and Sets" in *The Wireless World* prompts one to say that anything which helps the public to know exactly what it is buying is worthy of support.

On this score, however, the disclosure of *electrical* values, of impedances, resistances, capacities, inductances, in fact all details and qualities in given components which the many excellent technical articles in *The Wireless World* have educated us to look for in experimental work and set building—all these, I say, are the data the public need to protect it from much disappointment with its sequels of wasted money and eventual abandonment of the hobby.

At present it is useless to go into a wireless dealer's and ask for a proprietary coil of a particular inductance with a specified minimum resistance, or a transformer with a needed minimum primary impedance and enquire about self-capacity values, etc., etc. Yet your excellent journal urges us, and rightly, to follow certain rules and laws in these matters in our long quest for perfect results.

From my observation, unsatisfactory wireless reception is due, not so much to ill-made components, as to excellent components unsuitably used.

There is, of course, much more to be said on these subjects, and I look forward to reading my fellow-readers' views.

W. M. CARR.

Hove,
May 4th, 1927.

EXPERIMENTAL SIDE-BAND TRANSMISSIONS.

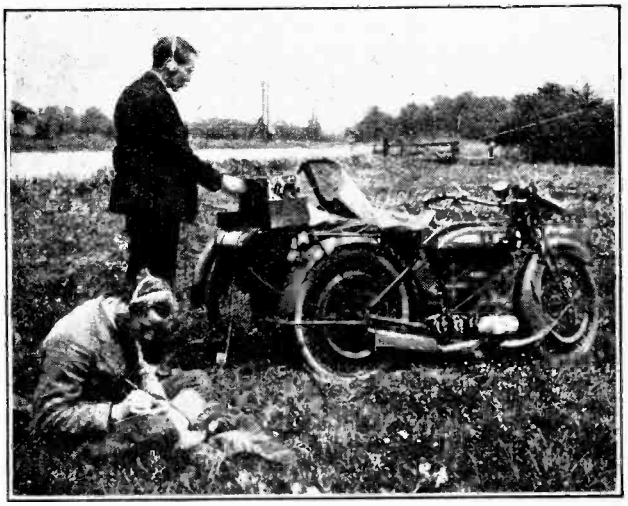
Sir,—In the course of the next few weeks listeners in the London area who listen in during the week-end below 200 metres may hear rather weird sounds emanating from my station between 6 p.m. and 8 p.m. B.S.T. on a wavelength of 194 metres. In order to allay any misconception which may arise I should like to point out that I am carrying out perfectly responsible experiments on a system of "side-band" telephony. Although it is heard as an unintelligible jumble of sounds on an ordinary receiver it contains the essentials of good speech and can be received as such only with a very accurately adjusted "homodyne"—that is to say a separate heterodyne oscillator adjusted to exactly zero beat frequency with respect to what would be my carrier-wave if it were there. It is quite hopeless for anyone to try to pick me up properly with a self-oscillating receiver, and any such attempt is only likely to interfere with the reception of the stations which are properly equipped to observe my tests.

For the benefit of your more technical readers I should like to state that I am transmitting *both* side-bands minus carrier component and not one side-band only as Rugby does.

The system is not intended as an attempt at secrecy. It is simply a rather advanced method of economising power.

E. HOWARD ROBINSON (2VW).

London, N.W.3, May 17th, 1927.



THE FIELD DAY SEASON. Members of the Tottenham Wireless Society picking up signals from mobile transmitters on a recent field day.

SHORT-WAVE TESTS FROM WGY.

TWO important short-wave transmission tests are to be carried out from the General Electric Company's station WGY, Schenectady, on May 28th and June 4th next. The station's technical department is anxious to secure accurate data as to the wavelengths which are most effective in daylight and darkness for long-distance transmissions. It has been found hitherto that the wavelength of 32.77 metres has been most effective in reaching great distances, but it is thought that possibly the 26 or 22-metres wavelength may be more suitable for daylight transmissions, or where one-half of the area covered is in the daylight zone. We give below the schedules of these transmissions from WGY, which will be of considerable interest to British wireless amateurs.

For the tests on Saturday, May 28th, the transmission of music and speech will be made from Station 2XAF on 32.77 metres, and from Station 2XAD on 26.8 metres. The transmission will commence at 12 (noon), Eastern Standard Time, and last until noon on Sunday, May 29th. The two wavelengths of 26.8 and 32.77 metres will be used simultaneously, both being modulated from the same source with voice and music. The times given are in American Time, and correspond to 6 p.m. in our own time.

In the second test, on Saturday, June 4th, the wavelengths of 22.02 and 32.77 metres will be used simultaneously, both being modulated from the same source with voice and music. It is possible that both transmitters will not be heard at the same time. In this case, also, the transmission will begin at 6 p.m. B.S.T. and last for twenty-four hours.

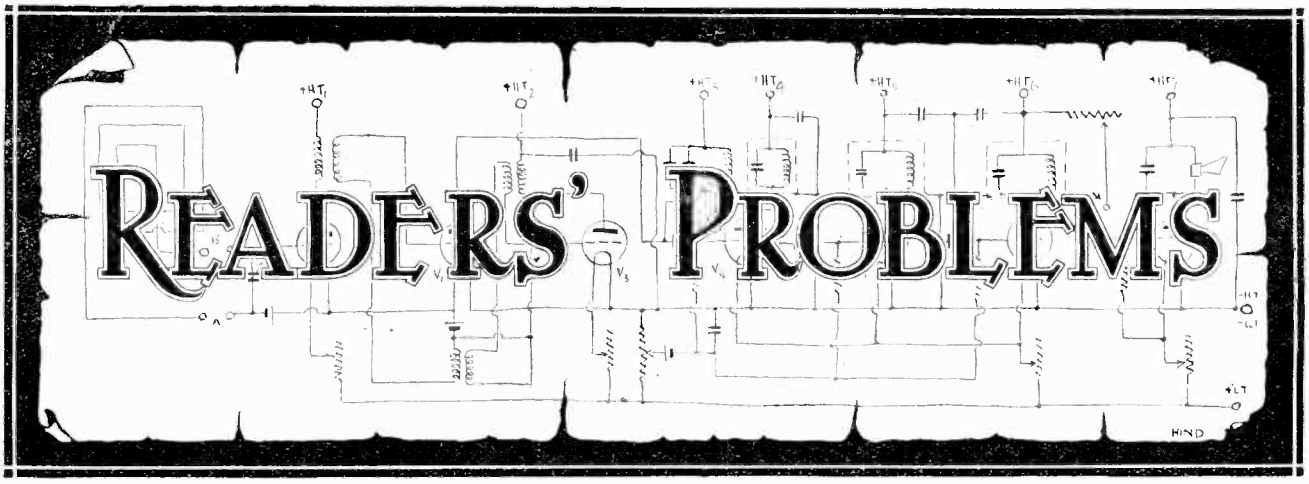
It is highly important that those who participate in the tests should make every effort to secure a complete twenty-four-hour record. Records which cover only a portion of a twenty-four-hour period are useful, but in general the data they contain is too meagre to permit the drawing of accurate conclusions.

In reference to this, the station directors point out that at certain periods of the day the signals will in all probability be inaudible, therefore reports stating that the station was listened for, but not heard, may be just as valuable as those which give the characteristics of a received signal.

As one of the primary objectives of the test is to determine the utility of given wavelengths for international broadcasting, it is essential that a record should be kept of the times, if any, when, in the observer's opinion, the signals are suitable for rebroadcast purposes.

From the quantity of data which it is hoped will result from these tests, the WGY engineers hope to increase considerably their present knowledge in relation to (1) the comparative merits of 22.02, 26.8, and 32.77 metres for the carrying out of an international broadcasting service; (2) the periods of the day that are most favourable to foreign reception of these wavelengths; and (3) the co-ordination of time and wavelength, so as to give maximum service to foreign listeners.

Our readers will understand from the foregoing remarks how important are the above tests which are being organised by WGY. We would like to urge British listeners who are successful in picking up these tests to communicate their observations to the Station Director of WGY, Schenectady.



"The Wireless World" Information Department Conducts a Free Service of Replies to Readers' Queries.

Questions should be concisely worded, and headed "Information Department." Each separate question must be accompanied by a stamped addressed envelope for postal reply.

Charging from D.C. Mains.

I propose to charge my 120-volt H.T. accumulators, as well as a 6-volt L.T. battery, direct from the 240-volt D.C. mains. Is the enclosed circuit diagram correct, and what lamp should be used? A. H. S.

In the first place, we would strongly dissuade you from attempting to charge an L.T. battery from the D.C. mains. This is an extremely wasteful procedure, as the greater part of the current consumed is wasted in heating lamp or other resistances. At the usual rates, a charge may well cost four or five shillings.

Regarding the H.T. battery, however, the case is quite different, due to the smaller difference between the voltages of the mains and that of the cells. Your circuit (showing a lamp in series with the mains and battery) is quite in order. You do not state the makers' recommended charging rate, but as a rule a 240-volt, 60-watt lamp will pass a suitable current, as the "back-voltage" of the battery must be taken into consideration.

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Two, Four, or Six?

One frequently comes across the statement that 6-volt valves are advised to be used in any given receiver if maximum efficiency is desired. Can you tell me if this is true, and what percentage of loss there is when using 2-volt valves in comparison with 6-volt valves? S. L.

In a 6-volt valve we have naturally a greater wattage available, and so they are, generally speaking, more efficient than valves of lesser voltage. Thus, a 2-volt, 0.1-ampere valve gives us 0.2 watt and a 6-volt, 0.1-ampere valve gives us 0.6 watt. A 6-volt power valve consuming 0.1 ampere, therefore, will always be more efficient than a similar 2-volt power valve consuming the same current. It is usually taken that on an average a 2-volt valve gives 70 per cent. of the efficiency of a 6-volt valve of a similar type, this figure only being a rough approximation. It will usually be found, however, that a 2-volt valve makes a much better anode bend rectifier than either a 4- or 6-volt valve, because it has a shorter filament, and therefore a more sharply defined bottom bend. The 4-volt valve rather falls between two stools, and it neither gives the full efficiency of the 6-volt valve nor the utmost economy of the 2-volt valve. From the point of view of efficiency, of course, it lies between the 2- and 6-volt valve. Usually in a modern receiver, especially using modern types of cone and moving coil loud-speakers, it is essential that a 6-volt valve be used in the last stage, and it is advised then that, if utmost economy be desired, 2-volt valves be used in every position except the last stage, where a 6-volt valve should be used. This does not necessitate running your 2-volt valves off a 6-volt accumulator, but entails merely having an auxiliary 4-volt accumulator working in conjunction with a 2-volt one, as shown recently in a diagram given in these columns (page 544, April 27th issue).

A Reaction Problem.

I was so pleased with my "Everyman Four" receiver that I used a similar circuit for a portable receiver without the long-wave attachment. As it was possible to use only 60 volts H.T., two L.F. transformers were used with leaky grid condenser rectification. Results are fair, but selectivity is disappointing when the set is used with a short improvised aerial. Would reaction improve its sensitivity, and, if so, how could it be applied? Space is limited. A. C. N.

It is certainly possible to add reaction, and we think you will find the capacity-control method to be the simplest. The skeleton circuit diagram given in Fig. 1 will show you how the necessary alterations may be effected. The reaction coil, wound close to the grid end of the H.F. transformer secondary, should have about 40 turns of very fine wire—say No. 38 or 40 D.S.C.—while the reaction condenser R.C. may conveniently be small, with a maximum capacity of 40 or 50 micro-farads.

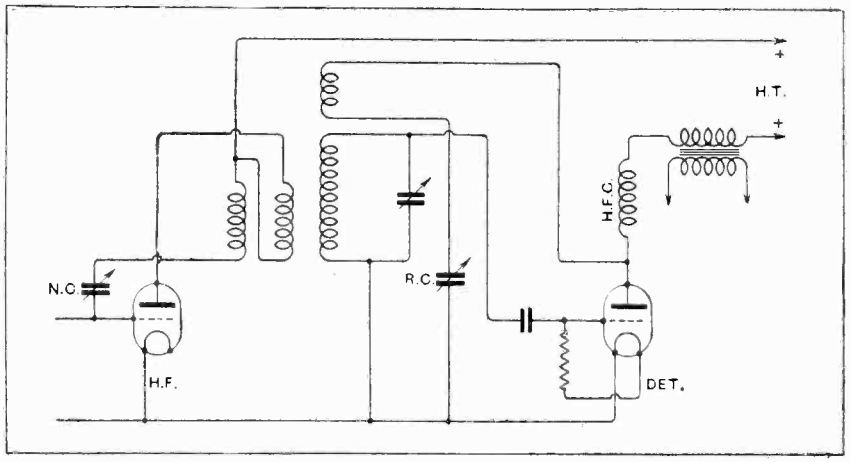

Fig. 1.—Method of adding reaction to the "Everyman Four" circuit.

Moans or Music.

I have constructed a receiver consisting of a detector without reaction and three L.F. stages, to give very great volume on the local station. Immediately upon switching on, however, the set gives vent to a moaning sound. This is not due to a mechanical feed back from the loud-speaker, as I have proved conclusively by operating the loud-speaker in another room entirely, and resting the receiver on "Sorbo." Under these circumstances the howl, which is a steady one and unaltered by moving the tuning dial, still continues as before. Will you please give me the cause and the remedy? S. T. B.

You do not give us full particulars concerning your receiver, but undoubtedly it is due to your attempting to use three L.F. stages running off the same H.T. battery. This is extremely liable to cause a howl of the same type you mention, due to coupling in the H.T. battery, and often occurs even when only two L.F. stages are used if the receiver is badly laid out, so that there is already a tendency to instability in the L.F. stages due to various causes, such as magnetic coupling between two transformers. You must increase the size of the condensers shunting from each H.T.+ tapping to H.T.−, and this should cure the trouble. Another excellent method is to use an entirely different source of H.T. supply for the final L.F. stage. By this we mean not merely a separate tapping on the same H.T. battery, but an entirely separate battery. We presume that you have made certain that your valves are being operated under their proper working conditions, and none of them is overloading.

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Tapped Anode Resistances.

I built the two-valve amplifier described in your issue of March 31st, 1926, in which a home-constructed 150,000 resistance was used in the anode circuit of the detector valve. This resistance had tappings on it for volume control. Since then the high-impedance, high-magnification factor valves have made their appearance, and I am using one with a ½-megohm anode resistance of the "grid leak" type and am obtaining every satisfaction on the local station and Daventry. Control of volume by dimming the H.F. valve filament is denied to me because I have no H.F. stage, and I earnestly desire to revert to the tapped anode resistance method, but cannot see how it is to be done when a ½-megohm anode resistance of the "grid leak" type is used. Your advice on this matter is therefore desired. I it possible to construct a wire-wound instrument having this high resistance? R. G. J. K.

From a mechanical point of view there would be no difficulty in constructing a tapped instrument having a total resistance of ½ megohm or even more. The point is that the self-capacity might be excessive. There is, as you know, wire-wound anode resistances having total values of ½ megohm, and even 1 megohm, already on the market, but so far as we are aware there is no *tapped* instrument having this high value. It would be impossible to tap a ½-megohm resistance of the "grid leak" type. However, the problem is by no means insoluble because it is now possible to purchase 100,000 ohm resistances in "grid leak" form and

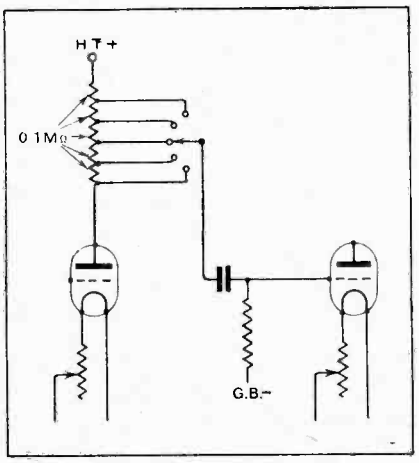

Fig 2.—Volume control with tapped anode resistance.

one may thus connect 5 of these in series and take a tapping at the junction between each "grid leak" resistance, and so have a very compact volume control.

There is one great precaution to be observed, however, and that is special care must be taken to avoid introducing stray capacity effects due to the wiring to the stud switch. It is permissible, of course, to shunt the total anode resistance with a 0.0001 mfd. fixed condenser, and, indeed, such a condenser is necessary to obtain rectification efficiency, and provided that reasonable care is taken in wiring up no harm should result from the little extra capacity introduced, as there will already be this 0.0001 condenser there. Of course, there are fixed condensers of smaller capacity than 0.0001 mfd. on the market, namely, such values as 0.00005 mfd., and if it is thought that this stray capacity was slightly excessive then we would suggest merely reducing the value of the normal shunting condenser from 0.0001 mfd. to 0.00005 mfd. We think that by referring to the diagram which we give you in Fig. 2 the necessary connection would be made quite plain to you.

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An "All-Wave Four" Modification.

I am about to build the "All-Wave Four" described in your issue of April 27th, but wish to use two L.F. transformers already in my possession in place of the resistance as specified. Do you advise this course? H. S. A.

We can hardly recommend you to substitute a transformer for the first resistance coupling, but there would be no harm in using it between the first and second L.F. valves; indeed, this course was recommended in the article to which you refer as highly desirable where long-distance reception is the first consideration.

The use of a transformer in the anode circuit of a bottom bend rectifier is hardly advisable, because the type of valve usually recommended for this function has normally a fairly high impedance, which is increased, by the negative bias applied to make it work on the bottom bend, beyond the point where it can be employed in conjunction with an average good transformer.

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Transformer By-pass Condensers.

I notice that in some circuit diagrams showing receivers with capacity-controlled reaction the usual by-pass condenser across the transformer primary is omitted while in others it is retained. As there is already an H.F. choke in series with the primary, and the reaction condenser acts as a by-pass, surely this condenser is unnecessary? R. T.

From the "H.F." point of view there is, as you suggest, very little reason for this shunting condenser, but it should be remembered that some of the better L.F. transformers are designed to operate with a certain value of capacity across their primaries, and in this matter the recommendations of the manufacturers should be observed.

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A Case of Mistuning.

I have been using for a long time a receiver designed for Daventry only having a short aerial of only 40ft. Results have been quite good, although there was not quite so much volume as I would like. I recently had the opportunity of erecting a much longer aerial to my hitherto 40ft., and now find that Daventry is distinctly weaker instead of stronger as I anticipated. Why is this? R. H. de K.

In the first place, the additional length of aerial would, of course, have the effect of adding additional capacity in parallel with your tuned aerial circuit, and signals would be weaker owing to the receiver being thrown out of tune with Daventry. This could be compensated for by turning your condenser to a slightly smaller capacity value until loudest signals were heard. Even then, however, you might find signals weaker than originally because of the increased aerial damping, but if you have reaction incorporated in your set you could compensate for this by increasing the reaction coupling slightly, but if you have no reaction you must try the effect of not directly coupling the aerial to the top end of the tuning coil. You can use a two-coil holder with a separate aerial coil, but possibly the best method is to insert a condenser of 0.0003 capacity in series with the aerial lead-in. Please note that this will necessitate turning your tuning condenser to a greater capacity value; in fact, probably a greater value than originally.

Cutting Out Local Interference.

I have built a receiver consisting of a detector followed by two H.F. stages, the purpose of which is not to receive distant stations, but merely to give me the local station or Daventry by moving a double-pole switch. Whilst everything is all right when receiving the local station, which is about eight miles distant, I find that on switching over to Daventry, the local station gives an unpleasant background. Can you help me to improve matters? M. K. D.

We notice that you use separate tuning condensers for the local station and Daventry. Fig 3 (*a*) is your circuit, with the addition of a 0.0003 mfd. fixed condenser in series with the aerial, which will effect some improvement in selectivity. The probable reason why you receive the local station when the switch is over to Daventry is that you have in the receiver a complete tuned circuit adjusted to the local station, and this picks up direct from the local station, which is not far away, and, since the two tuned circuits are in fairly close proximity in your set, it will be seen that it is highly probable that the local station will form a background when receiving Daventry.

Fig. 3 (*b*) is a much better circuit to use, since, in this case, when changing over from the local to Daventry, there is no longer a circuit left in the receiver tuned to the local station. Fig. 3 (*b*) may be used with or without this series 0.0003 mfd. condenser. This condenser will help to improve selectivity, and you will find that 0.0003 mfd. is just about the right size, being small enough to sharpen the tuning on the short wave stations, yet large enough to prevent unduly sharp tuning on the long wave stations.

The disadvantage of Fig. 3 (*b*) is that one cannot just change over the double-pole switch, but must readjust the 0.0005 mfd. tuning condenser each time a change is made. This defect may be overcome by placing a compensating variable condenser of 0.0001 mfd. capacity across the coil. We illustrate this in Fig. 3 (*c*). Thus, by putting the switch over to the left we first adjust the 0.0005 mfd. condenser until the local station is brought in, and then we put the switch over to the right and do not touch the main 0.0005 mfd. tuning condenser, but adjust the compensating 0.0001 mfd. condenser until Daventry comes in at full strength. The left-hand coil, that is, the local station coil, will, of course, be no longer tuned to the local station, the 0.0005 mfd. condenser being removed from it and at the same time, when putting the switch back to the left, the right-hand circuit shunted by the 0.0001 mfd. condenser will no longer be tuned to Daventry, but will resonate to a wavelength considerably below Daventry. We can, if we like, put a compensating condenser across the local station coil instead of across the Daventry coil, and exactly the same thing happens, namely, that when we switch over to Daventry the local station circuit resonates to a wavelength far below that of the local station, and so causes no trouble. Here again the 0.0003 mfd. series condenser is optional, but in any case it is advisable to include it, as it will lessen aerial damping and probably improve signal strength in this manner, apart from sharpening up the tuning. We advise, therefore, that Fig. 3 (*c*) should be used.

Of course, you doubtless know that by using a four-pole switch instead of a two-pole one it would be a simple matter to use also a separate reaction coil for both the local and the Daventry stations, thus sharpening tuning considerably, but, in our opinion, Fig. 3 (*c*) is ample for your purpose, and Fig. 3 (*b*) should only be advised in those cases where it is desired that the set also be capable of tuning in, say, Radio Paris, Moscow, or some other long wave long-distant stations on the right-hand coil, when, of course, reaction would be necessary. Similarly, reaction would be necessary in the case of the left-hand coil for bringing in a long-distant station on the normal broadcasting band.

Another occasion when it might be necessary to add Fig. 3 (*d*) to Fig. 3 (*c*) is if it were desired to make the set give either Daventry or Radio Paris by the movement of the switch, but even then only the Radio Paris circuit need have reaction applied, first for the purpose of rendering the set sensitive enough to bring in this station, and, secondly, for the purpose of making sure that Daventry was eliminated. The best scheme to adopt in this case is to use Fig. 3 (*c*) with a four-pole switch, thus making provision for reaction if necessary, but having short-circuiting plugs in each of the two reaction coil holders when desiring to use the set for its normal purpose on the local station or Daventry. The two coil holders and two pairs of plug-in coils which it will be necessary to use to effect this may make the receiver look rather clumsy, and small tuning units such as the "Polar" unit can be used instead if it is desired.

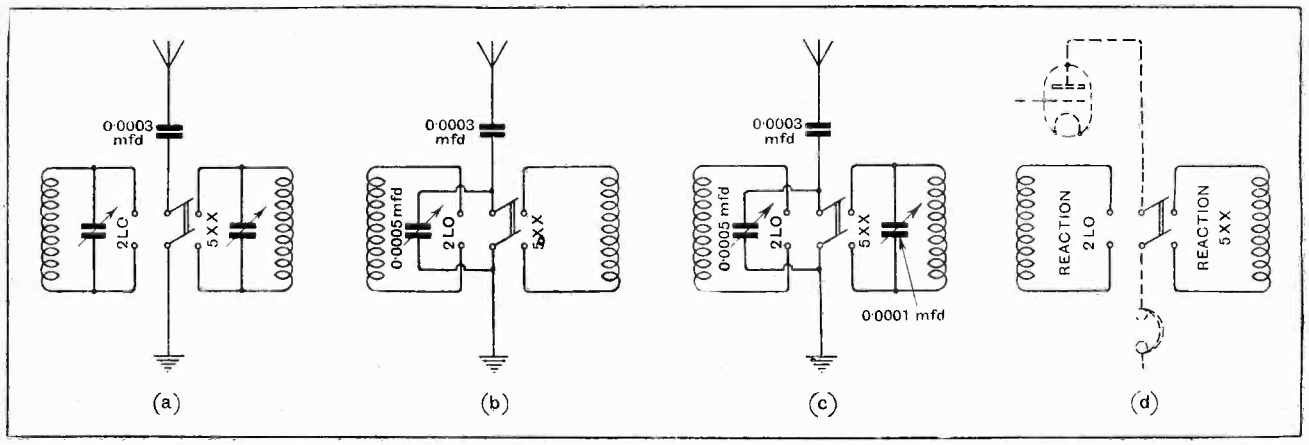

Fig. 3.—Methods of eliminating interference from a near-by station.

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Plug-in Coils in H.F. Couplings.

I should be glad if you can give me a circuit of a five-valve receiver employing two H.F. stages detector and two L.F. stages in which plug-in coils are used, in order that all wavelengths may be covered. N. M.

We cannot conscientiously recommend that you build a receiver of the type you mention, as it would probably be very inefficient indeed, and we would go so far as to say that it would probably be less efficient than a properly designed receiver employing only 1 H.F. stage. If you are specially desirous of using 2 H.F. stages, we can only advise you to build the "Wireless World Five" described in our issues of January 5th and 12th. We would point out, however, that this receiver only covers the 200 to 600 metre band, and if therefore you are intent on covering four wavelengths, it would be necessary for you to turn your attention to the "All-Wave Four," described in our April 27th issue. Although the "All-Wave Four" possesses but 1 H.F. stage, we have no hesitation in saying that it would be considerably more efficient than the receiver you propose.