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(14th Year of Publication)

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THE SHOW.

ANOTHER year of broadcasting is completed, and we look forward to seeing remarkable developments in broadcast apparatus which the industry promises us at the Olympia Show opening on September 4th.

From the point of view of radio technique the new season's apparatus may be expected to excel by a very considerable margin anything which we have seen at former shows. The wireless industry has gained by experience, and is in a better position than ever before to gauge the requirements of the public, whilst the technical advances which have been made have placed in the possession of the manufacturers information and apparatus which enable them to design their new sets on highly scientific lines.

In our next issue we shall review the Exhibition as a whole and deal with the principal components of novelty, whilst in the following issue new sets will be reviewed, and a general *résumé* given of the progress made since last season's Exhibition.

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A POINT OF CRITICISM.

THE ideal date for holding the Wireless Exhibition in London is always a somewhat vexed question. This year the date has been advanced a little as compared with previous years, and, whilst this should meet with the approval of most sections of the public and the industry, we have had numerous expressions of regret that the organisers did not arrange for the Exhibition to be held a week earlier still on account of the fact that the present period of the Exhibition just coincides with the commencement of the new school term. Had the Show been held a week earlier it would, no doubt, have been visited by thousands then enjoying their last week of vacation. This point, though overlooked this year, might well be taken into consideration by the organisers of the Exhibition next autumn.

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APPREHENSION.

A NEW YORK newspaper, commenting recently on the broadcast position in the States, says: "The leading stations are now selling 'broadcast time,' just as newspapers sell space, and little time is left for events not sponsored by advertisers. Political parties and candidates are 'buying time' for the coming campaign." This quotation provides us with serious food for reflection. There can scarcely be any member of the public who would not regard it as a calamity if at any time similar conditions became operative here. Even under Government control one cannot feel entirely immune from the possibility of broadcasting being utilised as a means of deriving additional revenue for the State, since Government Departments and, in particular, the Post Office, have recently adopted (in the face of strong public opposition) a scheme whereby the postmarking of stamps is to carry advertising to provide additional revenue to the Post Office. We have repeatedly urged that any form of advertising, however carefully disguised, should be totally excluded from the broadcast programmes and announcements, and we feel that one cannot too often impress this view upon the public.

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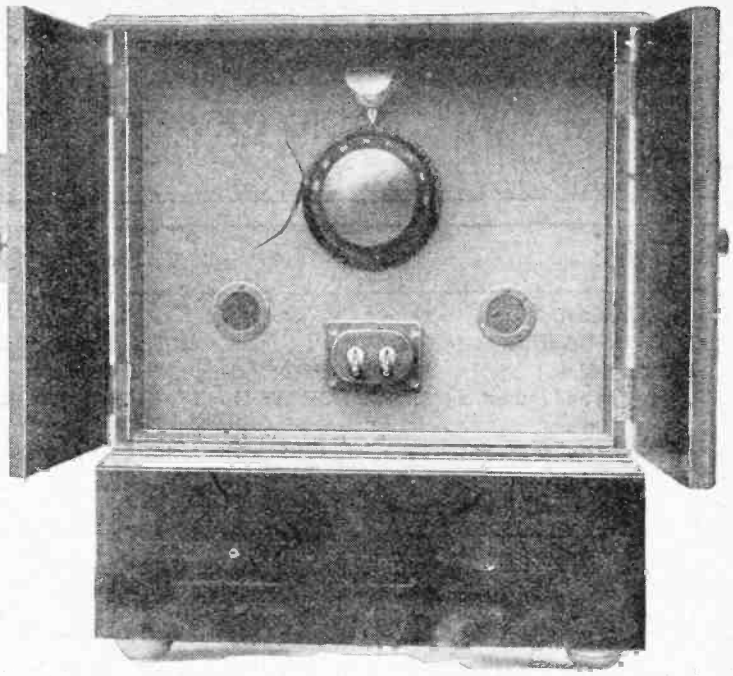
ECONOMICAL SINGLE CONTROL THREE VALVE SET

Incorporating D.C. Mains Unit for Filament and Plate Current



By W. JAMES.

THE receiver illustrated here was designed to give faithful reproduction from the local broadcast station and to work entirely from the direct current electric light mains, no filament or plate circuit batteries of any kind being used. A small dry cell battery of 15 volts is used for the grid bias, however, not because it is impossible to dispense with this battery, but because it is preferable to obtain grid bias from a battery of known voltage rather than to use the fall in voltage across a portion of the resistance included in the mains circuit. It was felt that many readers would experience a little difficulty in obtaining correct grid bias from the mains, while, on the other hand, the ordinary dry cell grid bias battery has a long life, is cheap, and, being tapped at points of known voltage, the novice can very easily adjust the grid bias for the different valves. The adjustment is a little more difficult than in the case of a normal receiver, because part of the grid bias is obtained from the valve filaments themselves, but this matter is explained in detail below.

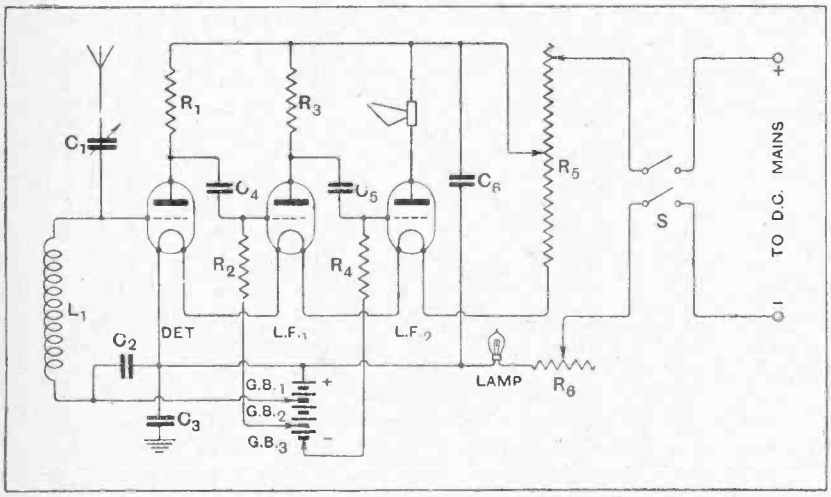


Fig. 1.—Circuit diagram C_1, 0·0005 mfd.; C_2, C_4, C_5, 0·005 mfd.; C_3, 0·5 mfd.; C_6, 10 mfds.; R_1, R_3, 1 megohm; R_2, R_4, 3 megohms; R_5, R_6, resistance of No 30 D.S.C. Eureka wire on wood frame; S, switch.

Running Cost.

Now, the running cost of the receiver mainly depends on the amount of current taken from the electric light mains, so that it is necessary to consider the method of connecting the filaments of the valves with a view to making the current taken from the mains as small as possible. If the valves used take a filament current of 0.25 ampere at 6 volts each and they are connected in parallel, the total current for the three valves is 0.75 ampere. By connecting them in series the current is 0.25 ampere, and although it is necessary to apply about three times the voltage, that is, about 18, when the valves are heated from the mains the voltage does not matter, for the mains voltage has to be reduced in any case.

It is clear that it is more economical to join the filaments in series. This can be done in practice without introducing any serious difficulties, and, assuming 0.25 ampere valves are used and the supply mains have a voltage of 240, the receiver consumes 60 watts. The electricity used costs about sixpence for 15 hours' working. If this is considered expensive, valves taking a filament current of about 0.1 ampere can be used, when the cost is more than halved. The cost of the power used is very small when compared with the maintenance cost of a filament accumulator and dry cell plate battery. If a 3-valve set with

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power valves is used 15 hours a week, battery costs are probably at least two shillings a week. Quite apart from this large saving there are other substantial benefits; for instance, the power unit takes very little room and can be included in the receiver; it requires no attention and ample power is always available by operating the switch.

The Circuit Used.

Referring now to the diagram of connections, Fig. 1, it will be seen that the three valves used have their filaments connected in series. In the aerial circuit is a tuning condenser C_1 of 0.0005 mfd. and the tuning coil L_1; these are connected in series and to the grid of the detector valve. In the earth circuit is a condenser C_3 of 0.5 mfd. and the bottom end of the tuning coil is connected to this condenser through the grid bias battery at GB_1. A shunt condenser C_2 of 0.005 mfd. is used to provide a path of fairly low resistance across the grid battery.

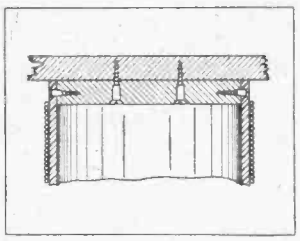


Fig. 2.—Method of fixing aerial tuning coil.

Anode rectification is used because an anode rectifier does not distort when properly adjusted and when the signals applied to it are fairly strong. Grid current plays no part in this method of rectification; hence the plate voltage and negative grid bias should be so adjusted that grid current does not flow. If the grid is made about 3 volts more negative than the point at which grid current commences to flow, signals of normal strength are not likely to produce grid current. We say the point at which grid current commences to flow, because certain valves require a positive potential on the grid to start grid current, whilst other valves give grid current at about zero grid volts. The valves are resistance-condenser coupled, resistances of high ohmic value being used. Plate circuit resistances are marked R_1 and R_3, grid leaks R_2 and R_4, and coupling condensers C_4 and C_5.

Power Circuit.

The direct current mains are connected through a switch S to one end of resistance R_5, and one end of R_6. Commencing at the positive terminal, the path of the current is through the resistance R_5, the three valve filaments, the small indicating lamp and resistance R_6, to the negative terminal. Now, the three valves should usually be of types working with an equal filament current; the voltage required across the filaments does not matter. For instance, the output valve (LF_2) can be a DE5a, which takes 0.25 ampere at 6 volts, while the detector and first low-frequency valve can be a Cosmos SP18 Green Spot. This is a good combination, the SP18 valves being remarkably efficient. They have an amplification factor of 15 and A.C. resistance of 17,000 ohms, and take a filament current of 0.3 ampere at 1.8 volts. But as the detector and first L.F. valves have a high resistance connected in their plate circuits

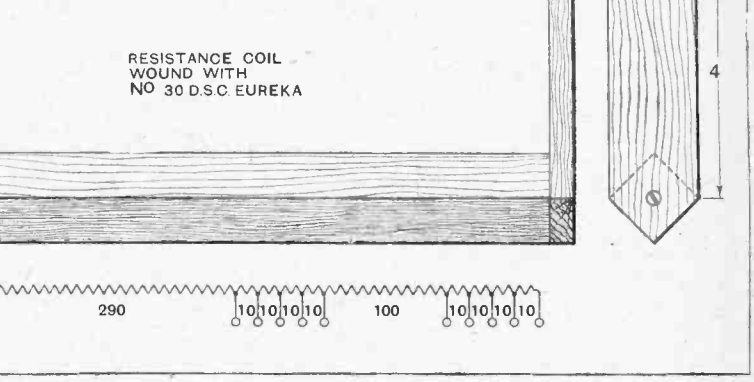
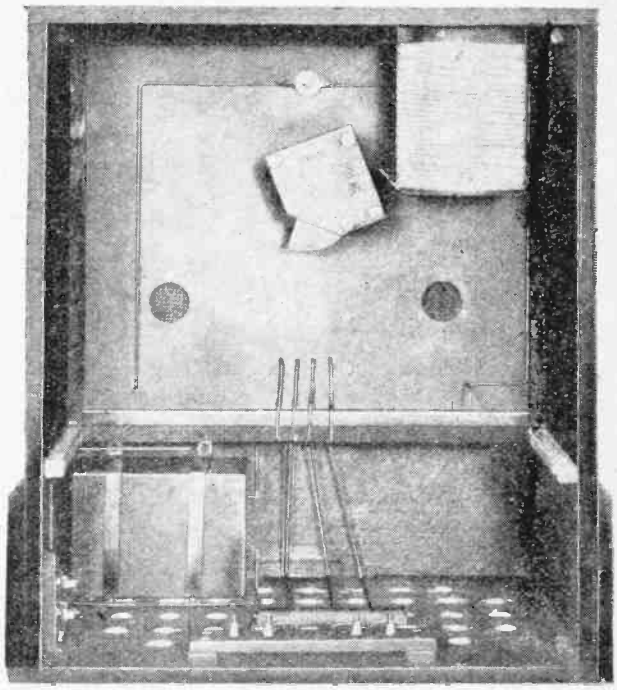


Fig. 3.—Construction of resistance R_5, R_6. The framework is of wood and the wire is wound on with the turns practically touching, taps being taken as indicated when the D.C. mains are of 240 volts.



View of the partly assembled set, showing the position of two connection strips and the 10 mfds. condenser.

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it is not necessary to heat them with the full normal current; they work quite well—in fact, better—when heated by a current of 0.25 ampere. This is an advantage, because the life of a valve is usually determined by the filament heating current. Hence we have so to proportion the resistances R_5 and R_6 that they pass 0.25 ampere.

We will assume the electric mains supply is at 240 volts, and that the current to be passed is 0.25 ampere. The fall in voltage over the filaments is 6 + 1.7 + 1.7 approximately, or, say, 10 volts; the indicating lamp (used to show whether the set is on or not) will take about 3 volts, making the total 13 volts. Now, it has been found that, if the voltage drop across R_6 is made about equal to the voltage of the negative mains to earth, the hum is considerably reduced. This voltage seems to vary between 10 and 20, and R_6 is given such a value that the voltage drop across it may be adjusted between zero and about 20 volts.

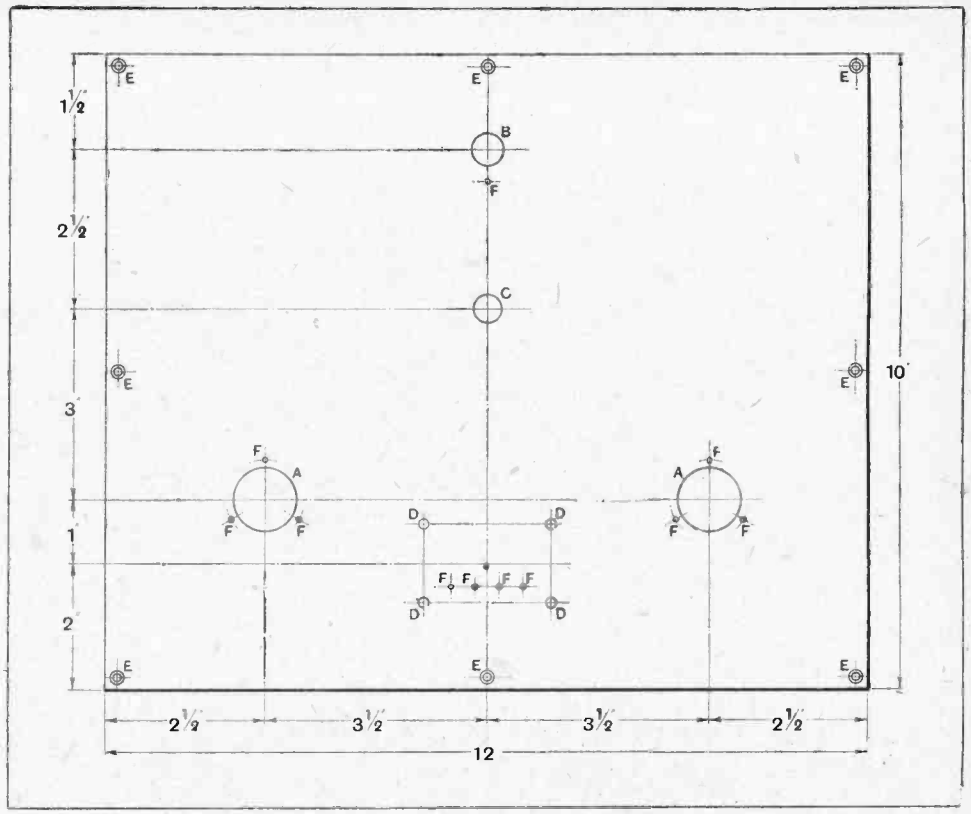

Fig. 4.—The ebonite front panel. This carries the tuning condenser, lamp indicator, double-pole switch and two valve windows. The holes are as follow: A, 1"; B, 1/2"; C, 7/16"; D, 5/32"; E, 1/8", and countersunk for No. 4 wood screws; F, 3/32"

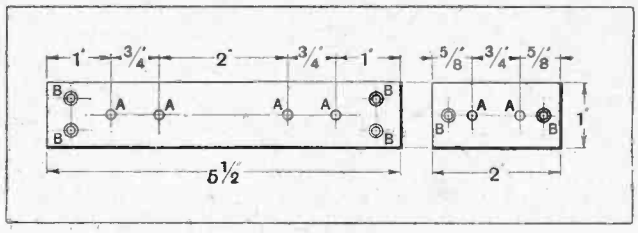

Fig. 5.—Details of connection strips. These are of 1/4" ebonite. A, 5/32"; B, 1/8", and countersunk for No. 4 wood screws.

No. 30 Eureka wire will carry 0.25 ampere continuously without getting hot (it warms up, but only slightly raises the temperature of the lower part of the cabinet). It has a resistance of 5.575 ohms per yard.

The framework which carries the resistance is almost exactly 12in. round; one turn has a resistance of 1.86 ohms, and, when carrying 0.25 ampere, the fall in voltage over one turn is 1.86 × 0.25, or 0.465 volt. Ten turns will therefore absorb 4.65 volts, which is a convenient step for adjusting the filament current. As shown in Fig. 3, R_6 has fifty turns, and can therefore be used to absorb about 23 volts. Resistance R_5 is called upon to absorb 240 − 23 − 13, or about 204 volts, ignoring the effect of the current required for the plate circuits, but it is advisable to include more resistance in R_5 than is represented by this voltage for adjustment purposes.

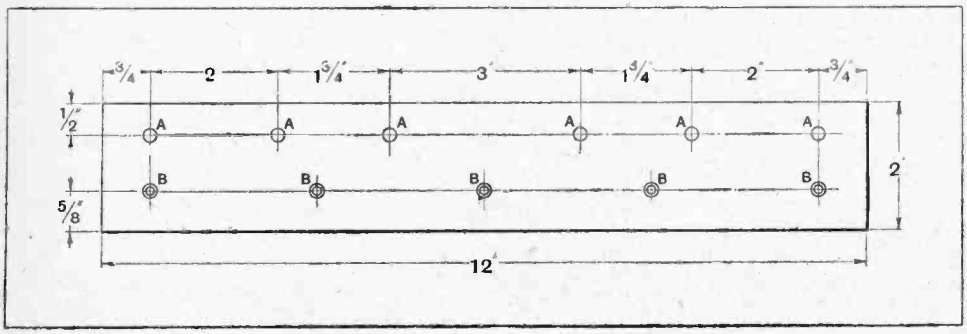

Fig. 6.—Terminal connection strip of 1/4" ebonite. A, 7/32" for terminals; B, 1/8" and countersunk for No. 4 wood screws.

Actually, resistance R_5 has 470 turns, as shown in Fig. 3, and is therefore able to absorb 470 × 0.465, or 218 volts. The coil is tapped by twisting the wire into a loop and removing the insulation at this point.

If valves taking only 0.12 ampere are to be used, No. 36 Eureka wire having a double silk covering can be employed as the resistance. This wire has a resistance of

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14.84 ohms per yard, and the resistance of the wire required is found by dividing the voltage to be wasted by the current. A little larger resistance than this should be provided for safety. Thus, if two-volt valves taking 0.12 ampere are to be used, the resistances can have a minimum value of $\frac{240 - 6}{0.12}$ or, say, 2,000 ohms. This is equivalent to 135 yards, or 405 turns, allowing 1ft. per turn. The resistance R_6 could be given 40 turns and R_5 365 turns with tappings at the end, as in Fig. 3.

For the plate circuit a minimum voltage of 120 is required. This is obtained from tappings starting at turn 290, Fig. 3.

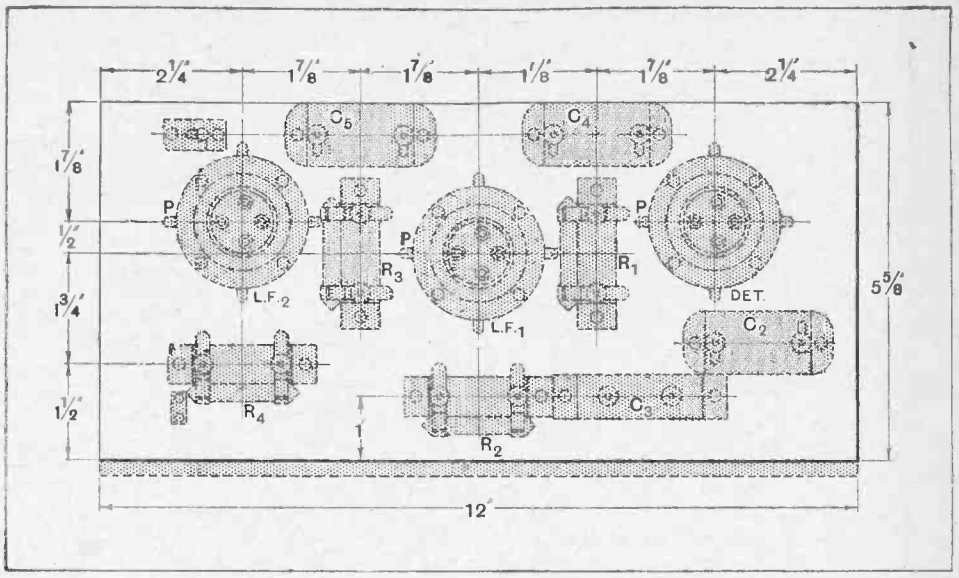
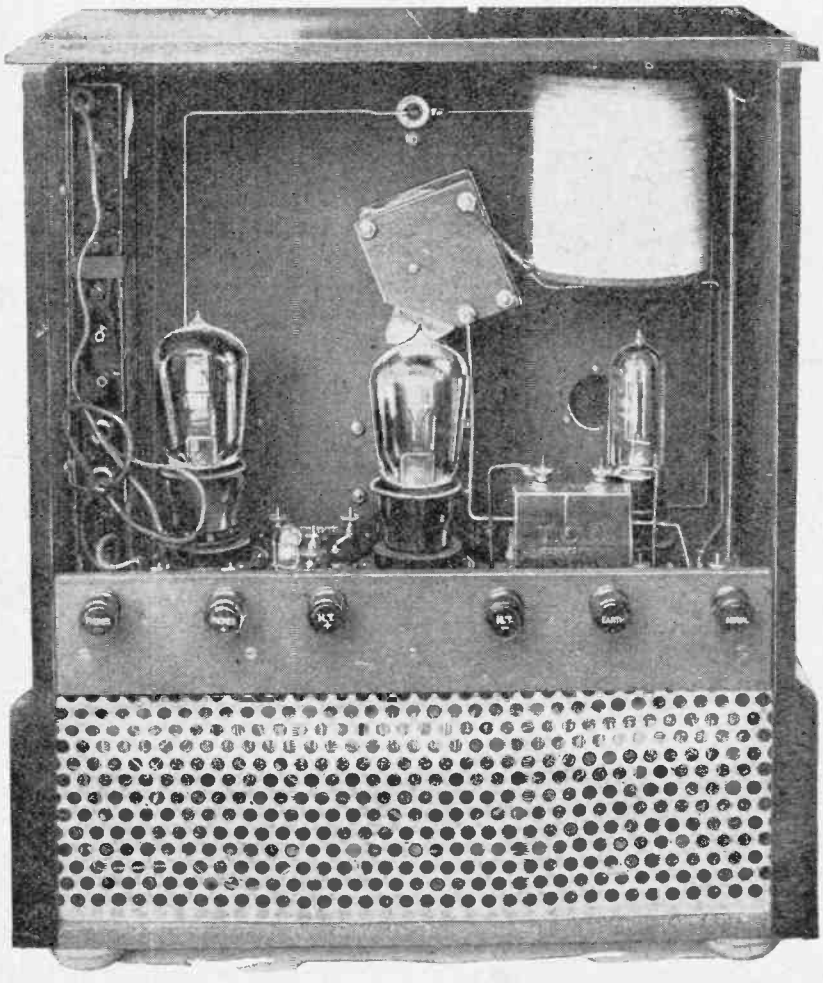


Fig. 7.—Arrangement of parts on the baseboard. This is of 1/2" wood.



Rear view of the completed set, showing the interior. The grid bias battery is on the left.

Referring to Fig. 1 again, it will be noticed that condenser C_6 is employed for smoothing the plate current. The capacity of this condenser is 10 mfds., and renders the receiver perfectly quiet when the resistances R_5 and R_6 have been adjusted. Without this condenser reception is usually rather noisy, a hum being heard.

In some instances it has been found necessary to include a more elaborate smoothing system, comprising choke coils and condensers, but with three valves connected as in Fig. 1 all trace of hum is removed by the condenser C_6 and resistance R_6. Quite apart from considerations of removing hum, the use of a large shunting condenser is to be recommended, as it reduces the coupling between circuits very considerably; its reactance to currents of 100 cycles is only 160 ohms.

Construction of the Set.

The photographs show the appearance of the receiver, from which it will be seen that a few of the parts are mounted on an ebonite panel, others on a wooden sub-panel, while the resistance and 10 mfds. condenser are placed between the sub-panel and the bottom of the cabinet.

On the front panel, which is of ebonite measuring 12in. × 10in. × ¼in., is screwed the tuning condenser, lamp indicator, dial indicator, valve windows, and switch. Details are given in Fig. 4. The parts screwed to the sub-

LIST OF PARTS.

1 0·0005 mfd. Polar Cam vernier condenser.
1 10 mfds. condenser, 300 volt type (T.C.C.).
1 0·5 mfd. condenser, 300 volt type (T.C.C.).
2 Fixed condensers, type 610, 0·005 mfd. (Dubilier).
4 Grid leak holders (Dubilier).
2 1 megohm grid leaks (Ediswan).
2 3 megohm grid leaks (Dubilier).
3 Valve-holders ("Lotus").
1 15 volt, grid bias battery (Ever Ready).
1 Piece ebonite tube, 3in. diameter, 3½in. long.
¼ lb. No. 30 D.S.C. Eureka wire.
½ lb. No. 22 D.C.C. copper wire.
2 Valve windows.
1 Two-way switch (A. F. Bulgin & Co.).
1 Flash lamp type holder, with shade (A. F. Bulgin & Co.).
1 Flash lamp type bulb, 0·4 amp. approximately.
1 Dial indicator.
6 Ebonite shrouded terminals (Belling & Lee, Ltd.).
1 Cabinet ("Camco" Carrington Mfg. Co.).
2 Cosmos SP18 green spot valves (Metro-Vick Supplies).
1 DE5a valve. Marconi or Osram.

Approximate cost, including loud-speaker and valves - - - £11 10s. od.

panel are arranged as in Fig. 7. This is of wood, measuring 12in. × 5⅝in. × ½in. On its back edge is screwed a terminal strip having six terminals, Fig. 6.

Two more connection strips are required; these are shown in Fig. 5, and have screws and connecting tags. They can be seen in the illustration of the partly assembled set, the larger strip being screwed to the bottom of the cabinet and the smaller strip to the side. The position of the 10 mfds. condenser is also shown in this illustration.

For the aerial tuning coil a tube of ebonite 3in. diameter and 3½in. long is wound full of No. 22 D.C.C. wire. This coil is screwed to the top of the cabinet as shown in Fig. 2 and the illustrations.

Resistances R_5 and R_6 have been described, and the framework carrying these resistances is screwed to the

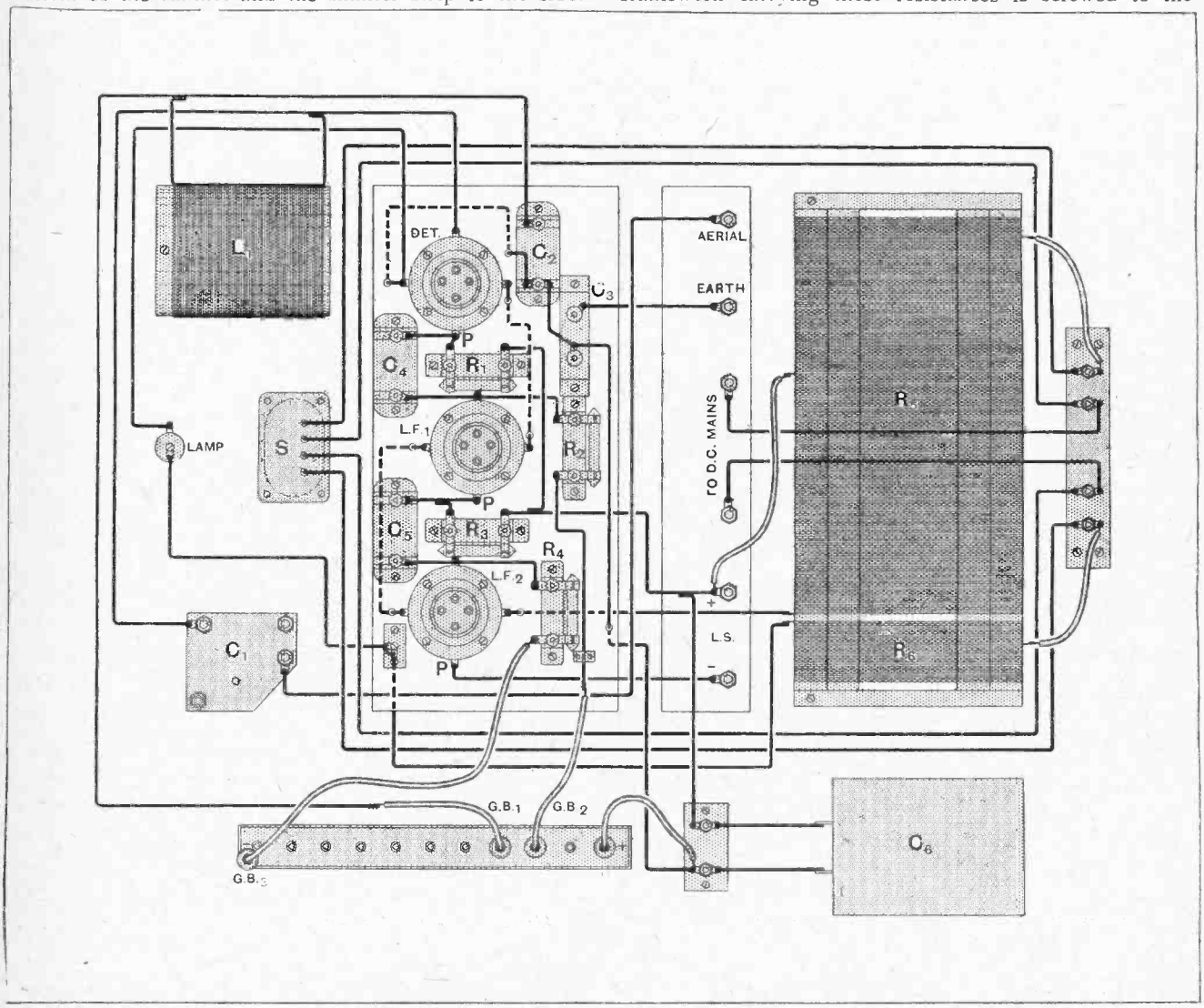


Fig. 8.—Wiring diagram. Several of the wires run beneath the baseboard and long wires are held by cleats.

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lower side of the sub-panel by brass straps, the frame being mounted at an angle. It will be necessary to cut the back of the cabinet to fit, and to obtain a piece of perforated zinc sheet to cover the lower part of the back of the set. Holes should also be drilled in the bottom of the cabinet and four feet be fitted to raise the set.

Fig. 8 is the wiring diagram. Wiring is straightforward except for the flexible wires connecting the grid battery, the positive H.T. to the plate circuits and the two wires connected to taps on R_5 and R_6. The position of these taps will have to be found by experiment. When the set is finished connect an ammeter in series with the mains and adjust the position of the flexible wires connected to R_5 and R_6 and also the H.T. wire. Then set the grid bias, allowing for the fact that the positive end of the grid battery is at negative 1.7 with respect to the first L.F. valve and negative 3.4 to the last valve, it being assumed that the detector and first L.F. valves have a filament voltage of 1.7 each. GB_1 would then be connected to about negative 6 volts, GB_2 to negative 1.5 volts and GB_3 to negative 15.

The receiver is enclosed in a neat cabinet with ample space for the main resistance unit in the base.

If an ammeter is not available for measuring the total current taken from the mains, which, it should be noted, is equal to the sum of the filament current and the plate current (of, say, 12 milliamperes), the exact value of the resistances included in circuit should be found and the current flowing through them estimated as shown above. It is important to note that the voltage indicated by an ordinary voltmeter connected across the valves will be lower than the voltage actually across the valves when the voltmeter is removed, because of the current taken by the voltmeter. The adjustment of the resistances is not critical, and it does not matter whether the voltage of the mains varies by a few per cent. during the day.

The final adjustment of the two resistances is made whilst listening to the loud-speaker, both tappings, on R_5 and R_6, being moved down or up until a minimum of noise is heard. This should also be tested while a carrier wave is being received. Having found the best position for the tappings, the effect of altering the tap connecting the plate voltage to the set should be tried. Inspection will show approximately what voltage is being applied; this need be no higher than that required to give good quality signals. Finally, solder the flexible wires at the tapping points, cover all taps with a piece of insulating tape, and bend them back out of the way.

Amplification Obtained.

When a high resistance is connected in the plate circuit of a valve and no change is made in the plate circuit voltage, the A.C. resistance of the valve increases. A Cosmos SP18 Green Spot, with a plate circuit battery of 120 volts, grid bias of -1.5 volts, and with a resistance of 1 megohm connected, had an A.C. resistance of 140,000 ohms. Hence, if we assume the plate circuit load is resistive only, and has a value of 1 megohm, the voltage amplification obtained is 13, the valve having an amplification factor of 15. The detector amplifies about 9 times, and the last valve (D.E.5a), 3. Thus the total voltage amplification is $9 \times 13 \times 3$, or, say, 350, and if 1.0 volt is applied to the grid of the detector, the voltage across the loud-speaker is probably 35, assuming 10 per cent. modulation, which is a usual value.

The amplification-frequency characteristic of a resistance amplifier such as this is not a straight line, of course, owing to the effect of shunt capacities. These capacities are much larger than is usually supposed, amounting in normal cases to as much as 100 micro-micro-farads. Thus, it is not wise to employ plate circuit resistances of too high a value, or the higher audio-frequency tones will be very seriously weakened. A slight weakening is often beneficial.

READING CIRCUIT DIAGRAMS.

It is safe to say that no one, even superficially interested in wireless matters, can go very far without a knowledge of theoretical circuit diagrams. The series of "Dissected Diagrams" which have been appearing in the "Hints and Tips" section of *The Wireless World* since October 14th, 1925, have, it is hoped, done something towards making the matter clear to some of our newer readers, and, at any rate, may have helped to show that the circuit diagram of a multi-valve set becomes much less terrifying when considered in sections instead of as a whole. Viewed in this light, the subject soon loses its terrors.

The ordinary pictorial plan has proved definitely unsuitable as an aid to the acquisition of this knowledge, and, indeed, too great a reliance, and it is likely to be rather dangerous. It is believed, however, that the sketches given, considered in conjunction with the theoretical circuit diagram, will enable the veriest beginner to gain a sufficient knowledge of the subject to enable him to turn theory into practice. The various stages in wiring are shown "step by step" in the same order as might well be adopted in wiring a receiver.

A few idle moments may profitably be spent by roughly drawing the components on a sheet of paper, preferably in different relative positions to those shown, and then filling in the wiring from the theoretical diagram without reference to the pictorial plan.

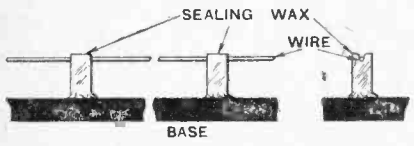
READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

SUPPORTING LONG CONNECTING WIRES.

In multi-valve receivers long internal connecting wires are sometimes unavoidable, and measures must be taken to prevent vibration which might affect reception or even cause a short-circuit.

An effective method of supporting connecting wires running parallel with the baseboard is shown in the diagram. The supports consist of short pillars of sealing-wax. These are fixed to the baseboard immediately under the wire, which is allowed to rest across the top. Heat is then applied to the wire by means of a match or soldering-iron at a point near the wax support. when the heat conducted along the wire will cause it to sink into the wax for a short distance, to be securely held when the wax sets.—A. E. H.



Preventing vibration of long connecting wires.

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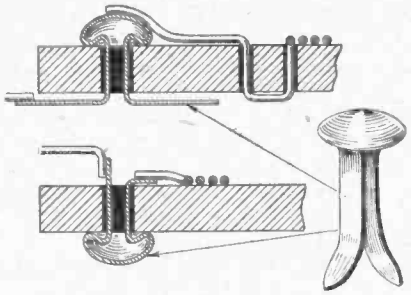
COIL CONNECTIONS.

A useful soldering tag for securing the ends of cylindrical coil windings may be made by attaching one of the ordinary type of paper fasteners shown in the sketch, which also indicates two methods of fixing.

A hole is drilled in each end of the coil former, having a diameter equal to the width of the tag, which can then be securely fastened with a squeeze of the pliers. The end of the coil winding is then soldered to one tag, the other being used for making connection to the rest of the circuit. If two circuit connections are to be taken from one end of the coil, the coil connection should be made to the head of the paper fastener, as shown in the upper sketch.—H. W. K.



Soldering tag for coil connections.

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COMBINED SCREEN AND BALANCER FOR DUAL CONDENSER.

In dual condensers used for tuning adjacent stages of an H.F. amplifier, the moving vanes are generally connected to a point of common H.F. potential, such as +H.T., the fixed vanes being connected to points between which a phase difference exists, *e.g.*, the anodes of adjacent valves.

To prevent interaction through the capacity existing between the two sets of fixed vanes, a small copper screen may be erected. This screen must be connected to a point of fixed potential, and if +H.T. is chosen for this purpose, the screen may be used to perform the function of a balancer, as it will be apparent that the effective capacity of both sections of the dual condenser will be changed as the screen is moved near to or away from a given set of fixed plates.—B. H. C.

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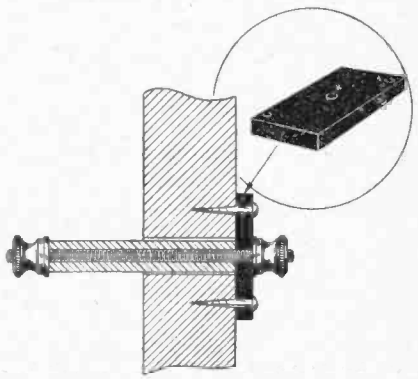
LOOSE LEAD-IN TUBES.

Ordinary lead-in tubes, consisting of a length of ebonite tube, with a screwed rod passing down the centre and terminals at each end, frequently do not fit securely in the hole drilled for them in the window sash. The result is that the tube slides through the hole until either the aerial lead-in or the wire connecting the lead-in with the set, eventually touches the woodwork, with a consequent reduction of the insulation efficiency of the aerial. An efficient method of holding the lead-in tube in position is to clamp a rectangular block of ebonite between one end of the ebonite tube and the base of the terminal. The ebonite block thus forms a flange which may be screwed to the frame work of the window with round-headed wood screws, as shown in the diagram.—A. H. E. A.



Improved method of fixing lead-in tube.

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.

THAT the time has arrived when the experimenter as well as the listener looks to the products of manufacturers with enthusiasm is evidenced in the receiving sets, components, and accessories to be shown at the National Radio Exhibition at Olympia.

It is already realised that the sets both purchased and home-made in the early days of broadcasting no longer represent the best practice, and those listeners who acquired their equipments at the start of broadcasting must now look for something better. The Show this year marks a definite advance in the evolution of a new industry, having passed from an almost experimental stage to the position to-day in which sets and components of proved performance can be offered. The requirements of design are now better understood and the fundamentals more generally mastered.

Although these words are penned by one who derives much pleasure from the making-up of receiving sets, feeling perhaps that by so doing he is producing something better than the market offers, he is forced to realise by the models shown at this year's Exhibition that the status of the manufactured set has rapidly gained ground, and that the component market can only hold its own by creating new parts of outstanding merit. Yet the home constructor will always exist, and during the coming season he will be well catered for with a range of components that will not be rendered quickly obsolete. The requirements of the listener, too, are being met by a range of receiving sets which will not be readily superseded.

NEXT WEEK.

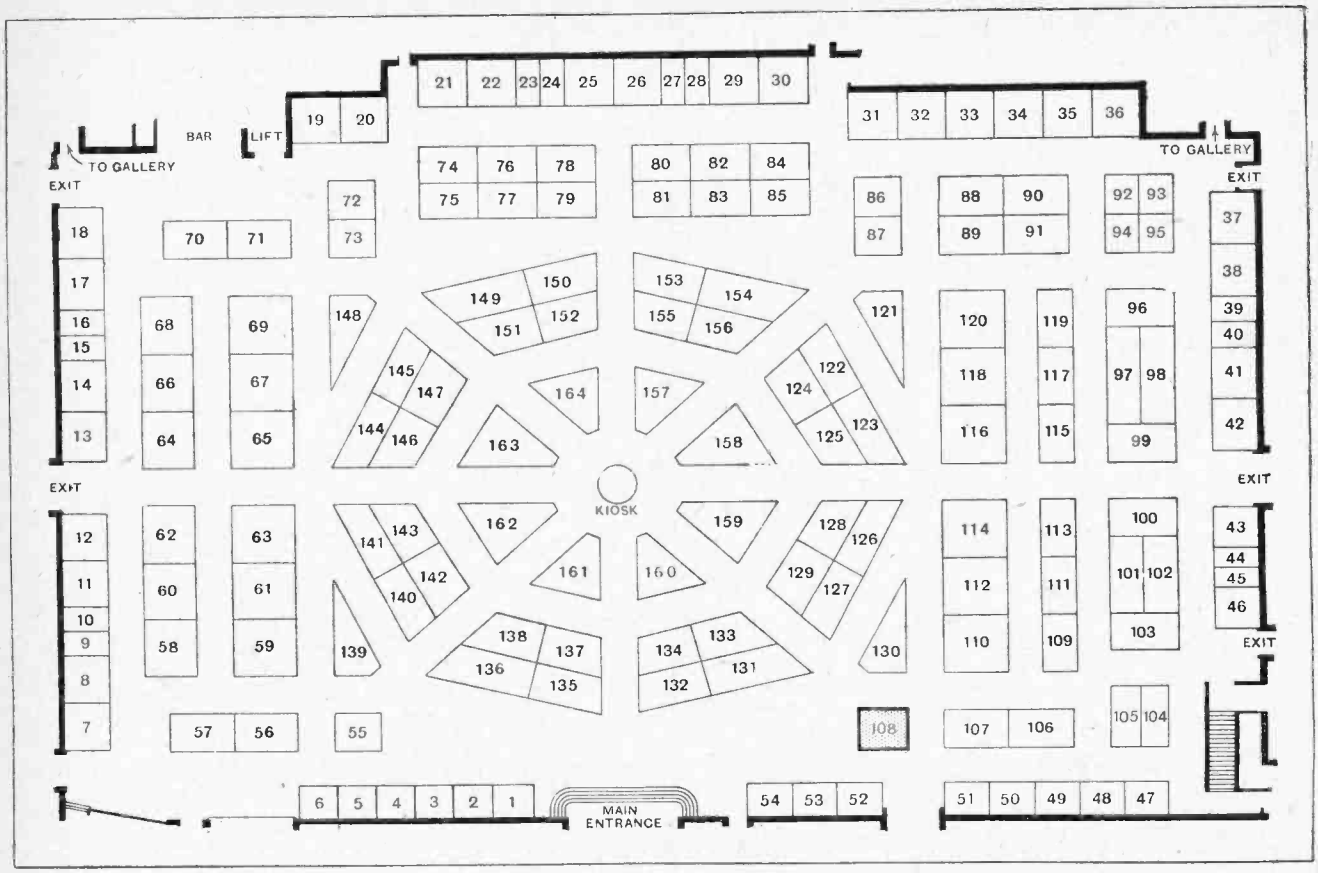
In addition to our usual articles and features we shall include a special

OLYMPIA SHOW REPORT,

describing in detail the principal component exhibits on the Stands.

It is no exaggeration to say that this year's Show at Olympia will be the most important wireless exhibition yet held. There are no fewer than one hundred and eighty exhibitors. Specialised H.F. sets and superheterodynes which at previous exhibitions were experimental in their design are now built in a form representing what has become well-tried and standard practice. H.T. battery eliminators, too, have been developed to perfection during the past few months, and will be shown at many stands, whilst the number of types of high-tension accumulator batteries has considerably increased since last year.

Among apparatus of outstanding interest to be seen on the stands will be the full-wave filamentless rectifying valve for H.T. supply from alternating current mains shown by Burndept Wireless, Ltd. The Bowyer-Lowe Co., Ltd., include in their range of components a bank of variable condensers with single control and balancing adjustments intended for tuning a number of circuits simultaneously. The valve holder of the Benjamin Electric Co., probably more used to-day than any other type, will be shown fitted with grid leak and condenser. Celestion loud-speakers, which in the short time they have been on the market have established a high reputation, are now manufactured in a range of models, one of which embodies the complete receiving set. Battery eliminators and apparatus for constructing them, by Climax Radio Electric, Ltd., will make a strong appeal to the home constructor. A receiving set developed by Felcourt Products, Ltd., is designed to provide a choice of two programmes, and is brought into



operation by press-button switches, while controls are provided for adjusting signal strength. The battery eliminator of Gent and Co., Ltd., should be seen by those interested in H.T. battery substitutes. The home construction of supersonic heterodyne receivers is very much simplified by the supersonic unit made by L. McMichael, Ltd., incorporating the long wave inter-valve couplings and connected up so that, with the addition of the input and oscillator tuned circuits, it constitutes a complete superheterodyne set. The Ormond Engineering Company is still well to the front in the design of variable condensers, and the latest model makes use of brass plates providing straight line frequency tuning.

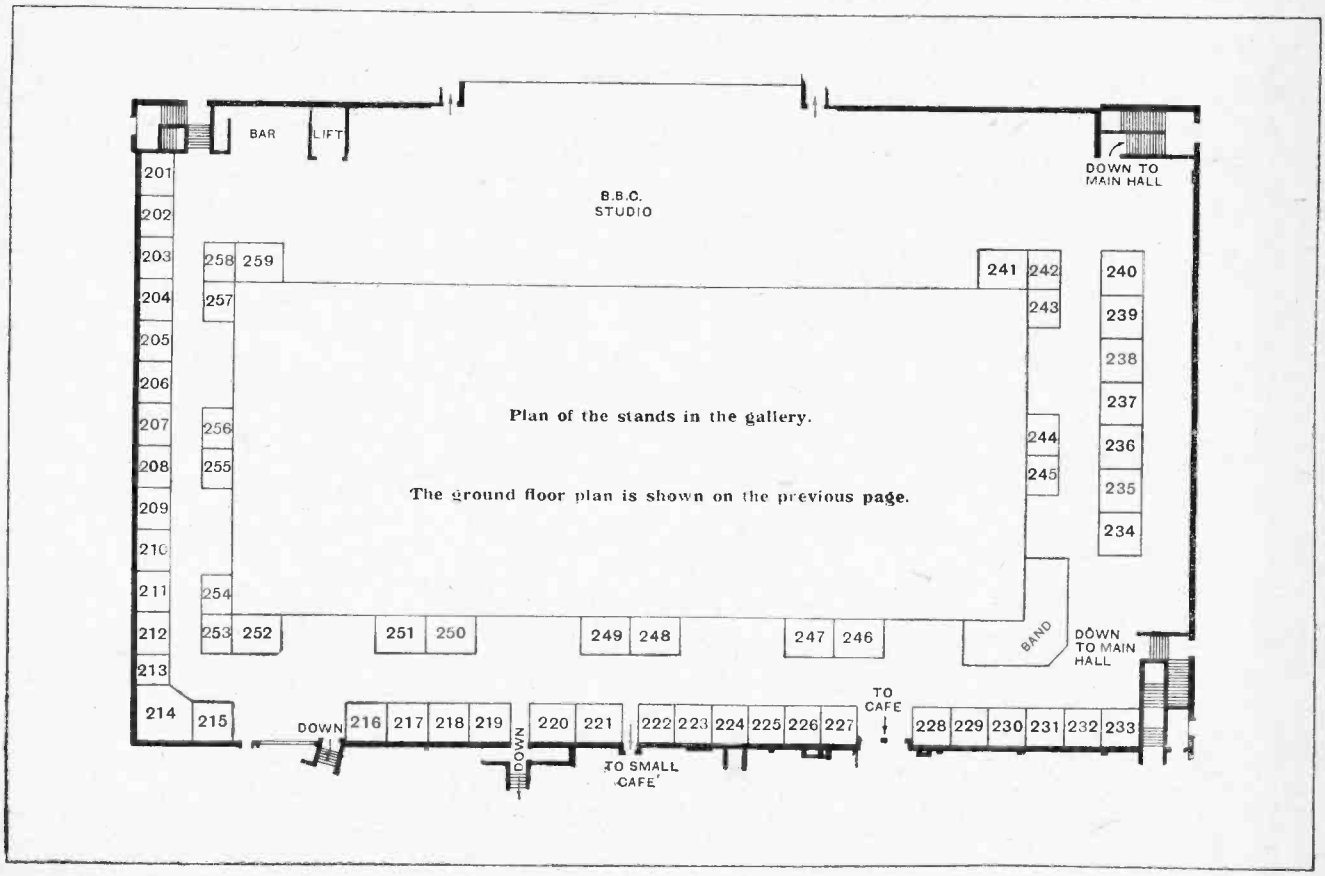
Demonstrations will not be permitted in the Exhibition, and many manufacturers have made arrangements to show their sets and accessories under working conditions in adjoining premises.

EXHIBITION STANDS.

1 Jonathan Fallowfield, Ltd., 61-62, Newman Street, W.1.
2 Detex Distributors, Ltd., 110, Victoria Street, S.W.1.
3 Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, E.C.4 (also 134).
4 Cable Printing and Publishing Co., 7-11, Theobald's Road, W.C.1.
5 Penton Engineering Co., 15, Cromer Street, Gray's Inn Road, W.C.1.
6 London and Provincial Radio Co., Ltd., 22, Colne Lane, Colne, Lancs.
7 Paragon Rubber Manufacturing Co., Ltd., 86, Gray's Inn Road, London, W.C.2.
8 Trader Publishing Co., Ltd., 139-140, Fleet Street, E.C.4.
9 E. K. Cole, 505, London Road, Westcliff-on-Sea.
10 Tudoradio Co., Ltd., Tudor Works, Park Royal, N.W.10.
11 J. W. See and Sons, 12, Earl Street, Maidstone, Kent.
12 Engineering Works (Electrical and General), Ltd., 17-21, Thurlow Park Road, Dulwich, S.E.
13 B.S.A. Radio, Ltd., Small Heath, Birmingham (also 163).
14 C.A.C. Valve Distributing Co., Ltd., 10, Rangoon St., E.C.
15 Blackadda Radio Co., 48, Sadler Gate, Derby.
16 Tunometer Works, Gosford Road, Beccles, Suffolk.
17 British Radio Corporation, Ltd., Weybridge, Surrey.
18 M.P.A. (Wireless), 62, Conduit Street, Regent Street, W.1 (also 65 and 67).
19 Wates Bros., Ltd., 12-14, Great Queen Street, W.C.
20 Autoveyors, Ltd., 84, Victoria Street, S.W.1.
21 and 22 Hobday Bros., Ltd., 21-27, Gt. Eastern Street, E.C.
23 Westam Accumulator Co., 355, Katherine Road, E.7.
24 Felcourt Products, Ltd., Greater Felcourt, E. Grinstead.
25 and 26 A. J. Dew and Co., 33-34, Rathbone Place, W.1.
27 Clayton Rubber Co., Ltd., Progress Works, Croft Street, Clayton, Manchester.
28 Celestion Radio Co., 29-31, High Street, Hampton Wick, Kingston-on-Thames.
29 and 30 East London Rubber Co., 29-33, Great Eastern Street, E.C.
31 Trelleborg Ebonite Works, Ltd., Audrey House, Ely Place, Holborn Circus, E.C.
32 Radiax, Ltd., 16, Palmer Place, Holloway, N.
33 and 34 Sun Electrical Co., Ltd., 118, Charing Cross Rd., W.C.
35 Ormsby and Co., Ltd., 10, New Oxford Street, W.C.1.
36 Varley Magnet Co., Granville House, Arundel St., W.C.
37 Thomas De la Rue and Co., Ltd., 110, Bunhill Row, E.C.
38 Electron Co., Ltd., 180, Regent Street, W.1.
39 Whittingham, Smith and Co., St. Mary's Sq., Ealing, W.
40 Lisenin Wireless Co., 1a, Edgware Road, London, W.2.
41 Wingrove and Rogers,
42 William Bullen, 38, Holywell Lane, Great Eastern Street, E.C.2.

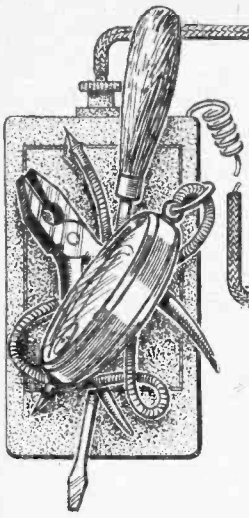
Guide to the Show.—

43 A. J. Stevens and Co. (1914), Ltd., Walsall Street, Wolverhampton (also 116).
44 Colonial Technical Press, Ltd., 36, Southampton Street, Strand, W.C. (also 232).
45 H. Quartermaine, Bath Road, Woking, Surrey.
46 Cleartron Radio. Ltd., 1. Charing Cross, S.W. (also 135).
47 Odhams Press, Ltd., 93, Long Acre, W.C.2.
48 Service Radio Co., Ltd., 67, Church Street, N.16.
49 The Radolian Co., Market Chambers, Watford.
50 Watmel Wireless Co.. Ltd., 332a, Goswell Road, E.C.1.
51 Collinson Precision Screw Co., MacDonald Road, E.17.
52 Masson, Seeley and Co., Ltd., Masseeley Building, Howick Place, Westminster, S.W.1.
53 H. J. Galliers 32, St. James's Street, Brighton.
54 J. J. Eastick and Sons, Eelex House, Bunhill Row, E.C.1 (also 231).
55 Eagle Engineering Co , Ltd., Eagle Works, Warwick.
56 Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.
58 British Electrical Sales Organisation, 623, Australia House, W.C.2.
59 Halcyon Wireless Supply Co., Ltd., 110. Knightsbridge, S.W.1.
60 Alphian Wireless, Ltd., 99, Mortimer Street, Regent Street, London, W.1.
61 General Electric Co., Ltd., Magnet House, Kingsway, W.C.2 (also 63 and 214).
62 Retrosonic. Ltd , Victoria Works, Millhouses, Sheffield.
63 General Electric Co., Ltd., Magnet House. Kingsway, W.C.2 (also 61 and 214).
64 New London Electron Works, Ltd., East Ham, E.6.
65 M.P.A. (Wireless), 62, Conduit Street, Regent Street, W.1 (also 67 and 18).
66 New London Electron Works, Ltd., East Ham, E.6.
67 M.P.A. (Wireless), 62, Conduit Street, Regent Street, W.1 (also 65 and 18).
69 Houghton-Butcher (Great Britain), Ltd., 88-89, High Holborn, W.C.1.
70 Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Road, N.1.
71 Stratton and Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.
72 and 73 Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4
74 Wilkins and Wright, Ltd., Kenyon Street, Birmingham.
75 Edison Bell, Ltd., Edison Bell Works, S.E.15.
76 Bedford Electrical and Radio Co., Ltd., 3-22, Campbell Road, Bedford.
77 Sylvex, Ltd., 144, Theobald's Road, W.C.1.
78 Formo Co., Crown Works, Cricklewood, N.W.2.
79 William Dibben and Sons, St. Mary's Road, Southampton.
80 H. Clarke, Ltd., Atlas Works, Eastnor, Old Trafford, Manchester.
81 British Ebonite Co., Ltd., Hanwell, W.7.
82 Neutron, Ltd., Sentinel House, Southampton Row, W.C.1.
83 Beard and Fitch, Ltd., 34, Aylesbury Street, Clerkenwell, E.C.
84 Garnett Whiteley and Co., Ltd., Lotus Works, Broadgreen Road, Liverpool.
85 Cahill and Co., Ltd., 64, Newman Street, W.1.
86 and 87 A. C. Cossor, Ltd., Highbury Grove, N.5.
88 Sel-Ezi Wireless Supply Co., Ltd., 6, Greek Street, W.1
89 Radi-Arc Electrical Co., Ltd., Bennett St., Chiswick, W.4.
90 Gambrell Bros., Ltd., Merton Road, Southfields, S.W.18.
91 W. G. Pye and Co., Montague Road, Cambridge.
92 Ripaults, Ltd., King's Road. N.W.1.
93 Bretwood, Ltd., 12-18, London Mews, Maple Street, W.
94 Redfern's Rubber Works, Ltd., Hyde, near Manchester.
95 Camden Engineering Co., Ltd., Bayham Place, N.W.1.
96 Pettigrew and Merriman (1925), Ltd., 122-124, Tooley Street, S.E.1.
100 Ever Ready Co. (Gt. Britain), Ltd., Hercules Place, Holloway, N.7.
102 Cleartron Wireless Sets, Ltd., 1, Charing Cross, S.W.
103 General Radio Co., Ltd., 235, Regent Street, W.1.
104 "D.P." Battery Co., Ltd., Bakewell, Derbyshire.
105 Benjamin Electric, Ltd., Tariff Road, Tottenham.



Guide to the Show.—

106 Gilfillan Bros., Ltd., 63, High Holborn, W.C.1.
107 Portable Utilities Co., Ltd., Fisher Street, W.C.2.
108 *Wireless World*, Iliffe and Sons, Ltd., Dorset House, Tudor Street, E.C.4.
109 Telegraph Condenser Co., Ltd., Wales Farm Road, N. Acton, W.3.
110 Fellows Magneto Co., Ltd., Cumberland Avenue, Park Royal, Willesden, N.W.10.
111 Burne-Jones and Co., Ltd., 296, Borough High St., S.E.1.
112 Oxford Wireless Telephony Co., Ltd., 22-29, Queen Street, Oxford.
113 Primus Manufacturing Co., Ltd., 114-115, Great Saffron Hill, E.C.1.
114 Falk, Stadelmann and Co., Ltd., 83-93, Farringdon Rd., E.C.
115 Gent and Co., Ltd., 25, Victoria Street, S.W.1.
116 A. J. Stevens and Co. (1914), Ltd., Walsall Street, Wolverhampton (also 43).
117 Wireless League, Chandos House, Palmer Street, Victoria Street, S.W.1.
118 Hart Collins, Ltd., 38a, Bessborough Street, S.W.1.
119 Automatic Coil Winder and Electrical Equipments Co., Ltd., Wellington House, Buckingham Gate, S.W.1.
120 Brown Bros., Ltd., 20, Great Eastern Street, E.C.2.
121, 122, 123, 124 and 125 Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1 (also 220).
126 Bowyer-Lowe Co., Ltd., Radio Works, Letchworth, Herts.
127 British Thomson-Houston Co., Ltd., Alma Street, Coventry (also 130).
128 and 129 S. G. Brown, Ltd., Western Avenue, North Acton, W.3.
130 British Thomson-Houston Co., Ltd., Alma Street, Coventry (also 127).
131 and 132 Alfred Graham and Co., St. Andrew's Works, Crofton Park, S.E.4.
133 Auto Sundries, Ltd., 10a, Lower Grosvenor Place, S.W.1.
134 Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, E.C.4 (also 3).
135 Cleartron Radio, Ltd., 1, Charing Cross, S.W. (also 46).
136 Muliard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, Balham, S.W.12 (also 138).
137 Ericsson Telephones, Ltd., 67-73, Kingsway, W.C.2.
138 Mullard Radio Valve Co., Ltd., Nightingale Works, Nightingale Lane, Balham, S.W.12 (also 136).
139 Britain's Best Crystal, Ltd., 170, Garratt Lane, S.W.18.
140 and 141 Burndept Wireless, Ltd., Eastnor House, Blackheath, S.E.3 (also 144, 209).
142 L. McMichael, Ltd., Wexham Road, Slough.
143 Brownie Wireless Co. (of G.B.), Ltd., 310-312a, Euston Road, N.W.1.
144 Burndept Wireless, Ltd., Eastnor House, Blackheath, S.E.3 (also 140, 141 and 209).
145 Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C. (also 147).
146 Rotax (Motor Accessories), Ltd., Willesden Junction, N.W.10 (also 212).
147 Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, W.C. (also 145).
148 Climax Radio Electric, Ltd., Quill Works, Quill Lane, Putney, S.W.15.
149 Radio Communication Co., Ltd., 34-35, Norfolk Street, Strand, W.C.2.
150 Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, Fleet Street, E.C. (also 152).
151 Cables and Electrical Supplies, Ltd., 234, Pentonville Road, N.1.
152 Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, Fleet Street, E.C. (also 150).
153 Selfridge and Co., Ltd., 400, Oxford Street, W.1.
154 Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, W.3.
155 Siemens Bros. and Co., Ltd., Caxton House, Westminster, S.W.1.
156 A. W. Gamage, Ltd., Holborn, E.C.1.
157 Brandes, Ltd., 296, Regent Street, W.1.
158 Chloride Electrical Storage Co., Ltd., 219-229, Shaftesbury Avenue, W.1 (also 233).
159 Peter Curtis, Ltd., 11, Red Lion Square, W.C.1.
160 Lissen, Ltd., 18-22, Friars Lane, Richmond, Surrey.
161 Peto-Scott Co., Ltd., 77, City Road, E.C.1 (also 259).
162 Metro-Vick Supplies, Ltd., Trafford Park, Manchester.
163 B.S.A. Radio, Ltd., Small Heath, Birmingham (also 13).
164 C. A. Vandervell and Co., Ltd., Warple Way, Acton, W.3 (also 210).
201 Worsnop and Co., Ltd., Victoria Street, S.W.1.
202 Rectalloy, Ltd., Vulcan House, 56, Ludgate Hill, E.C.4.
203 A. Hinderlich, 1, Lechmere Road, N.W.2.
204 The Lithanode Co., Ltd., 190, Queen's Road, S.W.8.
205 George Bowerman, Ltd., 10 & 12, Ludgate Hill, E.C.4.
206 Finston Manufacturing Co., Ltd., 45, Horseferry Road, S.W.1.
207 Belling and Lee, Ltd., 1, Queensway, Ponders End, Middlesex.
208 Radio Reception Co., 110, Wilton Rd., Victoria Station, S.W.
209 Burndept Wireless, Ltd., Eastnor House, Blackheath, S.E.3 (also 140, 141, 144).
210 C. A. Vandervell and Co., Warple Way, Acton, W.3 (also 164).
211 Louis H. Reid and Co., 32, Victoria Street, S.W.1.
212 Rotax (Motor Accessories), Ltd., Willesden Junction, N.W.10 (also 146).
213 Universal Bracket Co., Alpine Steelworks, East Molesey, Surrey.
214 General Electric Co., Ltd., Magnet House, Kingsway, W.C.2 (also 61, 63).
215 Reflex Radio Co., Ltd., 102, High St., Stoke Newington.
216 London Electric Wire Co. and Smiths, Ltd., 7, Playhouse Yard, Golden Lane, E.C.
217 St. Helen's Cable and Rubber Co., Trading Estate, Slough, Bucks.
218 Sydney Jones and Co. (London), Ltd., Dudley House, 28, Endell Street, W.C.2.
219 W. and T. Lock, Lower Bristol Road, Bath.
220 Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1 (also 121, 122, 123, 124, 125).
221 Manufacturers' Accessories Co., Ltd., 85, Great Eastern Street, E.C.2.
222 Spring Washers, Ltd., Eagle Works, Alexandra Street, Wolverhampton.
223 The M.A.P. Co., 246, Great Lister Street, Birmingham.
224 Wright and Weaire, Ltd., 740, High Rd., Tottenham, N.7.
225 Clarke Bros. (Leicester), Ltd., Victoria Passage, London Road, Leicester.
226 The Econasign Co., 94, Jermyn Street, Piccadilly, S.W.
227 M. Raybould, 37, Clapham Road, S.W.9.
228 R. F. Graham and Co., 101, Gloucester Road, Kingston-on-Thames.
229 Wireless Apparatus, Ltd., 35, Panton St., Haymarket, S.W.
230 Webb Condenser Co., 24, Hatton Garden, E.C.1.
231 J. J. Eastick and Sons, Eelex House, Bunhill Row, E.C. (also 54).
233 Chloride Electrical Storage Co., Ltd., 219-229, Shaftesbury Avenue, W.1 (also 158).
234 British Radio Manufacturers, 61, Borough Road, S.E.1.
235 Jackson Bros., 8, Poland Street, W.1.
236 Donotone Loud-Speaker Co., Sentinel House, Southampton Row, W.C.1.
238 A. H. Clackson, Ltd., 119, Fleet Street, E.C.4.
239 Radio Society of Great Britain, 53, Victoria Street, S.W.1.
240 International Electric Co., Ltd., 161a-166, Strand, W.C.2.
241 Amplion Magazine, 25-26, Savill Row, Regent Street, W.1.
242 W. J. Henderson and Co., Ltd., 351, Fulham Rd., S.W.
243 Darimont Electric Batteries, Ltd., Darimont Works, Abbey Road, Park Royal, N.W.10.
244 & 245 Wireless Association of Great Britain, Ltd., 7, Southampton Street, W.C.2.
248 Rees Mace Manufacturing Co., Ltd., 39, Welbeck St., W.1.
249 Batteries, Ltd., Redditch.
252 Le Carbone, Coventry House, South Place, E.C.2.
253 S. A. Lamplugh, Ltd., King's Road, Tyseley, Birmingham.
254 Rooke Bros., 55, Cardington Street, Euston, N.W.
255 Cantophone Wireless Co., Remo House, 310, Regent Street, Oxford Circus, W.1.
256 Goswell Engineering Co., White Lion Street, N.1.
257 Langham Radio, 3-4, Langham Place, W.
258 London Electric Stores, Ltd., 9, St. Martin's Street, Leicester Square, W.C.2.
259 Peto Scott Co., Ltd., 77, City Road, E.C.1 (also 161).



PRACTICAL HINTS & TIPS

A Section Mainly for the New Reader.

DISTANT CONTROL OF VOLUME.

It is often found that a greater degree of amplification is necessary for the reproduction of speech than for music, particularly when the latter is deeply modulated. Thus, if a set is adjusted to give comfortably loud signals on speech, it may be found that distortion is present on loud musical items, either due to overloading of the loud-speaker or the valves. The trouble would seem to lie partly with the loud-speaker itself, as it is often more sensitive to the higher frequencies than to the lower, and reproduces them with greater loudness.

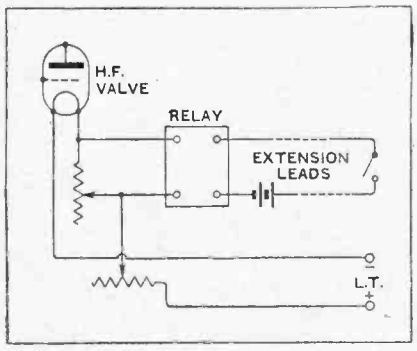


Fig. 1.—Distant control of filament brilliancy.

Some form of volume control, to meet varying conditions of transmission, is a refinement which will be found of use, and is fairly easily arranged for when the receiver and loud-speaker are installed in the same room. When a long extension lead is fitted, however, the choice of a suitable device becomes more difficult. The expedient of shunting the loud-speaker terminals with a variable non-inductive resistance is the most obvious and simplest method, and is, indeed, fairly satisfactory in practice. Unfortunately, however, if the set is so adjusted that the last valve is normally working near to the limit of its power-handling capacity, the application to its grid of high voltage swings corresponding to exceptionally loud musical passages will cause a form of distortion which is in no way compensated for by lessening the sensitivity of the loud-speaker by a reduction of the shunting resistance.

Under such circumstances, it is desirable to provide some form of distant control whereby the overall sensitivity of the set itself may be reduced; when it comprises a high-frequency amplifying valve, one of the most convenient ways of doing this is to dim its filament. When a valve of very low consumption, with an L.T. battery having a considerable excess voltage, is used, it may be permissible to connect its filament rheostat at the end of a long extension lead, but the drop in voltage in this lead will generally be excessive, and some form of relay becomes necessary. This may be connected as shown in Fig. 1, where it is arranged to short-circuit an extra filament rheostat, which is inserted in series.

To avoid an excessive consumption from the local battery, the relay may be of the ratchet-operated type, as sold for distant control of the filament circuit, which only requires a momentary current. The circuit is completed and broken by alternate contacts of the distant switch.

REACTION IN A NEUTRALISED H.F. AMPLIFIER.

The provision of reaction in a set with neutralised H.F. amplification presents some little difficulty, particularly when ready-made components are used. Opinion seems to be divided as to whether this extra control is necessary, but there can be little doubt that, in a single-stage set, followed by grid rectification, its use will result in a considerable increase in sensitivity. The anode rectifier, on the other hand, imposes very little damping on the tuned transformer, and, generally speaking, sufficient control of regeneration is provided by partial de-neutralisation; thus any additional device will be almost superfluous. This gain in

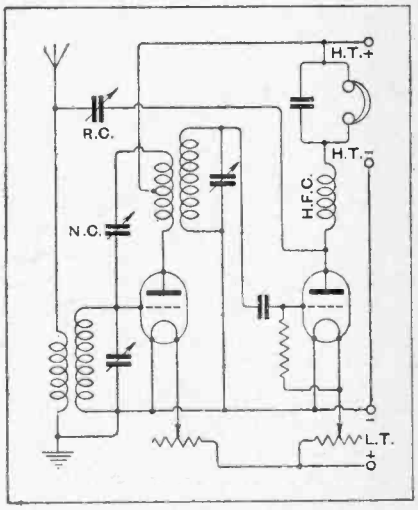


Fig. 2.—Capacitative control of reaction.

simplicity is, however, only at the expense of that reduced sensitivity to feeble signals which is inherent in the " bottom bend " detector.

When reaction is desired, the method shown in Fig. 2, which requires no extra coils, may be adopted, provided that the usual form of "untuned" aerial coupler is used. It is essential, however, that the primary winding which acts both as aerial and reaction coil should be wound in the correct magnetic sense with relation to the secondary. Fortunately, however, if an existing component is found, on trial, to fail in this respect, it will be a fairly easy matter to rewind the aerial coil.

The size of the reaction condenser (R.C. in the diagram) will depend on such factors as the inductance of the primary and the coupling between it and the secondary, as well as on the damping present in the various circuits. Its capacity will generally be small, and a vernier condenser should be tried.

o o o o

TESTING A NEW RECEIVER.

The advantage of obtaining a strong incoming signal when making initial adjustments to a set has already been mentioned in these notes. It was pointed out that the tracing of the small faults which are apt to exist in a newly constructed frame aerial receiver is greatly facilitated by connecting an aerial to the grid circuit of the first H.F. valve.

The same remarks apply, of course, to the set designed for operation on a normal aerial. The strong signals thus provided will help us to locate the more obvious type of fault, but are often a distinct handicap when making adjustments and tests of the H.F. amplifier. This latter may be almost or even totally ineffective, in spite of the fact that signals from a local station are apparently all they should be. This part of the instrument may conveniently be tested by entirely disconnecting the main aerial and substituting in its stead a short indoor aerial, of a length depending on the distance from the local station. This should give a weak signal, more or less comparable in intensity with that to be expected from a distant transmitter, but having the advantage that it is constant and not subject to fading effects. Furthermore, if the set is inadvertently allowed to burst into oscillation, the risk of causing interference will be reduced.

While working the set under these conditions, it is possible to observe the effect of various alterations and adjustments with a much higher degree of certainty than when a very strong signal is being applied, as the human ear is more easily able to appreciate small differences of intensity when dealing with feeble signals than with those which are perhaps deafeningly loud.

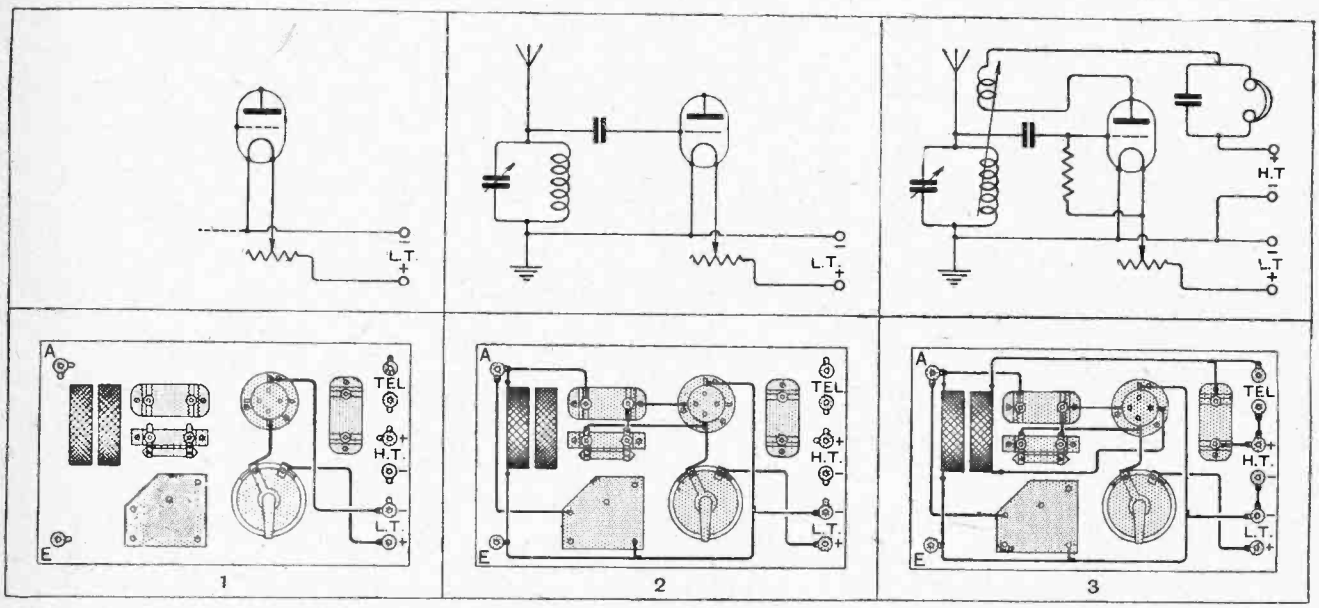
A word of warning should be added for the benefit of those testing an unscreened receiver in the immediate vicinity of a powerful transmitting station, as it may happen that the energy picked up directly by the coils and their associated wiring is comparable with that received by a very short aerial. This will obviously lead to complications, but it is fairly easy to decide, by a test without any aerial, whether these conditions exist.

DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 42.—A Single-valve Regenerative Receiver.

In a series of diagrams, of which the first appears below, it is hoped to make clear the steps to be taken in converting theory into practice in the construction of various typical receivers. The simple arrangement of valve detector with reaction, although lacking in selectivity, is an excellent circuit for the beginner.



The valve, with its filament heated by an L.T. battery through a variable resistance.

A tuned circuit, across grid and filament, is connected to aerial and earth.

The anode circuit is completed through the reaction coil, phones, and H.T. battery.

H.T. BATTERY ELIMINATOR

TWO VOLTAGE FOR A.C. SUPPLY

Easy and Inexpensive Construction is a Feature of this Eliminator, which a Novel Method is used for Providing Two Output Voltages.

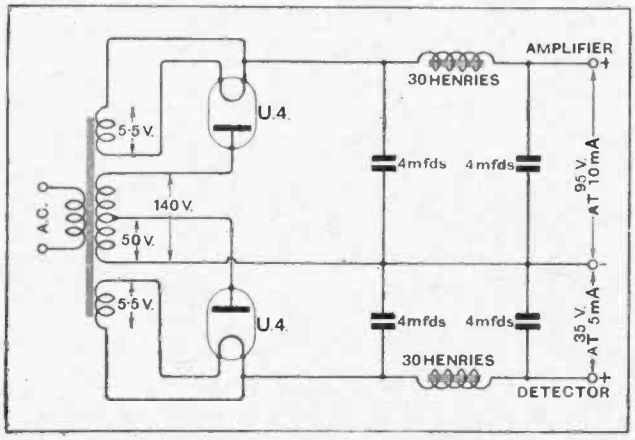
By F. H. HAYNES.

IN predicting that during the coming season most wireless users will have substituted their batteries with apparatus for deriving suitable current from the household electric supply, one does not feel that the case is being over-stated.

Batteries *v.* Eliminators.

With the exacting requirements of the modern multi-valve receiver as regards filament and plate potentials, the drawbacks of the accumulator and dry cell battery have been brought into evidence, apart from their high running and maintenance costs and inconvenience generally. The dry cell high-tension battery is unsatisfactory owing to its high internal resistance, the fluctuation of voltage over a wide range which occurs during its life, and the fact that it is usually rendered useless by an individual cell becoming faulty. High-tension accumulator batteries, owing to their small ampere-hour capacity, are difficult to charge, and, with a low insulation leakage path created by acid spray, often become discharged when not in use, and readily corrode. The H.T. accumulator battery is a good proposition if—and only if—facilities exist for keeping it properly charged and the terminals and connecting bars kept scrupulously clean. Unlike the dry cell battery, its potential will not fluctuate in use if kept in good trim. From the point of view of cost the H.T. battery eliminator, working from either alternating or direct current mains, undoubtedly has the advantage over any other method of obtaining high-tension supply.

The interest which has been taken in articles on battery eliminator construction which have recently appeared in these pages, has evidenced the demand for inexpensive apparatus, easy to make and of exemplary performance.



TWO-VOLTAGE A.C. RECTIFIER. Probably the best method of providing two output potentials consists of duplicating the rectifying apparatus. The filaments of the rectifying valves are separately heated from independent windings, and two potentials for the plates are obtained by a tapping point on the coil connecting to the anodes. Two smoothing circuits are required, the inductances and condensers being larger than those used in a full wave rectifier

Rectification by means of the valve is undoubtedly the best way of obtaining a continuous current from an alternating supply, and although in the near future other forms of rectifier may make their appearance, the writer is of opinion that the valve for some time to come will not be surpassed in economy and efficiency.

Problem of Two-voltage Output.

Any battery substitute must provide for giving two output voltages to suit the various valves of the receiver, and this may be accomplished by one of three methods:

(1) By shunting the rectified output from the valves across a resistance and stepping off along that resistance suitable potentials.

(2) By dividing the output into two paths; a high resistance being interposed in one of them across which a part of the maximum output voltage is dissipated; and

(3) The adoption of two independent rectifiers fed with different input potentials.

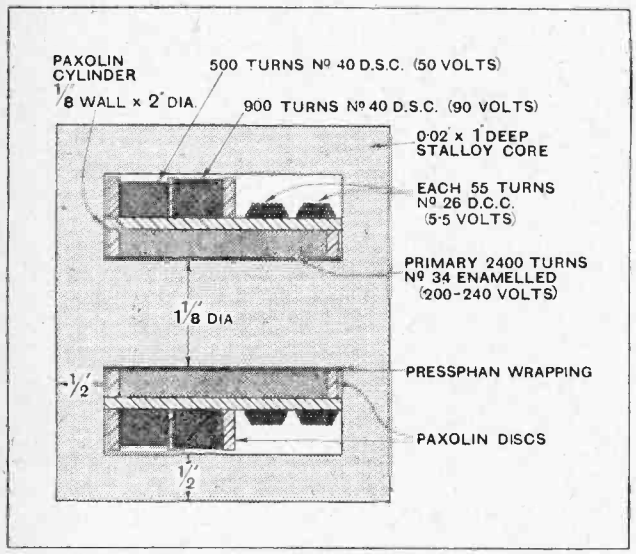
Method (1) suffers from the defect that far more power is absorbed in the shunt potentiometer than is used to operate the receiving set. The equipment of the smoothing circuit, if connected in front of the potentiometer, must be liberal owing to the heavy current and the high voltage with which it has to deal, or, on the other hand, two independent sets of smoothing apparatus may be connected in the two output leads. The heavy load created by the potentiometer, moreover, tends towards the reduction in the life of the rectifying valves. The second method, although the most economical, can only be recommended when the resistance by which the voltage drop is obtained is capable of somewhat critical adjustment. The actual potential delivered is not determined by the value of the resistance, but by the resistance of the anode circuit

H.T. Battery Eliminator.—

and its valve. A single smoothing circuit handling only the output current is a merit of the method.

Two Unit Rectifier.

The most practical system is (3), in which two separate rectifiers are used, each capable of giving an output current far in excess of that passed by the receiver and adjusted to normal voltages, which are maintained on load. The disadvantages are that the two rectifiers need separate filament heating windings on the power transformer, while two outputs are required on the plate potential winding, in addition to which both the rectifying and smoothing apparatus is duplicated. The rectifiers are working on small load, however, and the smoothing equipment only handles the small output current.



TRANSFORMER DATA. The primary is covered by a Paxolin tube, upon which the filament heating and anode coils are wound. Although arranged side by side, the filament windings must be carefully insulated from each other owing to the difference of potential which exists between them.

Half- or Full-wave Rectification?

Constructional details are given of a rectifier built on the latter principle. In developing the design, careful consideration was given to the question of providing either half- or full-wave rectification. The higher the frequency, obviously the easier it is to obtain a smooth output, the frequency of the rectified pulses being double in the case of a full-wave rectifier as compared with the half-wave arrangement, while the potential drop through the two rectifying valves (or double-anode valve) is halved. Four half-wave rectifying valves are, of course, needed in a double full-wave rectifier, which, apart from being expensive to build and maintain, consumes more current by way of filament heating as compared with a double half-wave rectifier, and even in the latter type the power consumed for filament heating is nearly twice that delivered to the anode circuits.

Provided that the smoothing chokes are of high inductance, which is easily possible, as the small current passed permits of the use of a fine wire winding and the shunt condensers are of liberal capacity, the half-wave rectifier is an entirely satisfactory proposition

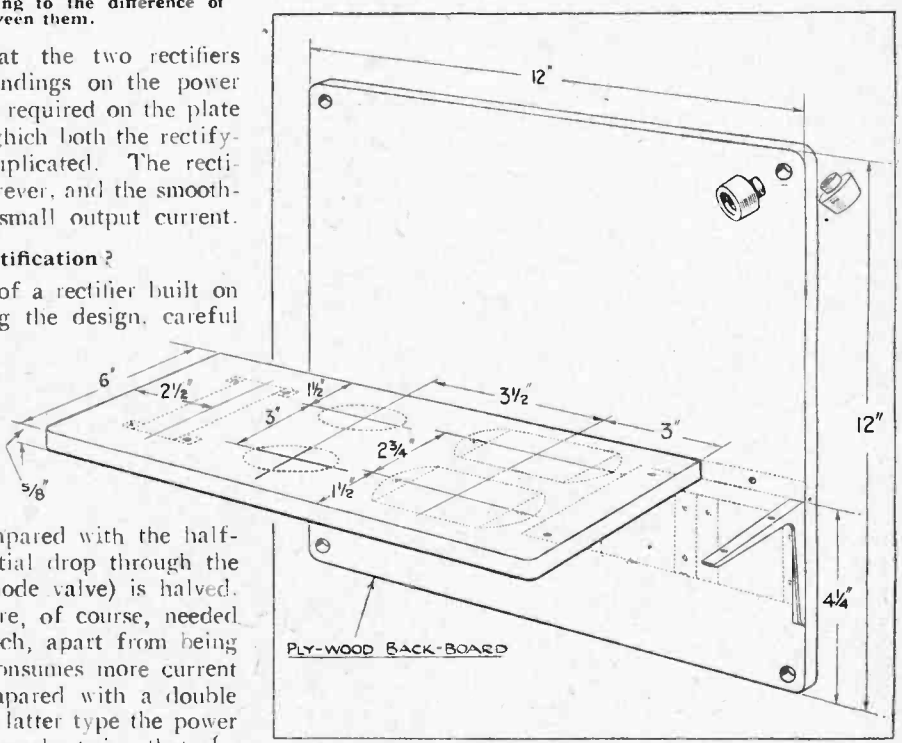
Details of the Transformer.

To give the two voltage outputs, an input transformer of special design is required, having separate filament heating windings for the two rectifying valves and a tapped anode winding. Full details of the construction of this transformer are given in an accompanying illustration. The secondary coils are wound on a hard "Paxolin" tube, which is more easily obtainable than a bobbin, while the core is built up entirely from "Stalloy" iron strip. It is doubtful whether any saving is effected by making up this transformer at home.

Stampings of the type used for the construction of large interval transformers, together with the corresponding form of spool, are used in the construction of the choke coils, which consist of 5,550 turns of No. 36 D.S.C., the core through the bobbin being ⅝in. square. Two smoothing condensers, each of 4 microfarads, are fitted to each rectifier, and under no circumstances should condensers of smaller value be employed. The make-up of the instrument consists of a back board made of 9-ply wood, such as is used for house lighting circuits for the meter, fuses, and switches, and supplied with porcelain insulators, fixing screws, and "Rawlplugs."

Easy Construction.

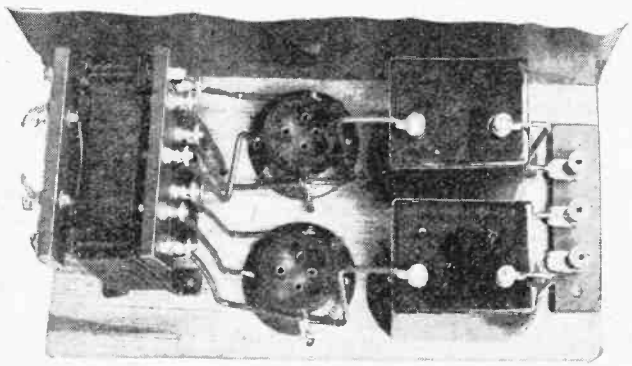
The apparatus is carried above and beneath a ⅝in. platform, measuring 12in. × 6in., secured in position by



ARRANGEMENT OF THE COMPONENTS, showing the positions for attaching the apparatus to the wooden platform while the four condensers are set up in line on the blackboard just beneath the platform.

H.T. Battery Eliminator.—

four heavy wood screws from the back and strengthened by two small brackets. The making up of the platform and the screwing of the components in position is the work

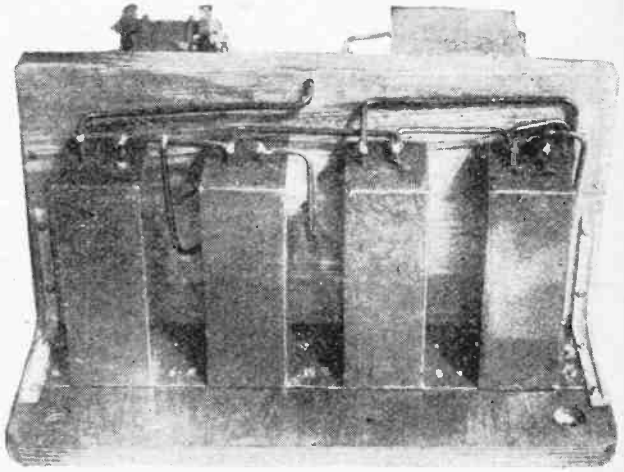


The mains are connected by means of a plug and socket and flexible lead to the input terminals of the transformer. An ebonite terminal strip can be made up for the output or the terminals may be secured directly through the wood.

of a few minutes, while with the aid of the practical wiring diagram connecting up is a simple matter. The leads are of No. 16 tinned wire in sleeving which will slide over the wire easily, the bends being made after the sleeving is on. Six holes are made through the platform for the leads which pass to the condensers.

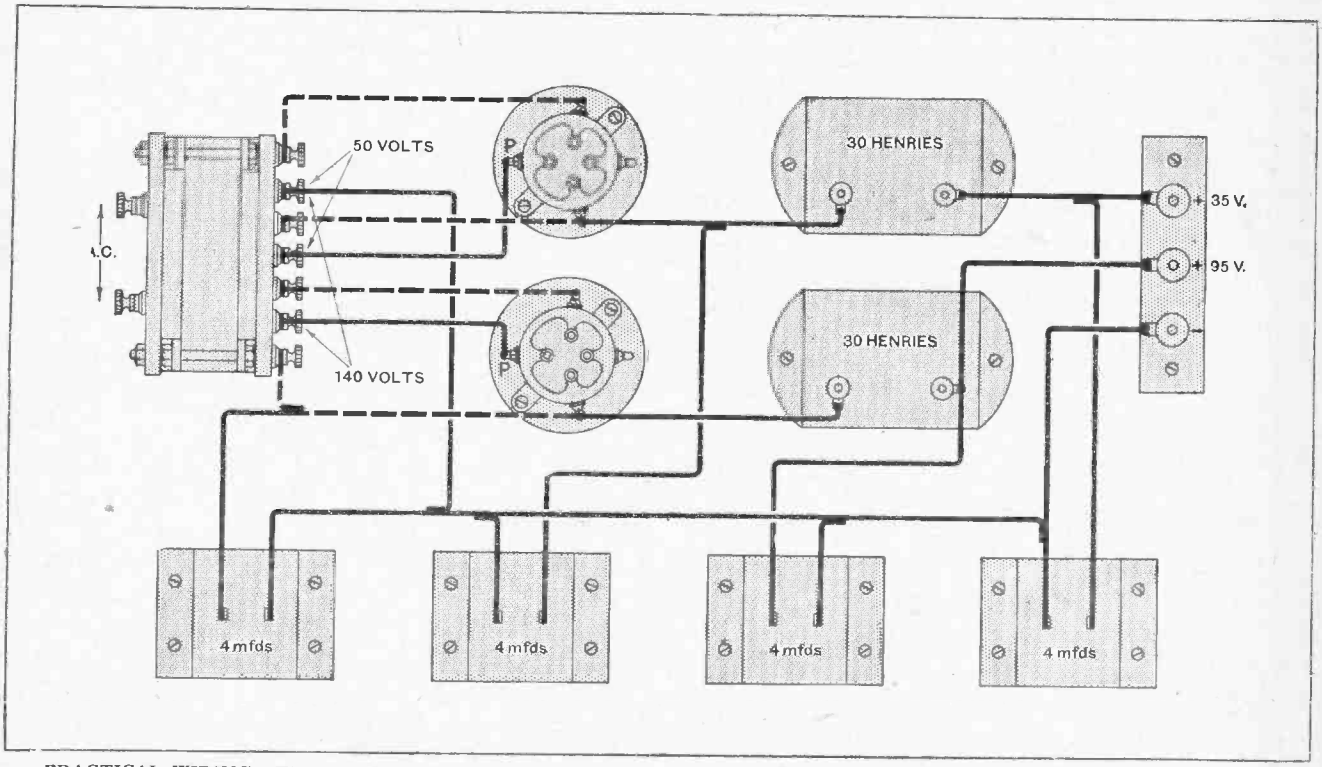
All of the wires should be spaced, and the leads in the output circuit must be kept away from those carrying alternating current, though the layout of the components makes this practically unavoidable.

The most severe test that can be applied to a set of this kind is to use it for the operation of a five-valve receiver consisting of two H.F. stages stabilised by neutralising, a valve detector brought near the oscillating point, and two low-frequency stages. The amount of A.C. hum was practically negligible when the receiving set was tuned to complete silence. On even a weak signal it was not possible to discern whether the set was deriving H.T. from batteries or the A.C. mains.



Arrangement and wiring up of the smoothing condensers.

The use of H.F. chokes appears to be quite unnecessary in the case of an A.C. battery eliminator for the purpose



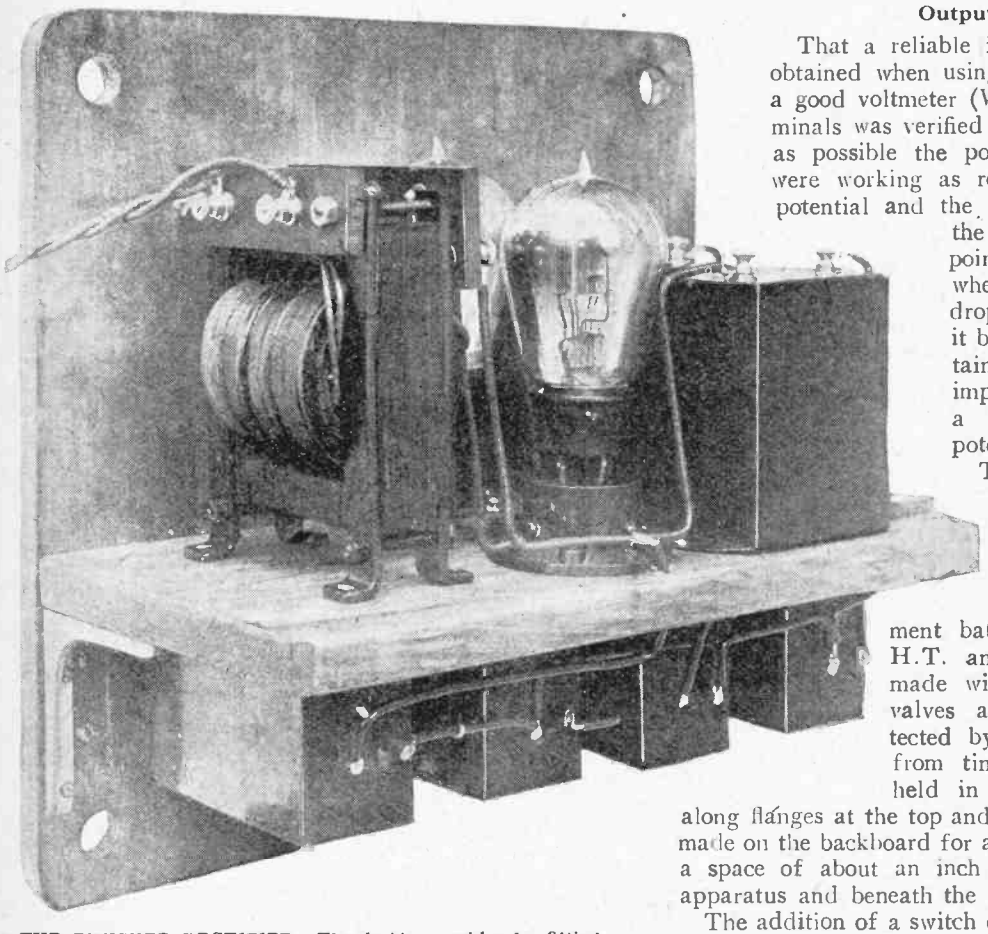
PRACTICAL WIRING. The point-to-point connections are shown, the junctions being made exactly at the positions given. The dotted leads show the filament-heating circuit, so that the various terminals of the transformer can be identified.

H.T. Battery Eliminator.—

LIST OF PARTS.

Power transformer constructed to the details given 37s. 6d. (Rich & Bundy, 13, New Road, Ponders End, Middlesex).
2 Valve holders for baseboard mounting, Aermonic (A. F. Bulgin & Co., 9-11, Cursitor Street, Chancery Lane, London, E.C.4).
2 Osram valves, type U4, 15s. each.
2 Smoothing chokes, type E152, 22s. 6d. each (Rich & Bundy).
4 Telegraph Condenser Company's condensers, low voltage type, tested up to 300 volts, 4 mfd.s capacity, 9s. each.
2 Cast aluminium brackets (A. J. Dew & Co., 33-34, Rathbone Place, Oxford Street, London, W.1).
Plywood back board, 12in. × 12in., complete with porcelain collets, Rawlplugs and screws, 2s. 6d. (Wooten & Co., High Street, Ponders End, Middlesex).
5 yards Sistoflex sleeving to easily slide over No. 16 wire.
Small quantity No. 16 tinned copper wire, to be straightened by stretching and cut off into 3ft. lengths for use.
Wood for platform, 12in. × 6in. × ⅜in., resin cored solder, Fluxite, and various round-headed wood screws.
3 Terminals, suitable for either screw-down or plug connection (J. J. Eastick & Sons, Eelex House, 118, Bunhill Row, London, E.C.1).

of eliminating radio-frequency interference, but there is the consideration, of course, that in so far as the tuning of the set is concerned an earth is virtually picked up through the rectifier as well as the usual connection to the earth terminal, though the effect of this scarcely requires attention when tuning on the normal broadcasting wave-length. Radio-frequency chokes, if provided at all, should be connected in each of the three leads close up to the H.T. terminals of the receiver



THE FINISHED RECTIFIER. The design provides for fitting a metal cover, if desired, over the entire apparatus. Porcelain collets are supplied with the back board for attaching it to the wall.

Tested for current output, the low voltage tapping gave a potential of 40 volts on a load of 5 milliamperes, and the high potential tapping gave 110 volts at 4 milliamperes. On increasing the load in each case to 6 mA. and 8 mA. respectively, the fall in potential was only slight, the voltages obtained being 38 and 98.

Output when on Load.

That a reliable indication of voltage can be obtained when using this rectifier by connecting a good voltmeter (Weston) across the H.T. terminals was verified by determining as accurately as possible the potential on which the valves were working as revealed by the grid biasing potential and the plate current in reference to the valve characteristic. This point is mentioned for, in cases where a considerable voltage drop occurs through a rectifier, it becomes very difficult to ascertain the plate voltage as the load imposed by the meter causes a considerable reduction in potential.

The design is such that the rectifier can be accommodated practically out of sight by being attached to the wall near a power point so that with the filament battery standing alongside the H.T. and L.T. connections can be made with a five-wire cable. The valves and apparatus can be protected by constructing a metal cover from tin plate, and which can be held in position by screws running along flanges at the top and bottom. Provision has been made on the backboard for attaching this cover by leaving a space of about an inch spare above the top of the apparatus and beneath the condensers.

The addition of a switch of the usual tumbler type can with advantage be screwed in the centre of the front edge of the platform, and joined up to break one of the leads passing to the input terminals and also controlling a parallel connected pilot lamp. A circular hole cut in the cover permits the switch to project and gives the outfit a good appearance.

PIONEERS of WIRELESS

BY ELLISON HAWKS F.R.A.S.

27.—The Genius of Clerk Maxwell.

AS we have already seen, Hertz was led to turn his attention to a study of electromagnetic waves through the work of the British scientist Clerk Maxwell, who had demonstrated their existence by mathematical analysis as early as 1863. We have purposely deferred any account of Clerk Maxwell's work until after the discoveries of Hughes and Hertz had been dealt with, feeling that Clerk Maxwell's genius would be better understood if his work was dealt with in a subsequent instalment.

James Clerk Maxwell, "one of the greatest of modern men of science," was born in Edinburgh on November 13th, 1831. His father (who died in 1856) was a lawyer, interested in science as a hobby, and he devoted himself to the education of his son.

James Clerk Maxwell.

James spent his childhood at his father's country house, "Glenlair," near Castle Douglas. When ten years of age he was sent to Edinburgh Academy, where he was nicknamed "Dafty." Although for some years he showed no promise, he later delighted his father, and surprised his schoolfellows, by winning a prize for mathematics. When fifteen years of age he drew some ovals so curious that they were brought to the notice of Professor Forbes, with the result that James communicated a paper to the Royal Society of Edinburgh, "On the Description of Oval Curves."

In 1847 he entered the University of Edinburgh, and studied several branches of science, including magnetism and the polarisation of light. No doubt his attention was drawn to the latter subject by a visit he paid (in 1848) to Nicol, the inventor of the prism that bears his name.

Appointed Professor of Physics at Cambridge.

In October, 1850, he went to Cambridge as an undergraduate at Peterhouse, moving to Trinity in the following December. He was elected a scholar of his college in April, 1852, and two years later graduated as second wrangler, being elected a fellow of Trinity in 1855, and placed on the staff of lecturers. In the following year he was appointed Professor of Natural Philosophy in Marischal College, Aberdeen. Four years later, on the College becoming amalgamated with King's College to form the University of Aberdeen, he was appointed Professor of Natural Philosophy in King's College, London, which post he resigned in 1865. Six years later he was appointed first Professor of Experimental Physics at Cambridge, and delivered his inaugural lecture on October 25th, 1871.

He Investigates the Properties of the Ether.

His life work commenced at Cambridge after he had won his fellowship. He had determined to master mathematics before studying electricity, and on entering Trinity he proceeded to make himself acquainted with all the existing knowledge on the subject. He closely followed Faraday's work, entered into a correspondence with the great man, and in December, 1855, read a paper before the Cambridge Philosophical Society on "Faraday's Lines of Force," which contained the germs of his future discoveries.

Faraday had suggested that the electrical interaction between two bodies was conveyed by lines of force through the ether, and was not merely action at a distance. The difficulty was, however, that Faraday's theory required an ether entirely different from the theoretical medium developed by the great mathematicians of the old school in connection with the "elastic-solid" theory of light. What Clerk Maxwell set out to prove was that there was only one medium in which electrical lines of force acted.

It was Faraday's researches that caused him "not to attempt to establish any physical theory of a science in which I have hardly a single experiment, but to show how, by strict application of the ideas and methods of Faraday, the connection of the very different order of phenomena which he had discovered may be placed before the mathematical mind."

Clerk Maxwell suggested that electrical and magnetic effects did not arise from the attractions of electrical or magnetic matter distributed over the surfaces of conduction or magnetic bodies. Instead, he believed them to be the means by which changes of some unknown description in the ether, or in some of its properties, become known

Pioneers of Wireless.—

to us. He thought that, in consequence of these changes, energy is stored up in the ether, and electric or magnetic forces are one form of the manifestation of changes in the distribution of energy.

He developed these ideas in his great paper "On a Dynamical Theory of the Electromagnetic Field," read before the Royal Society (December, 1864), and applied dynamical equations, in the generalised form given to them by Lagrange, to the problems of electromagnetism. He pointed out that, in dealing with these problems, "we are led to the conception of a complicated mechanism capable of a vast variety of motions, but at the same time so connected that the motion of one part depends, according to definite relations, on the motion of other parts. . . . Such a mechanism must be subject to the laws of dynamics."

Theoretical Discovery of the Hertzian Waves.

He showed also that electromagnetic action travels through space in waves at a definite rate, and that these waves consist of disturbances that are transverse to the direction in which the waves are propagated. He made the remarkable statement that the ether would transmit electrical waves with a speed exactly equal to that of light, and, therefore, he claimed any medium explaining electrical action could also be held to explain light. He thus accomplished a brilliant achievement in founding the electrodynamic theory of light. He showed that the dynamical principles devised by Galileo and Newton for dealing with ordinary matter could not apply to light, which was to be explained solely and wholly in terms of electricity and magnetism.

Clerk Maxwell's theory required it to be supposed that the electrical action at a distance was produced by a train of electrical waves. Not only did he work out the properties of these unknown waves, but he gave their measurements; and predicted, amongst other things, that if they ever could be generated they would be found to travel with the velocity of light. He also showed that the refractive index of a substance was intimately related to its dielectric coefficient, and that conductors of electricity must be opaque to light. He demonstrated that the ether had two great characteristic constants of value, one the electric constant, which Faraday called K; the other, the magnetic constant, which Kelvin called μ. He realised the impossibility of determining the value and nature of these constants, but was able to measure their product. This he showed to be equal to the reciprocal of the square of the velocity of light.

His original paper was subsequently enlarged and expanded into his famous "Treatise on Electricity and Magnetism" (published 1873), on the second edition of which he was engaged when he died.

His theory was not accepted until 1873, for scientific men were very reluctant to abandon the old idea of an "elastic-solid" ether in favour of Clerk Maxwell's alternative. Even so enlightened an authority as Lord Kelvin refused to accept the new theory. Opposition was finally crushed, however, when Hertz discovered the electric waves, the behaviour and measurement of which were found to fulfil Clerk Maxwell's predictions in every respect.

Clerk Maxwell did not live to see the vindication of his brilliant theory, for in the summer of 1879, whilst on a visit to "Glenair," his Scottish home, he became very seriously ill. Although he was able to return to Cambridge in October, he was never well and died on November 5th at the comparatively early age of forty-eight.

NEXT INSTALMENT.

Branly Invents the Coherer.

TRANSMITTING NOTES AND QUERIES.

Amateurs in France and Belgium.

Two experimental transmitters in the North of France, F 8TSP and F 8VL, are testing between 2200 and 2400 G.M.T. daily and will welcome reports. Both stations are transmitting telephony on 180 to 200 metres, F 8TSP with an input of 30 to 40 watts R.A.C., while F 8VL has an input of 10 watts. QSL cards for both stations may be sent either *via* "Journal des 8" or *via* Tourcoing Radio, 10, rue de Gand, Tourcoing (Nord), France.

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The French s.s. "Jacques-Cartier" (FTJ) is now working on 75 metres.

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Mr. Louis Era (B B1), 46, Avenue Van Put, Antwerp, is transmitting regularly on Saturday afternoons, Thursday mornings from 2 a.m. to 4.30 a.m., Sunday mornings from 9 a.m. to 10.30 a.m. B.S.T., and occasionally on Sunday afternoons. Reports will be welcomed.

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German Call-Signs.

Several correspondents have recently asked for information about stations whose call-signs begin with the letters "AG," and more especially about AGC. We understand that these call-signs are used by the stations at Nauen and Eilvese, most of them being used for commercial traffic on long wavelengths. Nauen uses the call-signs AGA, AGB, AGC, AGD, AGN, AGO, AGP, AGQ, AGR, AGS, AGT, AGU, and AGW, of which AGA is used for commercial traffic with the Argentine on 26 metres, and AGC for telephony on 39 metres. AGY and AGX are call-signs used by Eilvese working on wavelengths of 9,700 and 14,600 metres.

The call-signs AFM, AFN, etc., are used by Königswusterhausen station for commercial traffic and meteorological messages.

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Mr. F. Aughtie, G 6AT, 28, Terry St., Dudley, will shortly be testing on 3, 5 and 8 metres and will welcome reports of reception at any range.

Obituary.

We regret to announce the death of Mr. L. M. Baker, G 2FN, which occurred at his residence, Gordon Lodge, Ruddington, Notts, on August 8th. Mr. Baker was well known among amateurs in Great Britain, but owing to ill health has not recently been able to make use of his transmitting station.

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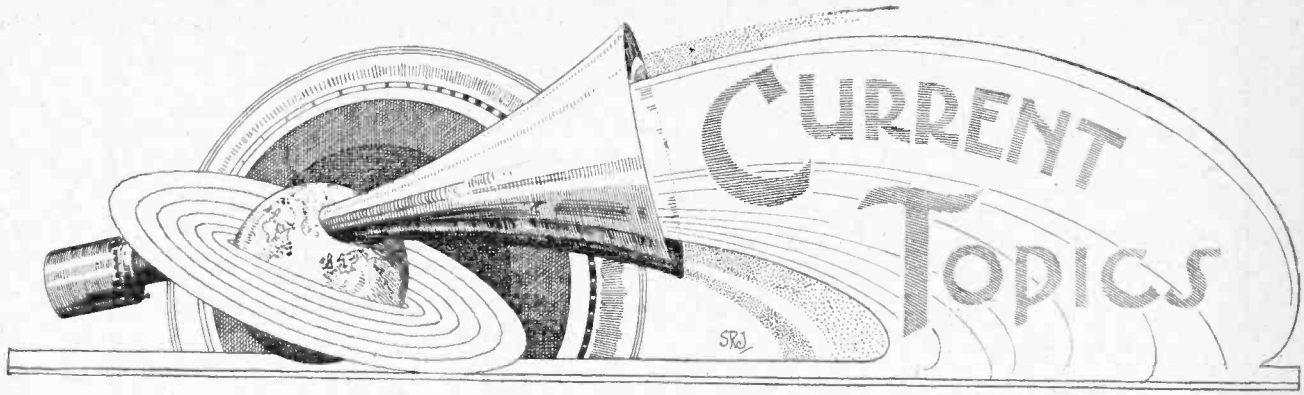
Low-power Transmission.

With reference to the correspondence in our columns on the subject of low-power transmission, Mr. J. Flynn (G 6TX) cordially supports the suggestion made by 6YK, 6YW, 6TY, 6YR, 5MU, and 5TD, that if a series of amateur tests on low-power, extending over a week or a fortnight, could be arranged, it would afford valuable information of the range that may reasonably be expected from modern low-power stations. He suggests, however, that an input of 3 to 5 watts should be the maximum.

We understand that Mr. T. P. Allen (6YW) has been in communication with the T. and R. Section of the R.S.G.B. on this matter and we hope that the number of transmitters interested will be found sufficient to warrant arrangements being made for an organised series of tests.



News of the Week in Brief Review.

THE NATIONAL RADIO EXHIBITION.

The exhibition opening at Olympia on Saturday next will be the largest of its kind ever held in this country. A full Guide to the Show will be found on page 291.

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A TIP FOR BRITISH EMPLOYERS.

"The installation of loud-speakers in American factories and workshops has increased production by 20 per cent."—Sir James Elder, Commissioner for Australia in the U.S.

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SOUND ADVICE.

In a pamphlet entitled "Holiday Occupations for Boys," Mr. J. Howard Whitehouse, Warden of Bembridge School for Boys, recommends the construction of a wireless set, and points out that much pleasure will be gained from writing a description of the set and illustrating it.

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LOUD RECEPTION IN THE ATLANTIC.

While crossing the Atlantic from America to England on the "Homeric" last week, Mr. K. L. A. Arnott carried out some interesting experiments in the reception of American broadcasting. In spite of summer atmospherics, at least eight stations were heard at good strength when the vessel was 1,000 miles out from New York.

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BUHO HERVIDO.

"Radiese" seems likely to prove a serious rival to Esperanto for amateur wireless purposes? Many of our foreign contemporaries frequently publish glossaries of Morse abbreviations, duly translated. A Spanish journal, determined to be thorough, includes "Boiled Owl" among the abbreviations, giving as the Spanish definiton: "(buho hervido) un aficionada incansable."

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GUARDING NEWS IN THE ETHER.

The protection of news transmitted by wireless came under review at the recent conference of Press experts convened by the League of Nations Secretariat. It was resolved to request the League of Nations to approach the various Governments with a view to the adoption of laws guarding the copyright of wireless news and providing that no commercial use shall be made of the public wireless services.

AN AMERICAN WIRELESS CELEBRITY.

Mr. David Sarnoff, vice-president of the Radio Corporation of America, and one of the founders of broadcasting in that country, is at present in England on holiday.

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PIONEER WIRELESS AMATEUR'S DEATH.

We regret to have to record the death of Mr. C. S. Baynton, the well-known Birmingham transmitter, whose call sign, 2KO, must have been familiar to many of our readers. Mr. Baynton was one of the first amateurs in this country to hold a wireless licence. He was responsible for the first public speech broadcast, this being a charity appeal by Sir David Davis, then Lord Mayor of Birmingham, from Mr. Baynton's residence.

RELAYING ENGLISH PROGRAMMES IN AMERICA.

The engineers at the Belfast, Maine, broadcasting station of the Radio Corporation of America hope to pick up and relay programmes from Daventry during the coming winter.

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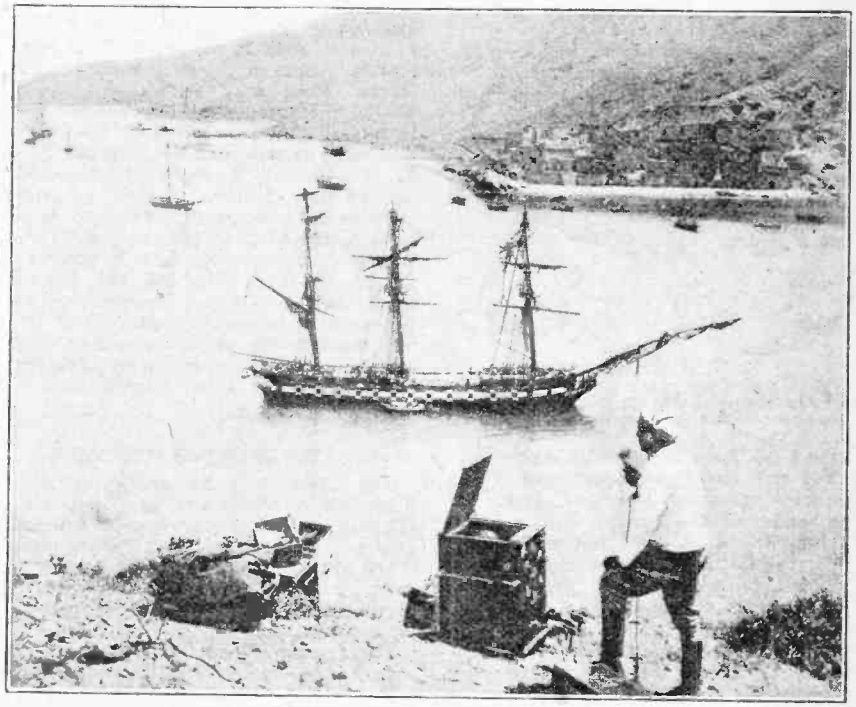
AMERICA'S WIRELESS SHOW.

Every inch of space is reported to be sold at the Radio World's Fair, which opens at the Madison Square Garden, New York, on September 13th.

Features of the exhibition will include an international contest among wireless amateurs, speeches by foreign Ambassadors on the value of radio in extending international amity, and the election of a Radio Queen who will represent the women listeners of America.



WIRELESS AIDS THE FILM PRODUCER. A scene at Los Angeles during the production of the Paramount Film "Old Ironsides" in which a contest is staged between century-old American frigates. The producer is seen giving instructions for the manœuvring of the vessels, using a portable wireless telephony transmitter.

BEAM TESTS WITH AUSTRALIA.

The Melbourne beam station will, it is understood, begin test transmissions in October. The beam stations working with Australia in this country will be at Grimsby and Skegness, the former being the transmitter.

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THE SEDATIVE.

The cowboy habit of "singing the cattle down," as the night herdman's crooning melody to quiet the herd is called in America, seems doomed, according to a letter received by the U.S. Station WGES. The writer, a cowman, explained that he had put up a portable wireless set out on the range, and treated the cows to dance music. "It was a big saving on the voice," he wrote, "and the herds do not seem to notice the difference."

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AN OFFENDING AERIAL.

At the North London Police Court a few days ago Bessie Sanson, of Grosvenor Road, Highbury, was fined £5 and £15 15s. costs for assaulting Mrs. Edith Alexander in a dispute over the position of an aerial wire. The plaintiff (Mrs. Alexander) had protested that the defendant's aerial ran across her garden and cut out all her wireless reception. As the aerial was not removed it was cut down. Hence the sad sequel.

THE BAIRD TELEVISION APPARATUS.

With reference to the note in our last issue concerning the proposed exhibition of the Baird television apparatus at the Science Museum, South Kensington, we understand that the exhibit will consist of the first rough model devised by Mr. Baird in his early experiments.

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BID FOR CHEAPER WIRELESS.

Press and commercial interests in Australia are complaining against the proposed Australia-United Kingdom wireless Press rate of 5d. per word, a figure arrived at on the basis of two-thirds of the cable charge. The Amalgamated Wireless Company, however, has based its calculations on the old cable rate of 7½d. per word; the cable rate is now 6d. Press and commercial representatives are now negotiating for a reduction to 4d.

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WEATHER CHART BY WIRELESS.

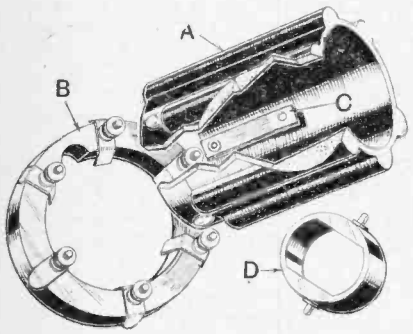
A complete weather map has been successfully transmitted by wireless by the U.S. Weather Bureau. The transmitter has a reliable radius of 1,500 miles, and the time taken to transmit a map is 45 minutes.

NEW APPARATUS.

A Review of the Latest Products of the Manufacturers.

SUPER-HETERODYNE INDUCTANCE FORMER.

The illustration shows the new type Silver Marshall former, sold in this country by the Rothermel Radio Corporation of Great Britain, Ltd., 24-26, Maddox Street, Regent Street, W.1, suitable for making up an oscillator coupler. The former is of Bakelite and carries six raised ribs so that the turns of wire are



The blank Silver Marshall former and contact ring suitable for the construction of super-heterodyne oscillator couplers.

lifted away from the face of the former.

The grid and plate inductances of the oscillator valve are, of course, wound on the outside of the former, while a small bobbin, which is held between spring clips, rotates inside the former and is intended to accommodate the winding which couples to the detector circuit.

To provide for tuning over a wide wavelength range the unit is interchangeable by insertion into a moulded ring carrying the necessary spring contacts; thus, in building a super-heterodyne receiver with the Silver Marshall coupler, coils can be wound to tune to the normal broadcast band as well as to the wavelengths of Daventry and other long-wave European stations. The winding of the former is quite an easy process.

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H.T. BATTERY FOR PORTABLE SETS.

Batteries used in connection with portable receiving sets constitute a weight far exceeding that of all the other component apparatus. It is quite unnecessary to fit in the portable set a large H.T. battery capable of giving at least six months' service when for portable purposes a smaller and proportionately cheaper battery is all that is required.

A new battery has been produced by W. H. Harper, 4, Eagle Street, Southampton Row, London, W.C.1, and is obtainable in a range of sizes, the series being marketed under the name of "Three Shepherd Batteries." The 60-volt type weighs about 2¼ lb., and the 100-volt 3½ lb., as against 5 and 7 respectively for the average sizes. The battery is of reliable construction, and the specimen which was examined after having been lying by for a period of three months gave its stated voltage.

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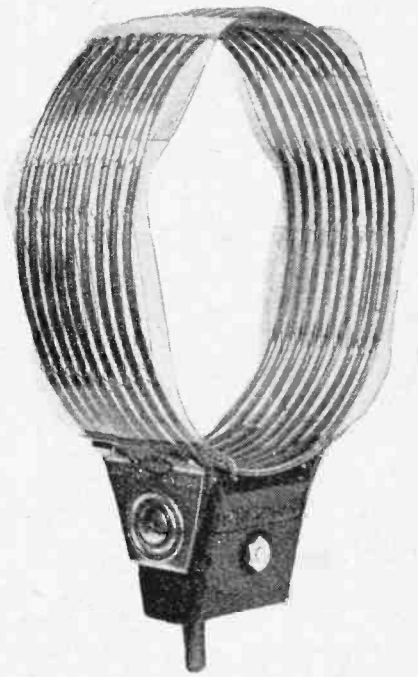
IGRANIC SHORT-WAVE COILS.

The extension of the Igranic tuning inductances to include a range of short-wave coils facilitates the conversion of a broadcast receiving set for reception on ultra-short waves. The increasing interest in short-wave broadcasting will assure a wide popularity for these coils during the coming season.

The Igranic short-wave coils are made with 2, 4, 6, and 9 turns, and are stated to be suitable for tuning over a wavelength range of about 10 to 100 metres. The form of construction adopted consists of bending to shape the turns of wire by winding on a mandrill, after which the turns are pressed through slots in a celluloid strip and locked in position by the insertion of other strips of celluloid across



Very little solid dielectric material is in the field of the turns of the new Igranic short wave inductance, the winding being practically air supported.

the turns. The celluloid support does not bed down on to the turns of the inductance, which is therefore practically air-supported.

OVERSEAS RADIO SERVICES

Notes on British Stations Engaged on Imperial and Foreign Communications.

By LT.-COL. CHETWODE CRAWLEY, M.I.E.E.

NOW at last, after many years of work and talk and acrimonious Press correspondence, we are really on the eve of Imperial wireless communication, and it may be useful, therefore, to pause for a moment from our visions of the future to take stock of what has actually been done so far to establish wireless communication between this country and the rest of the world.

It has been the fashion hitherto, largely through ignorance of the facts, to write inaccurately, and usually at great length, of the backward position of this country in its arrangements for wireless services with the rest of the world, whereas in reality these arrangements have been on a very satisfactory basis for a considerable time.

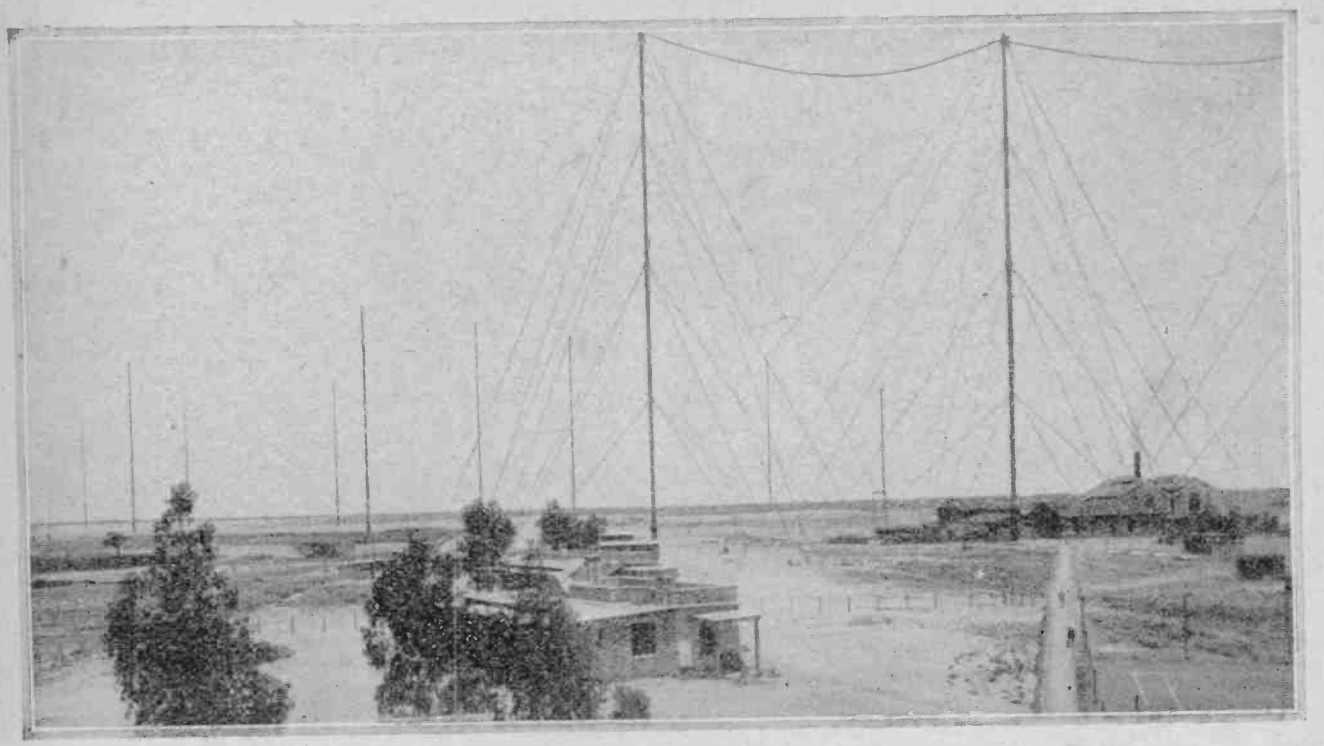
Control.

All these overseas communications are in the hands of the Government and the Marconi Company. The military communications are completely controlled by the three fighting services, and the commercial communications are divided up between the Post Office and the Marconi Company.

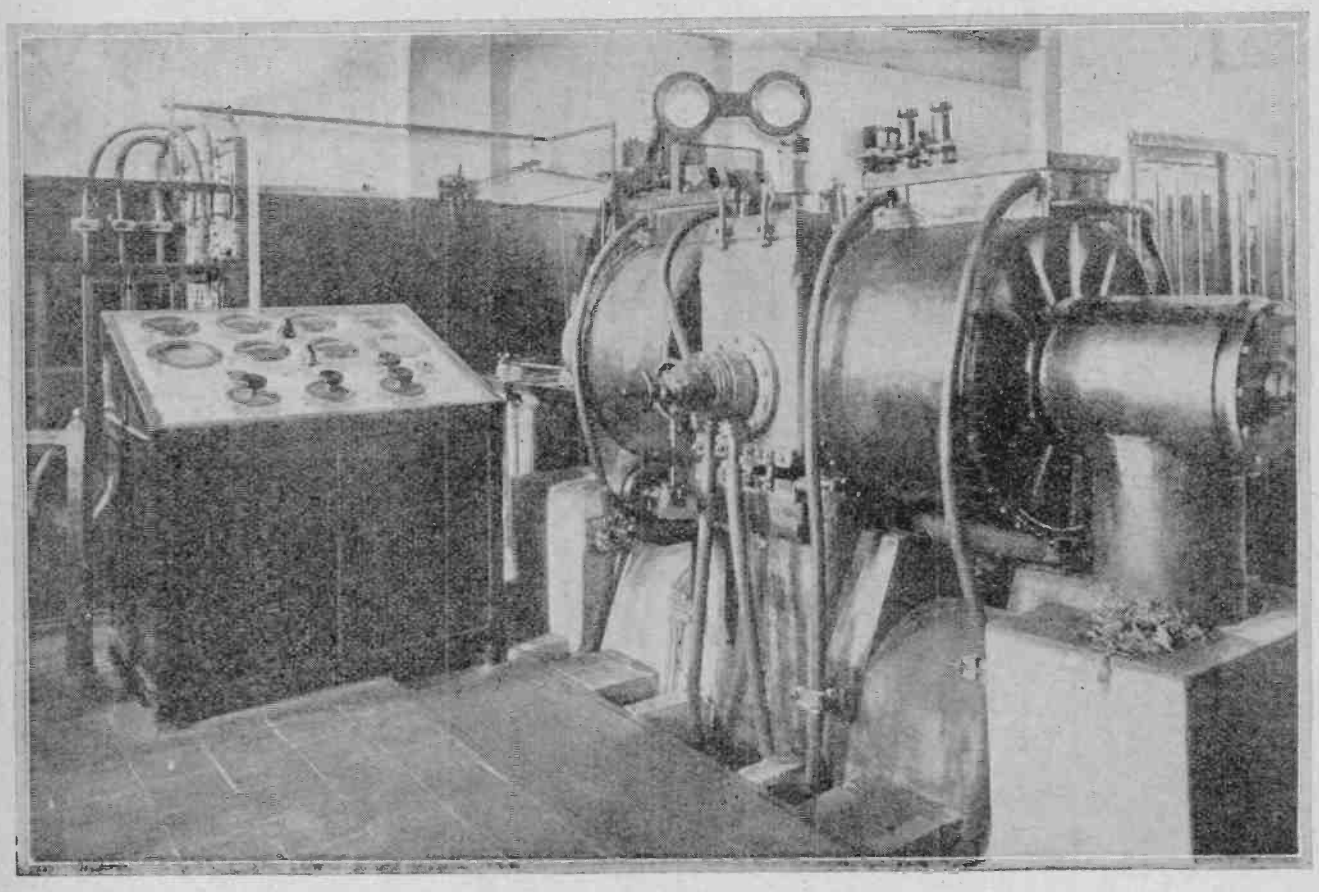
Principal transmitting and receiving stations engaged on overseas communication.

Operation.

The Post Office services are operated from the General Post Office in London in close proximity to the operation of the Government cables, thus allowing the best possible arrangements being made for the immediate disposal of traffic according to the circumstances prevailing at any given moment, which, after all, is of great advantage to the public who wish to send or receive the telegrams. Speed and accuracy are what most people want, irrespective of the route, but if the sender does have a preference for the route, he has only to say so and his telegram will be sent accordingly at the first opportunity.



General view of Abu Zabal Wireless Station, Cairo



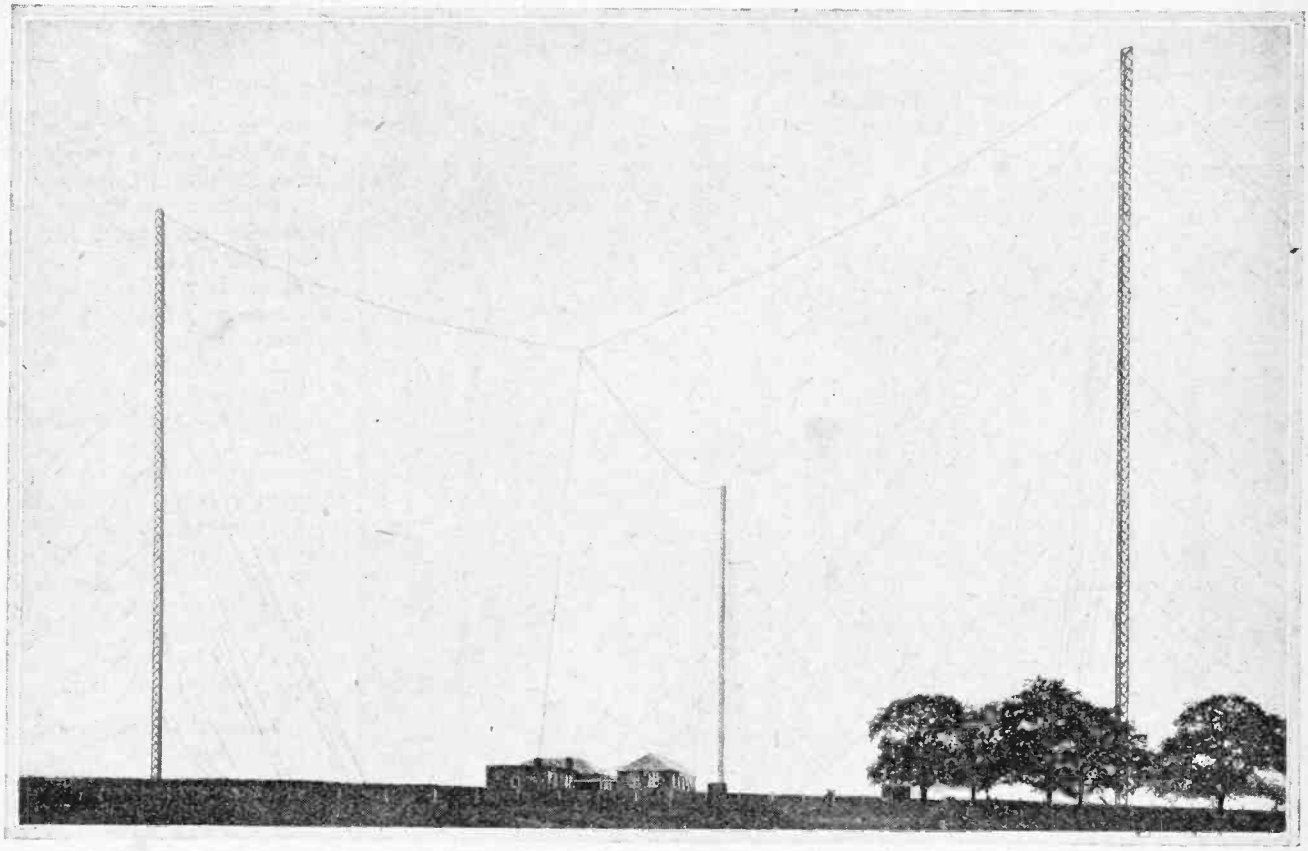
Abu Zabal Wireless Station—the Arc Room.

Overseas Radio Services.—

The reception of wireless telegrams in the case of the Post Office services is also carried out at present in the General Post Office, on the roof of which eight receiving aerials are installed; but this receiving station will shortly be transferred to St. Albans, to obviate the effects of the local electrical interferences inseparable from such a building as the General Post Office, situated in the heart of London. The wireless signals received in this Radio Relay Office are relayed to the Central Radio Office in the same building, where they work the recording machines which are placed alongside the signalling machines. These machines actuate the transmitting sets that recourse has to be made to the old-fashioned aural reception or hand transmission.

Rugby.—The most powerful of the point-to-point transmitting stations is, of course, the new Post Office valve station at Rugby, which commenced operations on January 1st. This station, using a wave of 18,740 metres (16 kilocycles), transmits Government communiqués and commercial messages to stations and ships all over the world, and further services are now being arranged. Later on, long-range radiotelephone services will be inaugurated.

Oxford.—The Post Office arc station at Leafield, near Oxford, uses waves of 12,350 metres (24.21 kilocycles)



Aerial and station buildings at Northholt. The three lattice masts are constructed of wood.

at Rugby, Oxford, Northolt, Stonehaven, Dollis Hill, and Caister.

When the St. Albans station is ready the arrangements will be precisely the same, except that the received signals will be relayed from St. Albans to the General Post Office in London instead of from one room in the General Post Office to another.

In the case of the Marconi Company's services the receiving aerials are at Brentwood in Essex, and the signals are relayed to the Company's operating station at Radio House in London, where the signalling apparatus for actuating the transmitting sets at Carnarvon and Ongar are also placed.

Machines for high speed transmission and reception are used for all these services, and it is very seldom now

and 8,750 metres (34.28 kilocycles), and transmits Press messages to Halifax and commercial traffic to Cairo.

A small valve set, using a wave of about 50 metres (6,000 kilocycles), is also installed at this station, and transmits commercial traffic to Cairo and Press messages to Halifax.

Cairo.—The Post Office arc station at Cairo is the only station operated by the Post Office outside the British Isles. It uses a wave of 11,000 metres (27.27 kilocycles), and transmits commercial traffic to Oxford, Germany, France, Italy, and Basra, as well as broadcasting meteorological messages on behalf of the Egyptian Government.

Northolt.—The Post Office station at Northolt is fitted with two aerial systems with separate transmitters, one a

Overseas Radio Services.—

valve set working on a wave of 6,950 metres (43.16 kilocycles), the other an arc set on a wave of 4,450 metres (67.37 kilocycles). The valve installation is used for the transmission of commercial traffic to Czecho-Slovakia and Hungary, and for special transmission to various countries on behalf of certain Press agencies. The arc installation is used for the transmission of commercial traffic to Italy and for special transmissions for a Press agency.

Stonehaven.—The Post Office valve station at Stonehaven transmits commercial traffic on a wave of 4,600 metres (65.22 kilocycles) to Poland and Esthonia, and in case of cable interruption to Germany, Norway, and Iceland. It is also used for special transmission on behalf of Press agencies.

Caister.—The Post Office valve station at Caister transmits commercial traffic to Holland on a wave of 1,490 metres (201.2 kilocycles) when cable communication is interrupted. Normally, the station is closed

Dollis Hill.—Dollis Hill is a Post Office experimental station, but has recently been used for the transmission of commercial traffic to Cairo and Press messages to Halifax on short waves in the neighbourhood of 50 metres (6,000 kilocycles).

Post Office Reception.

Commercial traffic is received at the General Post Office from the countries mentioned above, and in addition Press messages are received from Norway, Sweden, Denmark, Lithuania, and Finland.

Last year these Post Office point-to-point services dealt with over ten million words of paid traffic, and this traffic is increasing rapidly.

Marconi Stations.

The Marconi Company operate an alternator station at Carnarvon and a group of valve stations at Ongar.

Carnarvon. — Carnarvon transmits commercial traffic and Press messages to the United States on waves of 14,200 metres (21.15 kilocycles), and 9,400 metres (31.41 kilocycles).

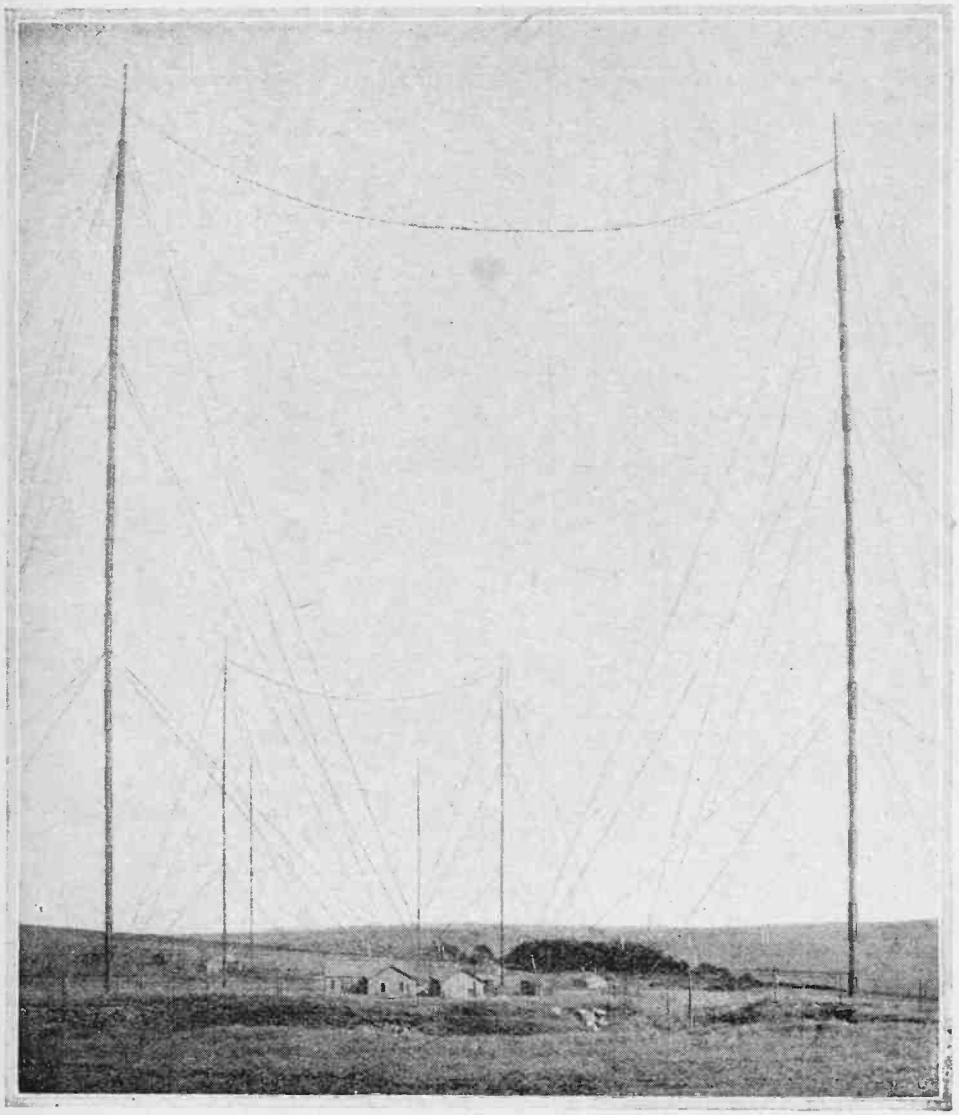
Ongar.—The group of stations at Ongar transmits commercial traffic and Press messages on waves of 2,600 metres (115.4 kilocycles), 3,850 metres (77.91 kilocycles), 4,350 metres (68.96 kilocycles), and 5,050 metres (59.41 kilocycles), to Spain and Switzerland, France, Canada and Austria, and Jugo-Slavia respectively.

Marconi Company's Reception.

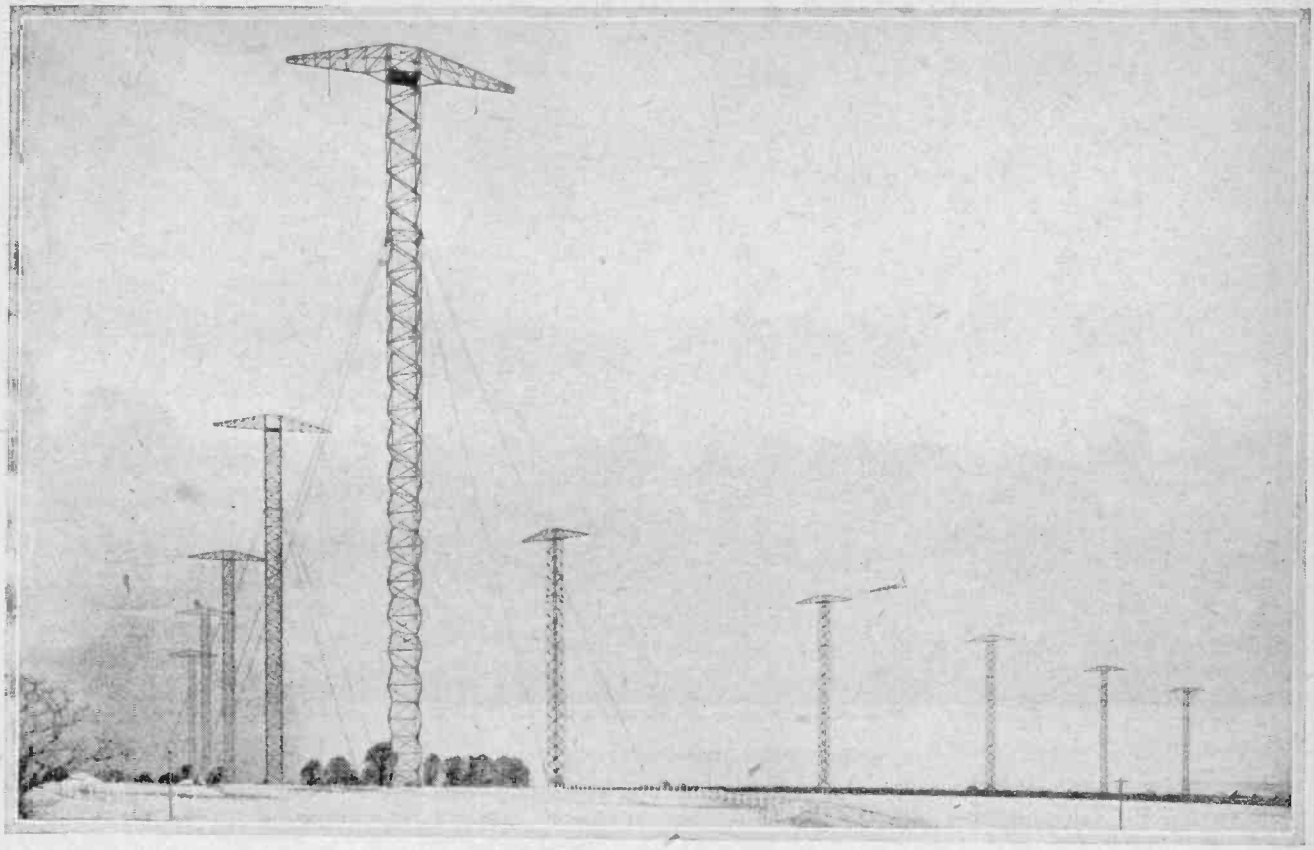
Reception of commercial traffic and Press messages from these countries is carried out at the Marconi Company's station at Brentwood.

Extension of Marconi Services.

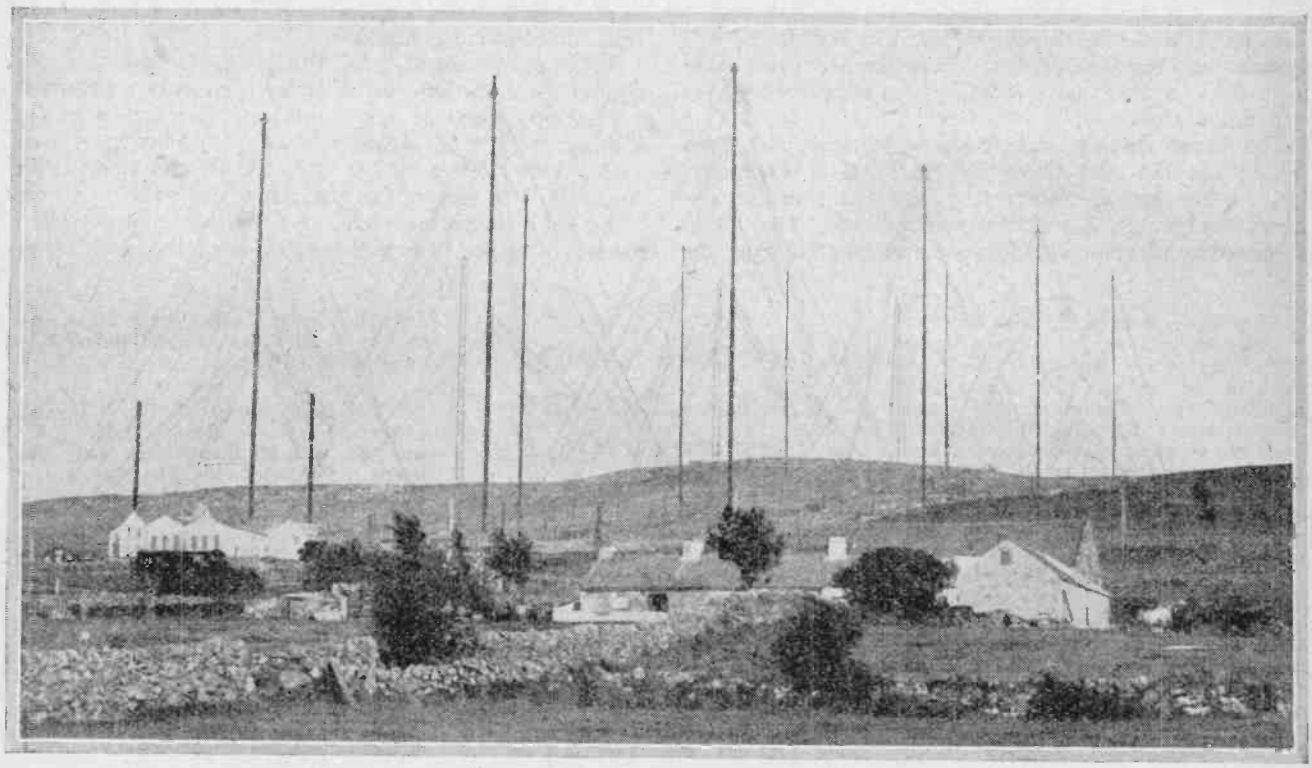
In addition to these services the Marconi Company was licensed on December 31st, 1925, to conduct services with Denmark, Finland, Portugal, Bulgaria, Greece, Sweden, Russia, Turkey, and any foreign country outside Europe, whereas all services with the Empire are to be in the hands of the Post Office so far as this country is concerned.



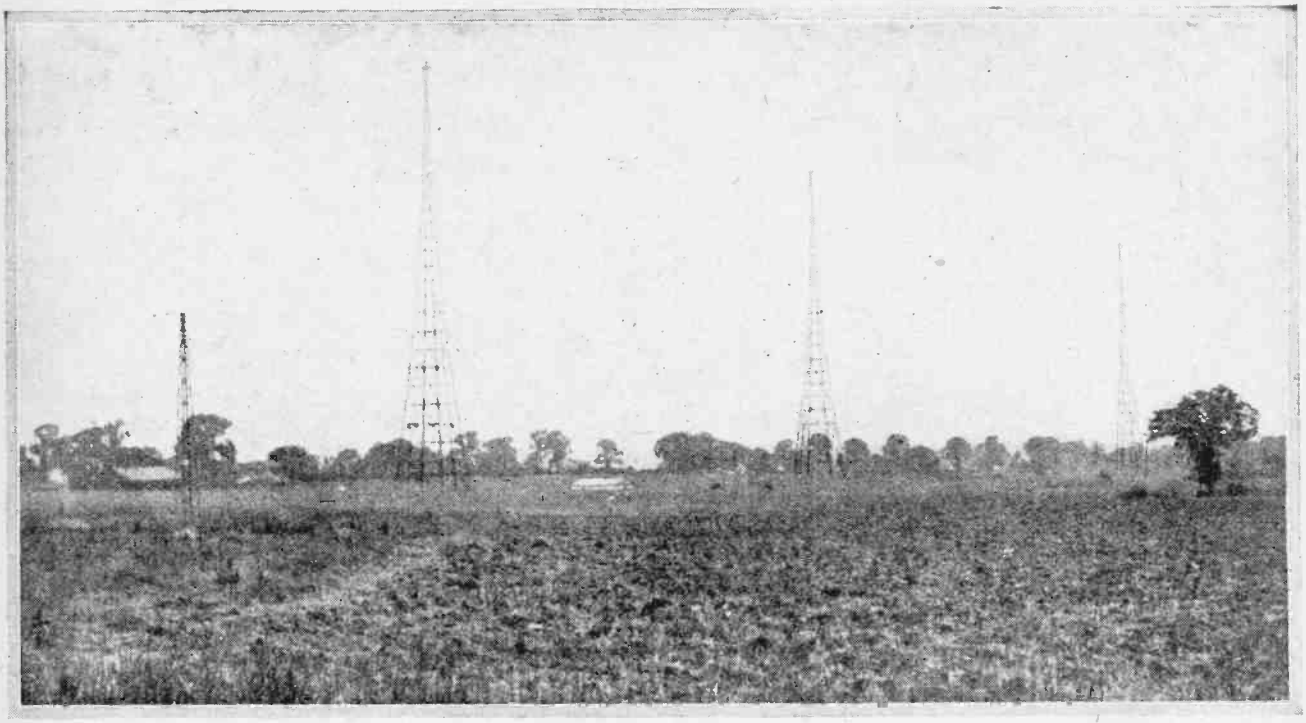
Stonehaven Wireless Station.



Bridgwater Receiving Station—the aerial system.



Carnarvon Wireless Station. The aerials are supported by tubular steel masts.



Ongar Wireless Station—(Canadian Section).

The company is also erecting a short wave beam station at Dorchester for communication with the United States and South America.

Imperial Services.

In addition to the Rugby station, the Post Office will operate from the General Post Office the new short wave beam stations which have recently been commissioned for Imperial services.

The beam sending and receiving stations have been erected for the Post Office by the Marconi Company, and the first group, transmitting at Bodmin and receiving at Bridgwater, is practically completed. This group is for communication with Canada and South Africa, the corresponding beam stations being situated near Montreal and near Capetown respectively.

The other group, transmitting at Grimsby and receiving at Skegness, is being erected for communication with corresponding beam stations near Poona, in India, and near Melbourne, in Australia.

In the agreement with the Post Office for the construction of these stations the Marconi Company guaranteed a signalling speed of 100 words a minute each way for a daily average of eighteen hours with Canada, eleven with South Africa, twelve with India, and seven with Australia. The rates for the Canadian traffic were not to exceed the existing rates, and the rates for the other services were not to exceed two-thirds of the cable rates.

BOOKS AND CATALOGUES RECEIVED.

"Gedenboek, Ter Herinnering aan het Tienjarig Oestaan van de Nederlandsche Vereeniging voor Radiotelegrafie."—A collection of articles by well-known authorities on Radiotelegraphy and Radiotelephony in English, French, Dutch and German. Arranged and edited by J. Corver and issued by the N.V.V.R. (Netherland Association for Radiotelegraphy) to commemorate the tenth anniversary of its formation. Pp. 403, profusely illustrated.

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"Premier Congrès International des Radio-Amateurs," being the report of the transactions of the first International Radio-Amateur Congress held in Paris in April, 1925, including introductory note, list of representatives and working committees, standing orders, constitution of the International Amateur Radio Union and recommendations concerning amateur tests, distribution of wavelengths, international prefixes, etc.; in French, English and Esperanto, published by Etienne Chiron, Paris.

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"The Admiralty List of Wireless Signals, 1926" (Corrected to December 31st, 1925). Including details of Direction Finding, Fog Signals, Weather Bulletins, Storm and Navigational Warnings, Time Signal Stations, etc. Compiled by the Hydrographic Department, Admiralty. Published by H.M. Stationery Office, and sold by J. D. Potter, 145, Minories, E.1; price 3s. 6d. net.

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"The Lead Storage Battery" (second edition), by H. G. Brown, A.M.I.E.E.; pp. 185, with 96 illustrations and diagrams. Published by The Locomotive Publishing Company, London; price 5s.

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Carrington Manufacturing Co., Ltd. (18-20, Norman's Buildings, Mitchell Street, Central Street, London, E.C.1). Camco cabinet catalogue for season 1926-7, providing an illustrated description of a wide range of wireless cabinets.

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Electradix Radios (218, Upper Thames Street, E.C.4). 66-page catalogue of all classes of wireless experimental apparatus and electrical gear.

GENEVA'S WAVELENGTH SCHEME.

THE most important co-operative move yet made by the broadcasting stations of Europe will take place on September 15th next, when the wavelength scheme prepared by the Technical Committee of the Office International de Radiophonie with the object of eliminating interference will be put to the test.

The problem before the Committee has been to bring two hundred broadcasting stations (existing or projected) within a waveband extending from 200 to 600 metres, and the only practicable method has been found to necessitate the allocation of a common wavelength to certain stations of low power which are not likely to suffer from mutual interference. Eighty-three exclusive waves will be employed, while 16 common waves will, it is hoped, supply the needs of the lesser transmitters.

The following list shows the Geneva plan as it stands at present. Alterations will almost certainly be found necessary when it is put into practice in ten days' time.

Frequency x 10,000.	Geneva Plan Wavelength.	Name of Station.	Country.	Present Power.	Present Wavelength.
51	588.2	Vienna II.	Austria	0.75	530.0
		Linkœping	Sweden	0.25	467.0
		Grenoble P.T.T.	France	0.5	475.0
		Vilna (?)	Lithuania	—	—
52	577.0	Madrid II.	Spain	1.0	392.0
		Joenkoeping	Sweden	0.025	265.0
		Freiburg	Germany	—	—
		Uzhovod (Ungava).	Czecho-Slovakia	—	—
53	566.0	Berlin II.	Germany	1.5	562.0
		Mikkeli	Finland	0.1	561.0
		Orebroe	Sweden	0.25	237.0
		Saragossa	Spain	—	—
		Sarajevo	Jugo-Slavia	—	—
		Vardoe	Norway	—	—
		Bloemendaal	Holland	—	—
54	555.6	Budapest	Hungary	2.0	546.0
55	545.6	Sundsvall	Sweden	1.0	545.0
56	535.7	Munich	Germany	0.75–4	485.0
57	526.3	Riga	Latvia	1.2	480.0
58	517.2	Vienna	Austria	5.0	590.0
59	508.5	Antwerp	Belgium	—	—
60	500.0	Zurich	Switzerland	0.5	515.0
		Helsingfors II.	Finland	0.5	522.0
		Palermo	Italy	—	—
		Tromsoe	Norway	—	—
		Karlstad	Sweden	—	—
		Bourges	France	—	—
61	491.8	Aberdeen	Great Britain	1.5	496.0
		Birmingham	Great Britain	1.5	479.0
62	483.9	Berlin	Germany	4.0	505.0
63	476.2	Lyons P.T.T.	France	1.0	480.0
64	468.8	Elberfeld	Germany	0.75	259.0
65	461.5	Jassy (alternative).	Roumania	?	?
		Bergen	Norway	1.0	350.0
66	454.5	Boden	Sweden	?	?
67	447.8	Paris P.T.T.	France	0.5	458.0
68	441.2	Brno (Brünn)	Czecho-Slovakia	3.0	527(?)
69	434.8	Bilbao	Spain	0.5	415.0
70	428.6	Hamburg	Germany	4.0	392.5
71	422.6	Rome	Italy	3.0	425.0
72	416.7	Stockholm	Sweden	1.5	427.0
73	411.0	Berne	Switzerland	1.5	435.0
74	405.4	Glasgow	Great Britain	1.5	422.0
75	400.0	Mont de Marsan.	France	0.3	390.0
		Tampere	Finland	0.25	373.0
		Cadiz	Spain	0.5	355.0
		Falun	Sweden	0.4	370.0
		Warsaw	Poland	—	—
		Koszice	Czecho-Slovakia	—	—
		Cork	Ireland	—	—
		Aalesund	Norway	—	—
		Charleroi	Belgium	—	—
		Bremen	Germany	?	?
76	394.7	Frankfurt	Germany	0.75–4	470.0
77	389.6	Toulouse Radio	France	2.0	430.0
78	384.6	Manchester	Great Britain	1.5	378.0
79	379.7	Stuttgart	Germany	0.75–4	446.0
80	375.0	Madrid	Spain	1.5	373.0
81	370.4	Oslo	Norway	1.5	382.0
82	365.8	Graz	Austria	0.75	397.0
83	361.4	London	Great Britain	3.0	363.5
84	357.1	Breslau	Germany	0.75–4	416.0
85	353.0	Cardiff	Great Britain	1.5	353.0
86	348.9	Prague	Czecho-Slovakia	5.0	365.5
87	344.8	Seville	Spain	0.5	357.0
88	340.9	Paris Petit Parisien.	France	0.5	358.0
89	337.0	Copenhagen	Denmark	0.7	340.0
90	333.3	Naples	Italy	1.0	350.0
		Reykyavik	Iceland	?	—
91	329.7	Nürnberg	Germany	0.75–4	340.0
92	326.1	Belfast	Great Britain	1.5	440.0
93	322.6	Leipzig	Germany	0.75–4	452.0
94	319.1	Dublin	Ireland	1.5	390.0
95	315.8	Milan	Italy	1.0	320.0
96	312.5	Newcastle	Great Britain	1.5	404.0
97	309.3	Marseilles P.T.T.	France	0.5	351.0
98	306.1	Bournemouth	Great Britain	1.5	386.0
99	303.0	Münster	Germany	1.5	410.0
100	300.0	Bratislava	Czecho-Slovakia	?	300.0
101	297.0	Agen	France	0.25	318.0
		Leeds	Great Britain	0.5	278.0
		Hanover	Germany	0.75	297.0
		Carthagena	Spain	0.5	330.0
		Eidsvold	Norway	0.05	?
		Jyvalskala	Finland	0.1	301.5
102	294.1	Dresden	Germany	0.75	294.0
		Bradford	Great Britain	0.2	278.0
		Trollhattan	Sweden	0.25	345.0
		Bilbao	Spain	0.5	418.0
		Valencia	Spain	0.5	400.0
		Liège	Belgium	0.1	280.0
		Innsbrück	Austria	—	—
103	291.3	Lyons (Radio)	France	1.5	280.0
104	288.5	Dundee	Great Britain	0.2	315.0
		Edinburgh	Great Britain	0.2	328.0
		Hull	Great Britain	0.2	335.0
		Liverpool	Great Britain	0.2	331.0
		Nottingham	Great Britain	0.2	326.0
		Plymouth	Great Britain	0.2	338.0
		Sheffield	Great Britain	0.2	306.0
		Stoke	Great Britain	0.2	301.0
		Swansea	Great Britain	0.2	482.0
105	285.7	Reval (Tallin)	Esthonia	?	350.0
106	283.0	Dortmund	Germany	1.5	387.0
107	280.4	Barcelona	Spain	2.0	324.0
108	277.8	Caen	France	?	332.0
		Barcelona II.	Spain	1.0	462.0
		Seville II.	Spain	0.5	300.0
		Hango	Finland	0.1	259.5
		Stavanger	Norway	—	—
		Salzburg	Austria	—	—

Frequency x 10,000.	Geneva Plan Wavelength.	Name of Station.	Country.	Present Power.	Present Wavelength.
109	275.2	Angers	France	0.25	275.0
		Madrid III.	Spain	1.0	340.0
		Eskilstuna	Sweden	0.25	243.0
		Zagreb	Jugo-Slavia	—	—
		Ghent	Belgium	—	—
110	272.7	Cassel	Germany	0.75	273.0
		San Sebastian	Spain	1.5	343.0
		Norrkoping	Sweden	0.25	260.0
		Klagenfurt	Austria	—	—
		Genoa	Italy	—	—
		Danzig	Danzig	—	—
		Christiansand	Norway	—	—
111	270.3	Lemberg	Poland	1.5	—
112	267.8	Lisbon	Portugal	—	—
113	265.5	Brussels	Belgium	1.5	263.0
114	263.2	Athens	Greece	—	—
115	260.9	Gothenburg	Sweden	1.0	290.0
116	258.6	Turin	Italy	—	—
117	256.4	?	Holland	—	—
118	254.2	Pori	Finland	0.1	255.3
		Kiel	Germany	0.75	233.0
		Malaga	Spain	—	—
		Venice	Italy	—	—
		Linz	Austria	—	—
		Rennes	France	—	—
119	252.1	Montpellier	France	0.2	238.0
		Stettin	Germany	0.75	241.0
		Skien	Norway	0.1	?
		Ostend	Belgium	—	—
		Umea	Sweden	—	—
120	250.0	Gleiwitz	Germany	0.75	251.0
		Oulu	Finland	0.1	233.0
		Oporto	Portugal	—	—
		Lille	France	—	—
121	247.9	Posen	Poland	—	—
122	245.9	Toulouse P.T.T.	France	0.5	260.0
123	243.9	Trondhjem	Norway	1.0	?
124	241.9	Königsberg	Germany	0.75–4	462.0
125	240.0	Helsingfors (1)	Finland	?	318.0
126	238.1	Bordeaux	France	—	—
127	236.2	Bucarest	Roumania	—	—
128	234.4	Vilna	Poland	—	—
129	232.6	?	Holland	—	—
130	230.8	Trieste	Italy	—	—
131	229.0	Malmoe	Sweden	1.0	270.0
132	227.3	Vigo	Spain	1.0	270.0
133	225.6	Belgrade	Jugo-Slavia	—	—
134	223.9	Leningrad (2)	Russia	?	?
135	222.2	Strasbourg	France	—	—
136	220.6	Odessa	Russia	—	—
137	219.0	Kovno (3)	Lithuania	—	—
138	217.4	Luxemburg	Luxemburg	—	—
139	215.8	Sofia	Bulgaria	—	—
140	214.3	Viborg	Finland	—	—
141	212.8	Cracow	Poland	—	—
142	211.9	Kiev	Russia	?	281.9
143	209.8	Smolensk	Russia	—	—
144	208.3	Tirana	Albania	—	—
145	206.9	Minsk	Russia	—	—
146	205.5	Jassy	Roumania	—	—
147	204.1	Gäfle	Sweden	0.025–1	208.0
		Salamanca	Spain	—	—
		Speyer	Germany	—	—
148	202.7	Christianhamn	Sweden	?	202.0
		Asturias	Spain	—	—
149	201.3	Oviedo	Spain	—	—
		Karlskrona	Sweden	—	—
		Aix-la-Chapelle (Aachen)	Germany	—	—

(1) Helsingfors can repeat 375 m. wavelength of Madrid.
(2) Leningrad can repeat 434.8 m. wavelength of Bilbao.
(3) Kovno can repeat 344.8 m. wavelength of Seville.

Individual Research Work.

Research work to be undertaken by individual members is the object of a scheme prepared for the winter session by the Radio Experimental Society of Manchester. Any problem, however small, is worthy of investigation, and the Society intends to give every help in the choice of a suitable problem and in the prosecution of the work.

It is realised that the choice of a problem is difficult, and accordingly a list has been prepared outlining various avenues of research. These are included under the headings of Bridge Circuits, Wet Cell H.T. Batteries, Screening, Neon Lamp Uses, Measurement of Small A.C. Currents, Problems of Rectification, and Sensitivity of Receiving Circuits.

The Society is continuing experimental transmissions with the call sign 2FZ.

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

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Coventry Transmitters Organise.

Weekly meetings are now held by the Coventry Transmitters' Association, which has recently been formed for the interchange and discussion of ideas relating to transmission and wireless subjects generally. During the past few weeks the Association has visited the Rugby High Power Station, the B.B.C. Station at Birmingham, and the Coventry Corporation Electric Light Works.

The Hon. Secretary is Mr. L. W. Gardner (G 2BPI), 10, Ludlow Road, Coventry.

NEWS FROM THE CLUBS.

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Irish Transmitters Active.

During the remainder of the summer the members of the Irish Radio Transmitters Society intend to carry out experiments with portable transmitters.

At a recent well-attended meeting at the offices of the "Irish Radio Journal" it was decided to institute Morse classes for the benefit of members who feel the need of extra practice in this direction.

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Busy During the Summer.

The Croydon Wireless and Physical Society has not lain dormant during the summer recess.

A thoroughly enjoyable afternoon was recently spent in a visit to 2, Savoy Hill, where the B.B.C. studios, control room and distribution panel were inspected. The party subsequently journeyed to the transmitting plant in Oxford Street, and were able to view the aerial equipment on the roof of Messrs. Selfridge's.

Another visit of exceptional interest was that to the Wireless Section of the Science Museum, South Kensington, which contains numerous historic exhibits of apparatus used in the early days by Sir Oliver Lodge, Senator Marconi, and others. The processes depicted in the manufacture of accumulator plates and of carbon filament lamps aroused much curiosity, and special attention was given to a model illustrating the tuning of a heterodyne receiver. In this exhibit the pressing of a button lights the valves, and a note is emitted from a loud-speaker. By turning a knob controlling a condenser, another note is produced which, by careful tuning, can be varied and brought into resonance with the first note, thus producing the "beat" effect.

The society's next visit will be to the works of Messrs. Edison Bell, Ltd., early next month.

Full particulars are obtainable from the Hon. Secretary, Mr. H. T. P. Gee, 51-52, Chancery Lane, W.C.2.

WIRELESS CIRCUITS in Theory and Practice.

20.—Valve Amplifiers.

By S. O. PEARSON, B.Sc., A.M.I.E.E.

THE greatest possible voltage amplification which a three-electrode valve is capable of giving theoretically is equal to the amplification factor of the valve, and, where greater degrees of amplification are required, two or more valves are connected in cascade in such a manner that the amplified oscillations obtained from the plate circuit of the first valve are applied to the grid of the second valve, and so on. If we had three valves in cascade, each giving a voltage amplification of, say, 5, the total amplification of voltage obtained would be $5 \times 5 \times 5 = 125$. Thus, theoretically, by connecting a sufficiently large number of valves in cascade, we can amplify any signal, however weak, up to a reasonable strength; but in practice there is a limit to the number of stages which can be used satisfactorily, chiefly because the aerial circuit picks up not only the desired signal oscillations, but various undesired electrical disturbances which cannot be eliminated, and are, therefore, amplified by the valves along with the signals. Thus, when the received signals are weak, compared with the extraneous noises, amplification will be useless if the disturbances are amplified to the same extent. Whether the undesired electrical variations are amplified to the same extent as the signals or not depends entirely on the design of the couplings between the valves.

H.F. and L.F. Amplification.

There are quite a number of ways of connecting valves in cascade, and these may be divided into two groups, namely, high-frequency intervalve couplings and low-frequency intervalve couplings. To produce audible sounds in the telephones, the received high-frequency oscillations have to be rectified so as to give current pulsations of audible frequency. Now, if it is necessary to amplify the signals, either the modulated high-frequency oscillations may be amplified before being rectified (high-frequency amplification), or the rectified low-frequency variations may be amplified (low-frequency amplification), or an amplifier may be designed in which both H.F. and L.F. amplification occur simultaneously.

Before discussing the methods of coupling valves in cascade, it will be advantageous to consider when it is better to employ low-frequency amplification (note magnification) and under what circumstances high-frequency amplification is the more suitable. This depends on the strength of the signals being received by the aerial and the amount of interference to be eliminated. If the signal is strong, the first valve can be made to operate efficiently as a detector, and initial high-frequency amplification will be unnecessary, and if used may increase to such an extent the amplitude of the oscillations applied to the grid of the detector valve that the latter fails to act efficiently as a rectifier, causing serious distortion. It must also be remembered that a strong signal swamps all the undesired electrical disturbances, and great selectivity is not necessary.

For receiving weak signals high-frequency amplification is to be recommended for two main reasons:—firstly, a valve does not operate efficiently as a detector if the signals are too weak, and it is necessary to amplify the high-frequency oscillations up to a suitable amplitude before they are applied to the grid of the detector valve; secondly, when the incoming signals are weak, they may be considerably interfered with by other undesired signals if the receiving circuit is not made very selective, and as some high-frequency intervalve couplings can be made extremely selective, the use of high-frequency amplification provides a means of eliminating interference.

Having amplified the signals at high-frequency and rectified them, the question now arises as to whether further stages of low-frequency amplification should be added. This depends chiefly upon whether a loud-speaker or telephones are to be used for listening. The output from a detector valve is quite sufficient to operate a few pairs of head telephones, but with the greatest signal strength that can be efficiently applied to the grid, the output is, as a rule, not sufficient to operate a loud-speaker unless it be a very small one.

Where a set is to be used for receiving weak signals sometimes, and strong signals at other times, it is best to design the set so that either high-frequency or low-frequency amplification, or both, can be used, switches being provided for cutting out the H.F. or L.F. valves as required. Circuits of this nature have been described from time to time in *The Wireless World*. One of the most useful sets to possess for all-round work with a loud-speaker is perhaps a four-valve receiver with one stage of high-frequency amplification, valve detector, and two stages of low-frequency amplification (1-v-2), so arranged that the H.F. valve can be cut in or out, and also one of the low-frequency stages. With such a set the possible arrangements are:—

(1-v-2) for weak signals from a distant station.

(1-v-1) for moderate signals requiring selective tuning.

(0-v-2) for operating loud-speaker on moderate signals free from interference.

(0-v-1) for powerful signals (loud-speaker) or moderate signals (telephones).

The first figure in each bracket denotes the number of high-frequency valves in use, the middle letter denotes the detector, and the last figure the number of low-frequency stages.

Intervalve Couplings.

Although in general the principles involved in the methods of coupling two valves in cascade in a high-frequency amplifier and in a low-frequency amplifier are more or less the same, the practical considerations are

Wireless Circuits in Theory and Practice.—

entirely different, and each group will have to be considered separately. There is, however, one method of coupling where the conditions are practically identical in both the H.F. and L.F. circuits, namely, the resistance-capacity method of coupling valves, and the operation of this method will be considered first.

Resistance-capacity Coupling.

If a high-resistance R is connected in the plate circuit of a valve V_1, as shown in Fig. 1, and an alternating voltage of amplitude E_g volts is applied to the grid, the resulting variations of the current in the plate circuit will cause an alternating potential difference of amplitude $\mu E_g \frac{R}{R + R_a}$ volts to be set up across the ends A and B of the resistance R, where μ is the amplification factor of the valve and R_a is the internal plate to filament resistance. Assuming that $\mu = 10$ and $R = R_a$, the above arrangement will give a voltage amplification of $\frac{1}{2}\mu$ or 5. As it is most convenient and the usual practice to operate all the valves in an amplifier from a common low-tension battery, we cannot connect the ends A and B of the resistance R directly to the grid and filament respectively of the valve V_2, because both of these points are at a high D.C. potential with respect to the filament. If we connected the point A directly to the grid of V_2, the grid would be given a high positive potential with respect to the filament, and so render the valve inoperative. But if a condenser C_1 is included in the grid lead as shown, the high tension is insulated from the grid of V_2, whilst at the same time the alternating component is allowed to pass on to the grid, the A.C. circuit being completed from B, through the H.T. battery or the condenser C_2 shunting it, to the negative leg of the filament. Needless to say, the condenser C_1 must have good insulation, which should be mica. The alternating voltage across AB is thus applied between the grid and filament of V_2 without allowing the high tension to get on to the grid.

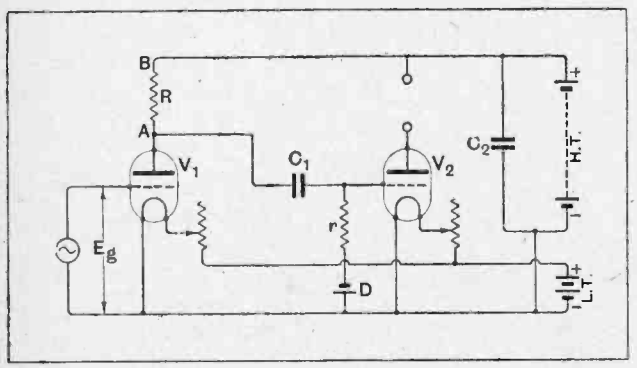

Fig 1.—Resistance-capacity method of coupling amplifying valves.

A grid leak resistance r and grid bias battery D must be connected between the grid and filament to maintain the former at a given mean negative potential with respect to the negative end of the filament. Whenever the potential of the grid becomes positive, grid current flows and the valve has a rectifying action, as explained in the section on Grid Rectification. Thus, if the grid leak and battery were omitted, the grid would automatically acquire a negative potential, but it is not satisfatcory to depend upon this automatic action, because any violent disturbance, such as that of a powerful "atmospheric," will produce such a high negative potential on the grid of V_2 that the valve is rendered inoperative for several seconds until the excess negative charge in the condenser C_1 has had time to leak away through the insulation and other parts of the circuit, and during this time the signal is suppressed or "wiped out" altogether.

The most suitable voltage value of grid battery to use depends upon whether the valve V_2 is being operated as another amplifier or as the detector. When V_2 is used as an amplifier, the negative grid bias should be sufficient to prevent the flow of grid current with the highest signal amplitude applied to the grid, and should, therefore, be just about equal in value to this amplitude. The plate voltage must then be adjusted so that the valve operates over the straight part of the anode characteristic curve when using this value of grid bias. Since the signal amplitude increases with each stage of amplification, it follows that in a cascade amplifier the negative bias should have increasing values on the grid of each succeeding valve.

The resistance capacity method of coupling is not very extensively used for high-frequency amplification, firstly, because the circuits are untuned and there is no selectivity whatever in the couplings, all wavelengths of a given order being amplified to the same extent; and, secondly, because the voltage amplification falls off very rapidly as the wavelength is decreased below about 1,000 metres. This is because the frequency of the oscillations increases as the wavelength is decreased, and the high-frequency component of the plate current does not all pass through the resistance R, a large fraction of it being shunted through the plate to filament capacity of the valve, since the reactance of a condenser decreases as the frequency is increased.

For long wavelengths resistance-capacity coupling is quite practicable if means are provided for obtaining selectivity in the tuning circuits. For high-frequency amplification in this manner the capacity value of the coupling condenser C_1 need not be greater than about 0.0002 mfd., because even with this low value of capacity the reactance is small compared with the grid to filament impedance of the valve.

Resistance-capacity coupling is more extensively used for low-frequency amplification or note magnification because all audio-frequencies are amplified to the same extent, and practically no distortion of the waveshapes is possible when suitable values of plate voltage and negative grid bias are employed.

For audio-frequencies the coupling condensers must be sufficiently large to allow the lowest note frequencies to be passed freely on to the grids of the successive valves, and in practice it is found that capacity values of the order of 0.1 mfd. are suitable. For low frequencies the grid leaks should be about 0.5 megohm.

Since there is a considerable D.C. potential drop in the anode resistances, it is necessary to employ a larger high-tension voltage than is required with other types of coupling, but this disadvantage is more than compensated for by the superior quality of reproduction.

Broadcast Brevities

SAVOY HILL TOPICALITIES

By Our Special Correspondent.

Thirty New Stations.

Since the Geneva scheme for the allocation of wavelengths became known, information has been received of the proposed erection of no fewer than thirty new Continental stations!

It is to be hoped that Geneva will get busy and make sure that the new stations will conform to the "Geneva Plan," and take wavelengths which fit in with the published schedule.

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How British Listeners are Affected.

So far as Russia is concerned the wavelengths employed for broadcasting lie with the band of 550—1,050 metres, with the addition of a few wavelengths under a hundred metres. Russia's large reconstruction plan, therefore, is not likely to interfere with British listeners, but the same cannot be said of countries nearer to Great Britain.

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The Question of Power.

In addition to the regularising of European wavelengths it would be a good thing if the power of stations were likewise determined. A certain French station which is supposed to be working on a power of 250 watts has been found to be using two kilowatts. This helps us to understand some of the astonishing long distance feats performed by lowly little stations which, under normal conditions, could hardly be expected to make their voice heard over more than a few miles.

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Pleasure with Economy.

"Radio Vizcaya," the well-known Spanish station at Bilbao, now includes a selection of international re-transmissions in each programme.

"This is an admirable plan," writes Mr. Angus McHaggis, of Aberdeen. "It combines pleasure with economy; but will you tell me what would happen if every station did the same thing at the same time?"

Nothing would happen, Mr. McHaggis.

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A Hair Raiser.

A subtle form of broadcast interference has been detected in the West London district. Complaints were received at Savoy Hill that a strange noise was heard during a regular period of half an hour each evening. When the case was investigated the interference was traced to a new electrical installation for ladies' hair treatment. This suggests still another problem for Geneva!

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Higher Power from 5XX.

There is a distinct possibility, I hear, that Daventry's power will shortly be increased. The station is at present working well within its maximum power.

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B.B.C. as Publishers.

It used to be said that broadcasting had its limitations. In the face of one development after another, however, it seems risky to hold such an antiquated belief. Pausing on the threshold at Savoy Hill the other day, I found myself listening to the sigh of the wood-saw and the dignified tread of the British workman. And then, halfway down the corridor, I espied a new office, almost completed, bearing the legend: "Book Sales Department."

A Large Demand.

The B.B.C. has inaugurated its publishing business with a remarkably successful sale of the souvenir prepared in connection with the "Shakespeare's Heroines" series of broadcasts, nearly 10,000 copies already having been disposed of. The popularity of the opera libretti prepared for the use of listeners may be judged from the fact that "Rigoletto" has already sold to the tune of 45,000 copies.

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Earliest Form of Broadcasting.

For those listeners who revel in peace and quietness, a competition between town-criers should be just about the last straw. Let them beware on September 15th. On that date 40 or 50 staunch town-criers will gather at Pewsey, Wilts, to take part in a competition arranged by the National Town-Criers' Association.

So far as listeners are concerned, the fun will begin at 7.35 p.m., when a talk entitled "Town Crying: The Oldest Form

WIRELESS IN THE HEART OF EUROPE. A picturesque scene in the Swiss Alps, where listeners have an exceptionally wide choice of programmes. Geneva, the seat of the Unione Internationale de Radiophonie, is literally surrounded by broadcasting stations.

of Broadcasting," will be given at 2LO by Mr. Francis Gribble. This will be followed by a relay from Pewsey. The first five winning competitors in the N.T.C.A. contest held earlier in the day will each give his own town cry, but the precaution will be taken of keeping the microphone at a safe distance of at least 60 yards!

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"None but the Brave."

A play which has benefited by broadcasting is "None but the Brave," extracts from which were heard a fortnight ago. Prior to the broadcast the attendances were capable of improvement, but Mr. Le Sage, of the Garrick Theatre, tells me that the play has since drawn a full house at every performance.

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Gunnery "Sigs" on the Coast.

Much as we relish the confidence inspired by the boom of British guns, there seems to be considerable justification for the complaints raised by listeners on the coast regarding Morse signals from ships engaged in target practice.

Gunnery tests are now in full swing around various parts of the coast, and Morse interference is reported by listeners all the way down the map from the Moray Firth to the South Coast. Morse signalling is doubtless an essential part of the gunnery programme, but perhaps the Service could show a little more accommodation to broadcast listeners without impairing efficiency.

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Manchester Through the Centuries.

The Manchester station is preparing a programme which will revive episodes in the history of the city and neighbourhood. These historical reconstructions will be based on the lives of individuals, the aim being to present to us our prototypes of past centuries.

Manchester was once Roman, and the broadcasting officials will, so to speak, take a sponge, and, wiping out the modern city, reconstruct a day in the life of Manchester during the Roman occupation, and so on down the ages.

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Auditions.

Many artistes who can face a large audience without a suspicion of "nerves" come to grief when taking their solitary stand before a B.B.C. adjudicator. The audition is often regarded in the same light as a visit to the dentist.

The B.B.C. programme department has now made a sensible change by placing the would-be performer in a separate studio. The aspirant for broadcast fame now sings into the microphone just as if the performance were actually being broadcast, while the adjudicator, 'phones on head, carries out his (sometimes melancholy) task in another part of the building.

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Sifting the Wheat.

In the London studios approximately 700 auditions are given every week. Hitherto the B.B.C. has opened its doors to practically every applicant for a hearing, with the result that the work thrown on a small staff has been enormous. The problem of dealing with applicants is now being discussed and it is probable that in the near future applicants will be asked to furnish a letter of recommendation from a dramatic or musical institution or from someone well known in the theatrical world.

FUTURE FEATURES.

Sunday, September 5th.

LONDON. — Scenes from "Will Shakespeare."
BIRMINGHAM.—Symphony Concert.
GLASGOW.—Day of Remembrance Parade: Regimental Associations and Ex-Service Men's Organisations.

Monday, September 6th.

LONDON.—Chamber Music.
ABERDEEN.—Ballad Concert.
BOURNEMOUTH.—"An Elder of the Kirk," a Play by Alan Macbeth.
MANCHESTER.—Variety Programme.

Tuesday, September 7th.

LONDON. — Speeches at the N.A.R.M.A.T. Dinner.
ABERDEEN. — Instrumental and Vocal Concert.
CARDIFF.—The Art of Gwalia—, a Welsh Programme.
GLASGOW.—The Parkhead Forge Silver Prize Band.
MANCHESTER.—Symphony Concert.
NEWCASTLE.—Italian Concert.

Wednesday, September 8th.

LONDON.—Symphony Concert.
ABERDEEN. — Scottish Song and Humour.
BIRMINGHAM.—"The Open Gate," a Drama in One Act.
CARDIFF.—"Grey Ash," a Play by Leonora Thornber.
MANCHESTER. — Buxton Gardens Night.

Thursday, September 9th.

LONDON. — "Trelawny of the Wells"—a Comedietta in Four Acts.
ABERDEEN.—The Jap Hawaiian Quartet.
BELFAST.—Irish Night.
GLASGOW.—Instrumental Concert.

Friday, September 10th.

LONDON.—Margate Night.
BELFAST. — "The Things That Happen"—a Play by A. McClure Marnock.
GLASGOW.—Homeland Harmony.
MANCHESTER. — "The Missing Link"—a Play by James Dryenforth and H. M. H. Graham.
NEWCASTLE.—Ballad Concert.

Saturday, September 11th.

LONDON.—Charlot's Revue.
BIRMINGHAM.—Popular Concert.
NEWCASTLE.—The Marsden Colliery Band.

Laughing at Breakdowns.

In avoiding the unpleasant delay caused by a breakdown, the B.B.C. engineers might take a leaf out of the book of the G.E. Company, who operate the famous 50-kilowatt station WGY at Schenectady.

Should a breakdown occur during transmission the engineer in the control room can switch on the emergency five-kilowatt transmitter in the space of a few seconds. This transmitter, which is located at about a quarter of a mile from the studio, can be automatically operated by an ingenious series of fifteen relays.

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Switches and Relays.

One switch starts the machines generating plate and filament current. A second switch supplies a low plate voltage, and, while this is on, the controlling engineer can consult an indicator showing whether the transmitter is functioning properly. The third switch puts the transmitter on full power. There are interlocking relays which automatically control the flow of water used for cooling the power valves, and these relays automatically shut down the set if any part fails to operate.

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The Wily Atmospheric.

Some interest has been aroused by the suggestion that a sort of "Atmospherics Bureau" should be set up to acquaint listeners with the atmospheric conditions likely to be encountered over a given period on different wavelengths. I am told that there is no likelihood of such an innovation. The scheme is quite a pretty one on paper, until one examines it closely. In the first place, it would mean doubling the staff at coastal stations for the purpose of obtaining reports from ships on the Atlantic. At the same time a separate staff would be required at the broadcasting stations to receive and collate the reports. Further, conditions in one part of the country vary from those in another, and are also different on varying wavelengths.

Next, please.

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Wireless Dinner Speeches.

In addition to the broadcasts from Olympia during September in connection with the wireless exhibition, the speeches at the dinner of the National Association of Radio Manufacturers and Traders will be relayed on September 7th from the Piccadilly Hotel.

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Father Knox Again.

Father Ronald Knox will give a humorous sketch, and, it is expected, take charge of the studio at the Glasgow station from 8 to 9.30 p.m. on September 11th. Although a certain secrecy is being observed respecting the nature of Father Knox's "turn," it is stated that he will not this time broadcast anything in the nature of the mythical sacking of London

UNIVERSAL THREE-VALVE RECEIVER.

Details of Final Adjustment and Operating Data.

By N. P. VINCER-MINTER.

(Continued from page 273 of the August 25th issue.)

In the first part of this article, published in the August 18th and 25th issues, we discussed the question of the "perfect" set, and concluded that so far as detector and L.F. amplification were concerned, a fair measure of finality was attainable. We therefore considered the constructional details of a "final" three-valve receiver (0-V-2) which would tune to all wavelengths from 20 to 20,000 metres, and could be connected to any type of open or frame aerial, or to the output of any H.F. amplifier. This week we consider the question of finally adjusting and operating the receiver.

WE are now in a position to discuss the question of adjusting and operating this receiver in order to obtain the best results. Commencing from the bottom of the wavelength range on which this receiver was designed to operate, namely, 20 metres, we first need a No. S.W. 4 "Dimic" coil, which has a wavelength range of 20 to 50 metres when tuned by the appropriate variable condenser. With regard to the H.F. choke, which consists of 200 turns of No. 36 D.S.C. wound on a former 1½in. in diameter, it should be pointed out that this comes automatically into action on these short wavelengths, the "Cosmos" choke, owing to its self-capacity, not offering a very great impedance to the fifteen million cycles frequency corresponding to 20 metres. Great care must be exercised with regard to the construction of this choke in the matter of avoiding any resonance effects due to the self-capacity of the choke, which would upset the smoothness of reaction control over certain portions of the tuning range, and it may be necessary to experiment a little in removing a few turns from the choke.

20 Metres and Below.

There is no reason, of course, why readers should not experiment below 20 metres with this receiver, but they will have to make their own coils, since "Dimic" coils are not at present made for wavelengths below 20 metres. Since on 15 metres, for instance, the coil required will be only four turns wound on a "Dimic" coil former, this should present no difficulty, however. Extraordinary care will have to be taken in eliminating self-capacity from the choke, however, or the valve will not oscillate. Less turns can be used on the choke, since the required inductance will be less, and this will have the effect of reducing the self-capacity. Perhaps, therefore, it would be advisable at the outset to make the short wave choke of the plug-in type, so that different values may be experimented with. This can easily be done by bringing the two ends of the choke winding to valve pins designed to plug into two valve sockets on the baseboard. The choke should, however, be mounted horizontally in this case, in order to avoid the two valve pins being close together, and so causing self-capacity across the choke. No. S.W.3 "Dimic" coil will enable the KDKA sixty-metre transmission to be tuned in, whilst by the use of the appropriate coils we can go up to four thousand metres. Above 150 metres, or so, the "Cosmos" choke comes into play, and will carry us up to four thousand metres.

Above this wavelength, we are again reduced to making our own coils, for the "Dimic" coils are not yet available below 20 metres or above 4,500 metres. The long wave "Dimic" coils are wound in slotted form, the slots reducing self-capacity. If, however, we desire to receive a long wave C.W. station on 10,000 metres, self-capacity will not trouble us, and we shall want all the space we can to wind the necessary 1,500 turns for this purpose, and so can use plain unslotted formers. The "Cosmos" choke is also slotted for a similar purpose, but again we shall not be greatly troubled by self-capacity and must use a plain former filled with No. 47 D.S.C. wire and clip this in instead of the "Cosmos" choke when desiring to receive the long wave C.W. stations. We must also plug in a larger type of feed back condenser, and it is advisable also on these very long wavelengths to experiment with the values of grid leak and condenser, and, therefore, these two components have also been made interchangeable and easily accessible.

With regard to the question of valves, we require a valve having an impedance of between 20,000 and 30,000 ohms to act as a rectifier, a low impedance valve of 8,000 ohms or so for the first stage of L.F., and if we are situated fairly close to a broadcasting station, a valve of still lower impedance, namely, 3,000 or 4,000 ohms for the output stage. These requirements are amply catered for by using the D.E.5B., the D.E.5, and the D.E.5A. in the order named. If, however, we are *not* within five miles of a B.B.C. station, the valve of extra low impedance in the output stage is unnecessary, and we can use a somewhat higher impedance valve without overloading. A D.E.5A. is really only necessary where very great volume combined with extreme purity is desired. Other valves having the approximate characteristics mentioned above, may be used, of course, irrespective of whether they are 2-, 4-, or 6-volt valves, and the writer has obtained excellent results with a Mullard P.M.1 L.F. valve as detector, and two P.M.2 valves in the output stages.

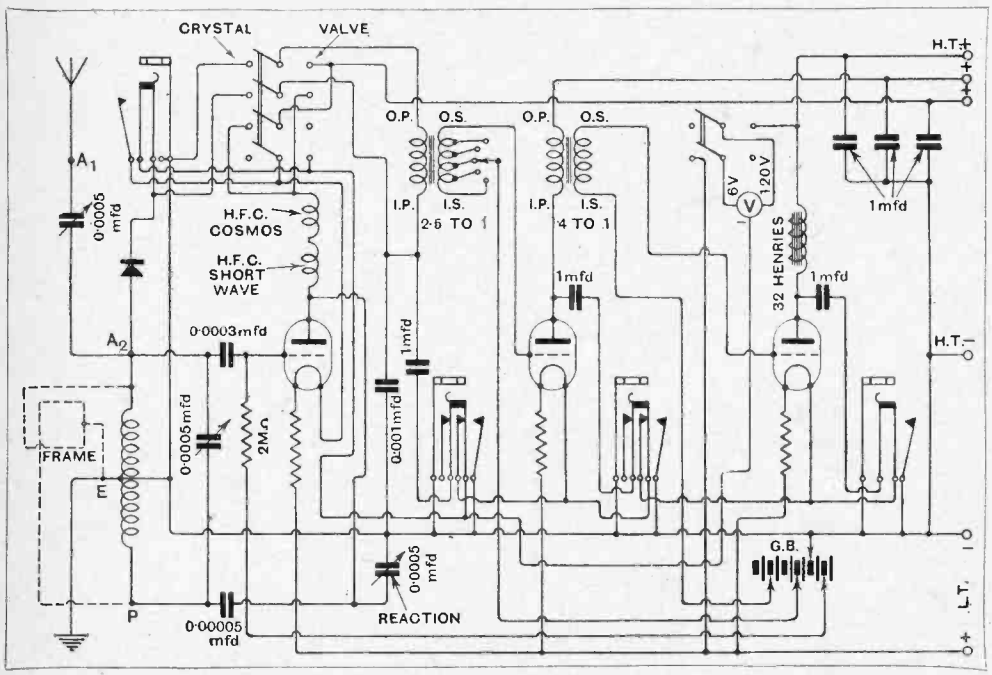
Adjusting the Detector Valve.

When the receiver is tested out the first thing to be done is to adjust the H.T. value on the detector valve so that smooth oscillation is produced. It should be pointed out that if such reaction opposing devices as an exceptionally high impedance valve or a direct coupled aerial are used, difficulty might be experienced in getting the receiver to oscillate, unless an unusually high H.T. value is used on the detector. The ardent experimenter is, therefore, advised to equip himself with a 0.0001 mfd. plug-in condenser and insert it in place of the 0.00005 mfd. feed-back condenser under these conditions. But under proper operating conditions, the value of 0.00005 mfd.

Universal Three-valve Receiver.—

is correct, and if a larger value than this were used under proper conditions of adjustment the receiver would oscillate perpetually, especially if a frame aerial were being used.

Do not forget when using grid rectification that the positive bias given to the detector valve need not exceed about three volts. The G.B.+ wander plug should, therefore, be placed in the first grid battery socket from the actual positive socket, and the wander plug of the detector valve placed in the + socket, thus giving three volts for grid rectification, whilst for anode rectification the grid wander plug should be placed on the other side of the G.B.+ plug, the actual negative voltage necessary to bring the working point down to the bottom bend of the anode current curve being determined by the characteristic of the valve and the H.T. value used. This information is readily obtained by studying the curve published by the makers of the particular detector valve in use. This matter was, however, fully gone into in an article published on page 799 of the June 16th issue.



The theoretical diagram of the receiver.

Adding an H.F. Amplifier.

As will have been seen from Fig. 3 of the first part of this article published in the August 18th issue, this receiver can readily be connected up to any existing neutralised H.F. amplifier of a modern type, the actual "2 H.F." amplifier illustrated in Fig. 3 being the neutrodyne unit described in the October 21st, 1925, issue of this journal. This unit can be constructed as described in that issue with such modifications as S.L.F. condensers and more efficient H.F. transformers, in accordance with the progress made in H.F. amplifier design and reflected in the pages of this journal. It is not necessary to use two stages of H.F., and, indeed, in the writer's opinion, the average user would be better advised to concentrate on getting the utmost efficiency from one stage of H.F. rather than to run the risk of getting instability and poor amplification per stage with two H.F. valves. It would be better, therefore, if the reader attempted to construct a single stage H.F. amplifier in accordance with the principles laid down in connection with the "Everyman's Four-valve Receiver" described in the July 28th and August 4th issues of this journal. It is also possible, of course, to add an ordinary non-neutralised stage of H.F. to this receiver as explained in column 2 on page 272 of the August 25th issue, the full circuit being given in the "Readers' Problems" pages of this issue in response to a request from a reader. For further details in the matter of add H.F. to this type of receiver, the reader is strongly recommended to study the complete article on this matter published on page 117 of the January 27th issue of this journal, which goes into great details on this matter, some very useful information and interesting circuit diagrams being published.

Reaction may or may not be used when employing the H.F. amplifier by setting the reaction condenser to the appropriate position, although if grid rectification is used it will be useful in counteracting the damping thus produced. The crystal rectifier may also be used after the H.F. amplifier if desired.

Limitations of Range.

Now with regard to some results which the writer has had with this receiver. First, let it be clearly understood that this receiver is merely intended to be a regenerative detector and two L.F. type receiver, rather more efficient than the average type, owing to the special form of reaction control employed. In addition, of course, it possesses the features of being adaptable to any type of aerial, including a frame, or to the output of any H.F. amplifier, and, furthermore, can, if desired, be used as a plain crystal set or used in conjunction with any of the valve combinations clearly indicated in Fig. 2, which we reproduce again for the convenience of readers. It is, however, no "three toob, knock 'em cold, go get 'em world beater," nor will it compare with the two receivers mentioned on page 212 of the August 18th issue.

Using a normal outdoor aerial and earth 8 miles from 2LO and about 70 from 5XX, loud headphone signals were received from the crystal receiver on both stations, considerably louder in fact with sharper tuning than with a "conventional" receiver, owing to the fact of the crystal and telephones being connected across half the

Universal Three-valve Receiver.—

coil only, thus lessening the damping effect of the crystal. Ample loud-speaker volume was received from plain crystal and 2 L.F., crystal plus reaction and 1 L.F., and also from valve detector (both grid and anode) plus 1 L.F. Both in the case of London and Daventry the valve detector and two L.F. overloaded the loud-speaker and called for drastic manipulation of the volume control even with reaction set at minimum. Simultaneous reception on the loud-speaker and headphones operated from both valve and crystal detector was tried with great satisfaction, using the many combinations already enumerated in this article. Results on a good indoor aerial were scarcely less satisfactory, which does not say much for the efficiency of the writer's outdoor aerial system. It must not be forgotten that a big outdoor aerial must be attached to A.1, but a small indoor aerial must be attached to A.2.

Some Results Obtained.

Using a standard two-foot centre tapped frame, both with and without an earth attached to the centre tapping of the frame, excellent loud-speaker results were obtained from 2LO, and also from Daventry, by loading it symmetrically, as explained last week. It might be mentioned that using the crystal *without* reaction valve, weak but perfectly audible headphone signals were obtained from 2LO, and on switching on the two L.F. valves the loud-speaker gave forth pleasant albeit rather quiet results. The addition of the reaction valve greatly increased signal strength and quality was very good. Using the frame plus three valves and reaction, three or four other stations were tuned in on the telephones as might be expected, and on returning to the normal aerial and earth and adjusting the aerial coupling condenser, no difficulty was experienced in eliminating 2LO and receiving a number of other stations on the loud-speaker *without* oscillating, although when attaching a neutralised H.F. amplifier, as already explained, results were very much better and a number of more distant stations were brought in.

Descending to the short waves, no difficulty was experienced in logging a fair number of distant amateurs. Reception of KDKA on his 60-metre wavelength was attempted, but unfortunately the writer, who is a truthful man, must confess that he fell asleep, in which condition he remained until aroused by the clarion call of the early morning milkman, although no difficulty is anticipated in receiving this station at any time when conditions are good enough for its reception by any other short-wave receiver. A number of long wave C.W. stations, including several Americans, in the neighbourhood of 12,000 metres, were received by making a rough long-wave coil and choke as already explained. This is, however, a comparatively simple achievement, which can be accomplished on almost any single valve long-wave receiver. A short test was conducted in a locality about 2 miles from 2LO for the purpose of determining selectivity, but it was found that, although the aerial coupling condenser behaved exceedingly well, its efforts were set at nought by the tuning coil acting as a miniature frame aerial and picking up direct. The makers of the " Dimic " coil, however, now manufacture a special copper screening box for this product, which should overcome this evil, and the writer hopes shortly to have an opportunity of adding it to this receiver.

The End in Sight.

In conclusion, the writer would like to point out that this receiver fully lives up to the ideals which he set out in the first part of this article, and if there is anyone who requires a receiver which will not be put out of date by the next advancement in H.F. amplifier design, but which, on the contrary, can either be used as it is as a source of musical entertainment, or can have any type of H.F. amplifier added to it for experimental purposes, then he will not waste his money if he builds this receiver. The question of a cabinet has been left entirely to the reader's discretion, but the writer suggests that a large cabinet be used, in which provision is made for housing all the batteries. A relay may also be fitted inside the cabinet, so that the receiver may be switched on or off from any room of the house, as described by the writer in his article in the April 28th issue, whilst provision is made for using a single wire extension only if it is desired to operate the loud-speaker at a distance from the receiver by attaching the single wire to the " tip " of the Jack. This, however, is fully gone into in a special article dealing with this matter which was published by the writer in the February 10th issue of this journal.

Canterbury.

Brazil :—BZ 1AD, 1AF, 1AO, 1AW, 1AX, 1BD, 1BI, 1IB, 2AA, 2AF, 2AJ, 5AA, 5AB. U.S.A. :—U 5ACL, 5AKL, 5JD, 5QL. Canada :—C 1AR, 1ED, 2AL, 2BE. Mexico :—M 9A, 9B. Uruguay :—CK84. N. Africa :—DA 1CW, FA 8IP. Hong Kong :—RXY. Australia :—A 7HL. New Zealand :—Z 2AC, 2AE, 4AA, 4AM.

(0-v-1) 30 to 45 metres.

H. and W. Hazeldene.

Chipping Campden, Glos.

America :—U 2GK, 2CY, 2KK, 1AWE, 1AFO, 1AKM, 1BYX, 1CMF, 1CIB, 1CAW, 1CMF, 1ED, 1FF, 1GA, 1ZK, 2ATC, 2ATI, 2ATZ, 2APV, 2ARM, 2AMZ, 2ANM, 2AAH, 2ASM, 2BEL,

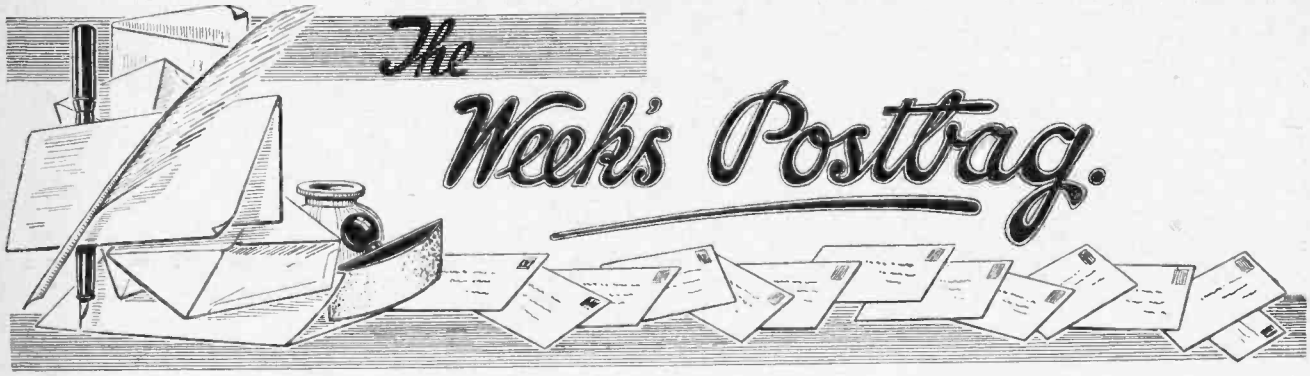
Calls Heard.

Extracts from Readers' Logs.

2CYX, 2CNF, 2CRB, 2EI, 2EH, 2EX, 2EY, 2EW, 3BMA, 3BMC, 3BMR, 3BUR, 3BWT, 3BGJ, 3WF, 4AAO, 4BK, 4CL, 4EF, 5ZAI, 5ZAJ, 6CQA, 8ALY, 8WA, 9DK, 9QR, 9WR. Africa :—D AITA, 2QR, 2KD. Argentine :—R AF2, BC8. Brazil :—BZ 1AD, 1AP. Canada :—C 1AR, 1AX, 1ARB, 1ARQ, 2CFZ. Australia :—A 2LM, 7CY, 7ZF, 7ZU. 7HL. Germany :—K 4AY, 4BT. Irish Free State :—GW 19B, 22B. Chile :—CH 3IJ, 3IM. Porto Rico :—PR 4GE, 6UR. Santa Fé :—FI2, FI7. Spain :—EAR12, EAR21, EAR27. Holland :—N OBL, PCMM, OGG, PCK4, OAM, OHB, OWC. Italy :—I 1FC, 1GW, 1CO, 1AX, 1SRA. Poland :—T PXX. Norway :—LA 1SE. India :—DCR, DC4. Switzerland :—HB 9XA. Portugal :—P 2AF, 1AE. France :—F 8AF, 8AR, 8AE, 8AE2, 8B4. New Zealand :—Z 1XB, 1RX. Tasmania :—A 7CW. Sweden : — SMTM, SMTI, SMLZ, SMXY. Africa :—O A7F. Various :—GB1, GB3, T3, SWS, OTC, NRK, TPX, PX1, AF8AF, UUN, SQF1, R41, TR4.

Reinartz and eight-valve superhet.

F. Woodroffe.



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.

TRANSMITTER FATIGUE—A SOLUTION?

Sir,—May I point out that when a B.B.C. station is first opened there are comparatively few receiving aerials in the district it is designed to serve. Very soon, however, aerials spring up in all directions and soon there is a forest of receiving aerials all tuned to the new transmitter. The transmitter only radiates a given quantity of energy and each of the receiving aerials tuned to it must absorb some portion of this. It follows that as the number of local listeners increases, so the absorption of energy locally increases, and the energy transmitted to a distance is lessened. Moreover, the absorption will be greater on the direct wave, so it will be weakened more than the reflected wave and this will assist fading. The Glasgow and Newcastle stations used to be quite easily obtained here almost any evening two years ago, but have become harder and harder to get as time has progressed, till now it is almost impossible to get good reception from either of these stations.

Swansea. J. C. KIRKMAN.

COMMUNICATION ON LOW POWER.

Sir,—With reference to the letter by Mr. T. A. Studley in the August 18th issue, I should like to mention that, as a very enthusiastic amateur, I am entirely in agreement with his suggestion, and think the idea as originated by Mr. Exeter and Mr. Allen a very excellent one, also one to be supported by all low-power "hams" who are really interested in experimental work.

As I rarely use more than the customary ten watts I should greatly welcome the inauguration of such a test, as of late owing to the ever increasing high-power QRM I have been unable to do anything of merit for the last two months, and have consequently closed down until such time as something like the above scheme comes into being.

I have found it very discouraging when working a station over 1,000 miles distance to be entirely blotted out by heavy high-power QRM, and feel sure that the "big noises" would give the QRP men a chance if they knew of the conditions.

Keighley. R. MITCHELL, (G5KZ).

Sir,—I have noticed in several of your recent issues a good deal of correspondence on the subject of low-power short wave tests.

I would like to state that this matter is whole-heartedly supported by the T. and R. Committee, and steps are being taken to organise a low-power test of one week's duration in November, 1926. All notices will be issued in this connection in the October issues of the T. and R. Bulletin.

G. MARCUSE (Hon. Sec.),
T. and R. Section,
The Radio Society of Great Britain.

Sir,—Further to my letter published in your issue of July 21st under the above heading, I would like to make known through your columns that I have since been in communication with the Committee of the T. and R. Section, and I understand that a scheme is being formed for the purpose of arranging these International tests.

As it is necessary that we have all the backing we can obtain, I should like all those transmitters who are desirous of taking part to forward me their names, call sign, etc., so that I can compile a comprehensive list to place in the hands of the secretary of the Section. It would help matters, too, if the interested persons could pass on the news to those who may like to assist.

Kensington, W.8. G. A. EXETER (G 6YK).

WIRELESS WITHOUT WEIGHT.

Sir,—Being very much attracted by the description of a single-valve portable receiver described in your issue of July 21st, I made one up on the lines described, using such material as I had by me. The attaché case was only 3in. deep, however, and necessitated a slight rearrangement of components.

Results were extremely good—in fact, to me, amazing—until I put it in the case, when it refused to oscillate and became almost inaudible. In view of the fact that it was an ordinary hide case this was surprising, but was finally overcome by raising the frame from the bottom of the case by about ¾in. by means of feet. In my case this gave about the same distance clearance all round, and the set works perfectly well now.

I mention this in case any of your readers who have constructed this set have met with the same difficulty, not having tested the set until in the case, when the fault would be very puzzling, and would possibly lead them to give it up in disgust, whereas the receiver is most effective, and should be a boon to many people who do not spend their evenings at home.

London, N.13. E. H. LAISTER.

AMATEUR WORKING RECORDS.

Sir,—In one of your recent publications you mention that the American amateur station 3BWT has created a record by working his station continuously, and I would like to mention that this station consists of 12 operators. I have recently had a visit from a young lady from the same town who imparted this information.

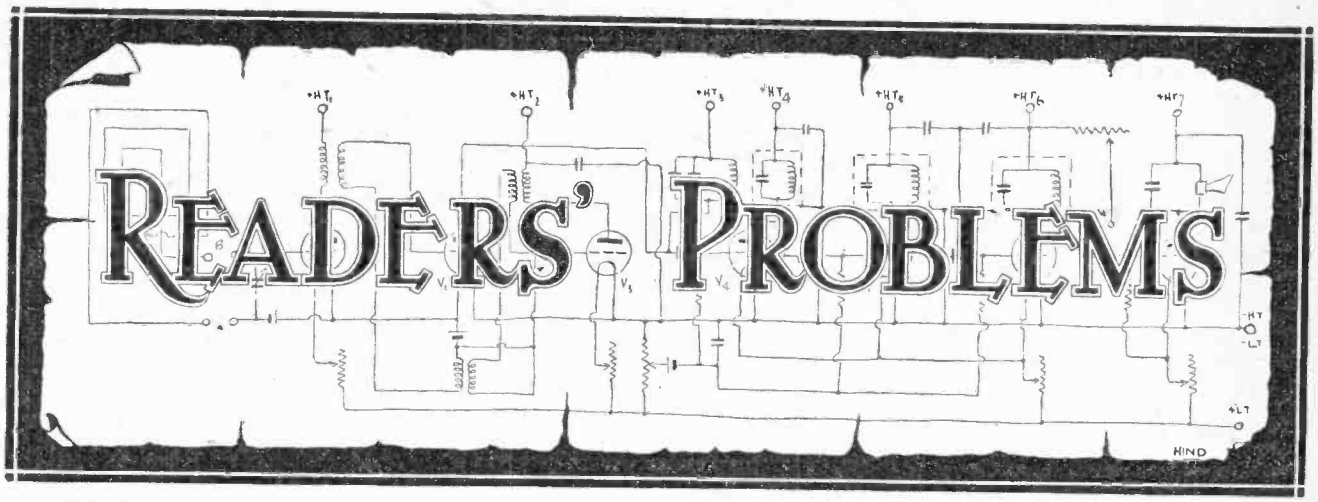
No doubt if the records of some of our enthusiastic T. and R. members who run their stations single-handed were known our multi operator stations would be surprised.

GERALD MARCUSE (Hon. Sec.),
T. and R. Section,
The Radio Society of Great Britain.

WHERE IS THAT STATION?

Sir,—Writing as an amateur who spends a considerable time listening in on short waves, may I ask if transmitters would kindly help us more, by giving the name of the district from which they are sending? One may wait for the call sign, and get it, only to find it is not in the best list you have. What the average person wants to know is, not the name of the station sending, but the distance away from him. Could we not have less O.M.s and O.K.s and more place names?

London, W.C.1. BM/BB5J



"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.

Adding an H.F. Stage.

I have read with very great interest the article on the "Universal Three-Valve Receiver" commencing in your August 18th issue. The method of adding a "Neutrodyne" H.F. amplifier is clearly seen from Fig. 3 on page 214, but I find it difficult to understand how it is possible to add an ordinary unneutralised amplifier to this receiver, and some further information would oblige.

R. H. S.

The method of adding an unneutralised stage of H.F. amplification is quite straightforward, and is illustrated in Fig. 1, where the dotted line portion of the diagram represents the first valve of the "universal receiver." It will be seen that the output of the H.F. amplifier connects to the A_2 and E terminals of the original receiver, the terminals P and A_1 and also the aerial coupling condenser not being shown, as they are not in use when the H.F. amplifier is added. It will be observed that the amplifier is of the conventional type, and provision is made for using either direct or "aperiodic" aerial coupling. It is most important that the H.F. choke in the plate circuit of the H.F. valve be of the highest possible efficiency, and a choke of a type specially designed for H.F. coupling rather than for Reinartz reaction effects, such as the Marconiphone choke, should be used, or, better still, a high-efficiency choke should be made in accordance with the constructional details given in the "Hints and Tips" section of this journal for February 24th.

It will be at once apparent that when the H.F. amplifier is in use reaction can still be applied by manipulating the reaction condenser, or alternatively, of course, if it was desired to make the operation of the receiver as simple as possible, reaction could be cut out entirely by turning this condenser to the appropriate position. It should be pointed out that this applies with equal force to the case of a neutralised amplifier, such as in Fig. 3, page 214, of the August 18th issue. The H.F. choke in the plate circuit of the detector valve need not, of course, be of high efficiency, as explained in the article dealing with the original receiver. Common H.T. and L.T. batteries may or may not be used as desired. If separate batteries are used, of course, it will be necessary to attach an H.T.– terminal to the L.T.– terminal of the H.F. amplifier, but otherwise it is unnecessary, this connection being automatically formed by the L.T.– busbar which is common to both amplifier and receiver.

By the use of appropriate values of plug-in coil, the combination may be made to operate on any wavelength, but if further information is desired reference should be made to page 754 of our June 2nd issue, where the whole question is dealt with in greater detail.

o o o o

An Efficient Superheterodyne.

I am contemplating the construction of an efficient superheterodyne, and am undecided upon the exact type of oscillator to employ. I wish if possible to make use of a combined oscillator and first detector, but not if this necessitates a sacrifice of efficiency, and should be glad of your advice in this matter. *H. O. S.*

Apart from the use of a separate oscillator valve, which is undoubtedly the most efficient method to use, there are two main methods of employing a combined oscillator and first detector valve, the first being the second harmonic method, and the second being the "auto-

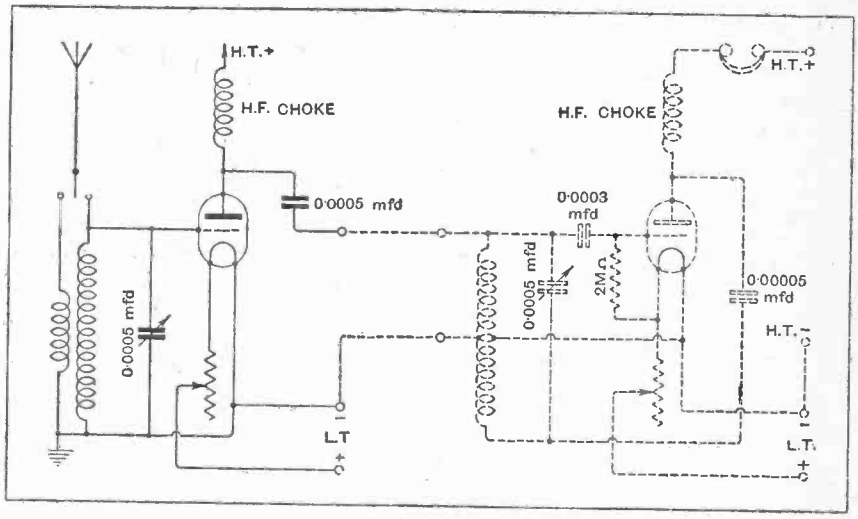


Fig. 1.—Adding an H.F. stage to the Universal Three.

dyne" method which enjoys a great vogue in America in a somewhat modified form under the title of "Tropadyne." Each of these methods of combining the function of two valves into one, however, suffers from the disadvantage of instability at the lower end of the wavelength scale when the frame and oscillator tuning condensers are set towards their minimum positions. These disadvantages have, however, been completely overcome by the introduction of the Hartley oscillator-detector, which has been developed quite recently from the well-known Hartley circuit, the result being that it is possible to construct a superheterodyne employing a common detector-oscillator valve which gives results approaching those obtained with a separate oscillator valve, but without the drawback of having an extra valve to maintain.

The necessary circuit is given in Fig. 2. It will be seen that it is necessary to employ a centre tapped coil which may consist of some such coil as the well-known "Dimic" coil. No other coil is necessary, nor is there any moving coil for adjusting the strength of oscillations produced, this being controlled entirely by the 0.00005 mfd. variable feed back condenser. Thus the changing over from the normal broadcasting wavelength back to, say, the Daventry wavelength can be accomplished simply and rapidly by merely interchanging one coil.

capacity of 0.0005 mfd. would need to have its two sections each of 0.001 mfd. capacity.

The strength of the oscillations produced is governed by the adjustment of the 0.00005 mfd. (50 micro-microfarads) variable condenser which can consist of some such instrument as the well-known

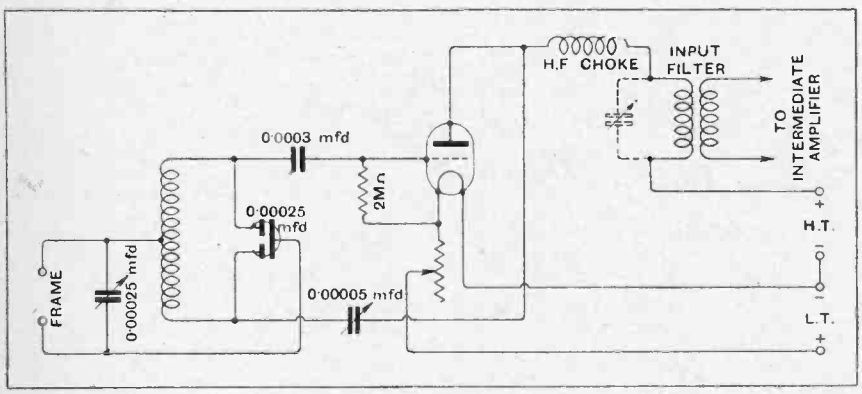


Fig. 2.—The Hartley superheterodyne oscillator

The oscillator tuning condenser consists of a double circuit tuning condenser such as are once more appearing upon the market, but in a modernised form. The connection coming from one side of the frame and the frame tuning condenser connects to the common rotor shaft, that is, the electrical centre of the double condenser, whilst the other side of the frame connects to the centre of the coil. It should be noted that this double condenser must be of a type in which each half of the condenser is of 0.0005 mfd. capacity, thus giving a resultant total capacity of 0.00025 mfd., since the two halves are in series. If the wavelength range is desired to be increased, it would be necessary to use a 0.0005 mfd. condenser for tuning the frame, and the double condenser in order to give a total

Gambrell "Neutrovernia." Since the frame aerial circuit is connected across the oscillator circuit at two points which are at equi-potential, no energy will be fed back to the frame aerial, and, therefore, no radiation will take place. By substituting a plug-in coil for the frame aerial, it is, of course, possible to substitute a normal outdoor or indoor aerial and so increase the range of the receiver without annoyance to neighbours, since, as already explained, no energy will be fed back into this circuit. By adopting suitable modifications in accordance with Fig. 1 on page 210 of our August 18th issue, it is possible to convert the circuit to the well-known Schnell system with equal effect. The remainder of the circuit can, of course, be of the conventional type.

The Correct Condenser Values for Capacity Reaction Control.

I notice in circuits in which capacity control of reaction is used, such as the Reinartz, Weagant, Hartley, and Schnell circuits, the values given for the maximum capacity of the reaction condenser vary greatly. Can you give me any definite ruling on this point and explain what factors govern these values? *S. H. W. R.*

In the Reinartz or Weagant circuits it is desirable to use the smallest possible value of reaction coil, that is to say, the smallest number of turns on the reaction coil winding, or, in the case of plug-in coils, the smallest size coil with which it is possible to produce oscillation. This postulates the use of a reaction condenser with a fairly large maximum capacity, say, 0.0005 mfd. In order to make this form of reaction control really smooth, however, it is necessary that a large movement of the reaction condenser dial be required to give a comparatively small change in capacity. From this point of view, therefore, the logical deduction is that a 0.0001 mfd. variable condenser be used for reaction control. This, however, entails the use of a large reaction coil, and trouble then arises due to the high capacity between the aerial coil and the large reaction coil, especially if plug-in coils are used. Actually in practice, therefore, it will be found that a useful compromise is to use a variable condenser having a maximum capacity of from 0.0002 mfd. to 0.0003 mfd.

In the case of the Hartley or Schnell circuits, of course, the value of the feed back condenser is very small, about 0.00005 mfd. (50 micro-microfarads) as a rule. This value cannot, however, be laid down as a hard-and-fast rule, because in certain circumstances it might not be large enough to give sufficient feed back to produce oscillation. This value is perfectly correct, for instance, if correct values of filament and plate voltage are being used on the valve, if the aerial coupling is fairly loose, or if the grid of the valve was only given sufficient positive bias to produce cumulative grid rectification. If, however, any of these conditions were violated, such as use of too little H.T., the use of a direct-coupled aerial or of excessive positive bias on the grid, the forces opposing reaction in the form of grid current and aerial damping, etc., might be sufficient to stop oscillation, and so necessitate the use of a larger capacity of 0.0001 mfd. in order to produce oscillation. In the case of the Hartley circuit described on page 77 of the July 21st issue, this could be arranged for by inserting a 0.00005 mfd. fixed condenser in parallel with the existing variable 0.00005 mfd. condenser, whilst in the case of the Schnell receiver described on page 210 of the August 18th issue it could be effected by substituting a 0.0001 mfd. plug-in fixed condenser in place of the 0.00005 mfd. instrument actually used in the receiver

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A REITERATION OF OUR POLICY.

EVERY distinct public need in this country creates a demand which is supplied by some industry. The prosperity of the industry is dependent entirely upon the extent of the public demand. Public interest is largely assisted and cultivated by the publications, either technical or popular, relative to the industry, which circulate amongst the interested public; these journals keep the reader informed on all matters allied to the subject covered by the editorial scope of each individual journal.

The Wireless Industry is comparatively new and there are in existence to-day a considerable number of journals, the editorial policy of which is designed to meet the needs of the various sections of the wireless public. Now we believe that a journal has very definite obligations to its readers, and if these obligations are properly met the industry benefits very largely as a direct result of the part played by the journals. In our opinion such journals should be conducted on lines which will place them altogether above suspicion of any motive other than the service of the reader.

It must be recognised that nearly all journals are very largely dependent for their financial success upon the revenue derived from the advertisement pages, and the temptation must always exist for the proprietors of journals to place the moral standard of their policy second to financial considerations and offer to advertisers special advantages in the way of references in the editorial pages as a means of inducing them to take advertising space. Such a policy is, in our opinion, calculated not only to degrade the journal which adopts it, but it is at the same time, we consider, deceiving the reader, since the reader is entitled to believe that the editorial policy is strictly impartial. All possible excuse for such a practice, even from the point of view of the interested advertiser, disappears when we remember that the reader, once aware of it, would never afterwards accept without suspicion even the most commendatory remarks regarding an advertiser's product thereby robbing the advertiser of the valuable publicity aid which a complimentary editorial comment gives when the impartiality of the journal is unassailable.

The policy of *The Wireless World* has always been, and will continue to be, that of considering first the requirements of the reader. Sets which we describe in our pages make use of apparatus chosen for its performance, and the choice is unhampered by any consideration of whether or not the manufacturer whose apparatus is used is an advertiser. We believe that by pursuing this policy unswervingly we shall retain the confidence of our readers and at the same time help to maintain the industry on that higher plane so essential to its prosperity, for by that means only can confidence as between the public and the manufacturer be assured.

Our readers may naturally be surprised that we should devote this space to a reiteration of our policy, which (at least to our regular readers) must be already well known; but we have reason to believe that the time is opportune for such a statement.

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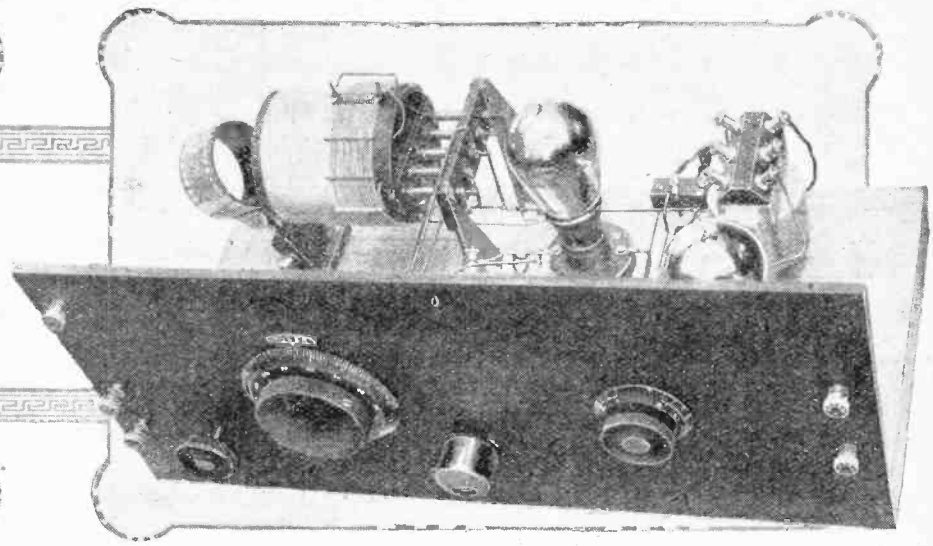
The Simplest Reflex.

TWO VALVES and CRYSTAL.



By H. F. SMITH.

THE amateur is often advised to build, for reception of the local station, a simple receiver with a crystal detector and two stages of low-frequency amplification. There is a good deal to be said in favour of such a course, but it seems rather a pity definitely to forego any possibility of receiving distant transmissions when, by adding little but a reaction coil and two fixed condensers, it is possible to convert this arrangement to one which has a much more extended range and greater selectivity. This latter property, it may be argued, is of little benefit when local reception only is being considered, but it must not be forgotten that there is a possibility of alternative programmes in the near future, and if and when this happy state of affairs comes to pass, any receiver altogether lacking this quality will be almost useless to those of us who may happen to live in the neighbourhood of a pair of "alternative" stations.

It may be thought that any attempt at obtaining both high- and low-frequency amplification simultaneously from a single valve will result in a reduction of quality. In fact, it has been stated that the tone quality obtainable from a reflex set must inevitably suffer because an H.F. by-pass condenser is, of necessity, connected across the secondary of the L.F. transformer. It would be useless to pretend that the addition of this condenser does not give rise to some lowering of tone, but, provided its capacity is kept down to the lowest possible value, and a transformer of moderately low ratio is used, it seems likely that, until the perfect loud-speaker is devised, the slight loss on the higher audible frequencies is rather an advantage than otherwise.

Principle of the Circuit.

The circuit used in the receiver is given in Fig. 1, and is by no means new, although its possibilities seem to have been somewhat neglected. The theoretical considerations involved have been discussed at some length in *The Wireless World*,[1] and the writer believes that a similar arrangement was described in an American contemporary about a year ago under the title of "The Old Dobbin"—presumably as a tribute to its reliability and "pulling" powers! Its operation is best understood by considering the action of the reaction coil as reducing the damping present in the aerial-grid circuit and helping to build up a larger signal voltage across the secondary coil than would otherwise be obtained. To assist further in reducing damping and to increase selectivity, the crystal and transformer primary are connected across only a portion of this coil, to reduce the H.F. voltage applied to the crystal, and consequently its loading effect on the circuit. Alternatively, the reaction coil may be considered as the primary of an

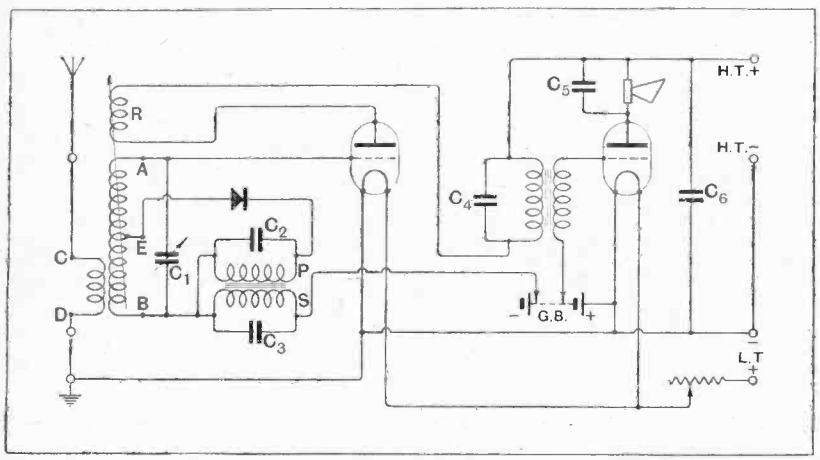


Fig. 1.—THE THEORETICAL CIRCUIT DIAGRAM. The lettering A—D corresponds with that in Figs. 5 and 9. C_1=0.0005 mfd.; C_2=0.0003 mfd.; C_3=0.0002 mfd.; C_4=0.0005 mfd.; C_5=0.001 mfd.; C_6=1 mfd.

[1] *The Wireless World*, April 28th, 1926, page 618.

The Simplest Reflex.—

H.F. transformer, with the coil to which it is coupled acting as its secondary, as well as performing the function of an aerial tuning transformer.

After rectification by the crystal, L.F. pulses are passed through the primary of the transformer, are stepped-up in voltage, and applied as potential differences to the grid of the first valve. The second valve operates merely as an L.F. amplifier, the condenser C_4 across its primary acting as a by-pass to the H.F. currents which are also flowing in this circuit.

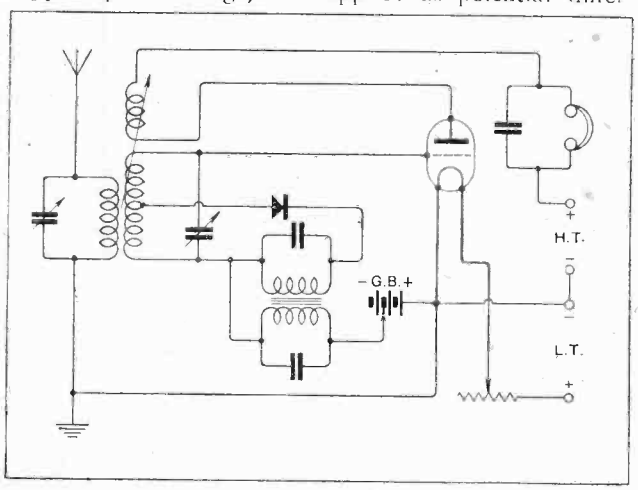


Fig. 2.—A suggested modification, using ordinary interchangeable coils.

The Aerial Circuit.

A coupled "untuned" aerial circuit is used, partly to increase selectivity, and also to enable the batteries to be earthed, as is always desirable in a dual-amplification set. This particular arrangement may be modified considerably without difficulty, and in Figs. 2 and 3 are shown circuits (omitting the L.F. valve) where standard plug-in coils may be used in an ordinary holder. In the first, variable reaction is obtained by swinging the anode coil, and in the second by means of the reaction condenser (R.C.). Some slight difficulty may be experienced in picking up connection for the crystal on the secondary coil, but it will generally be possible to make a joint to its approximate centre point, which is sufficiently accurate for our purpose. Moreover, a number of centre-tapped coils are now available commercially.

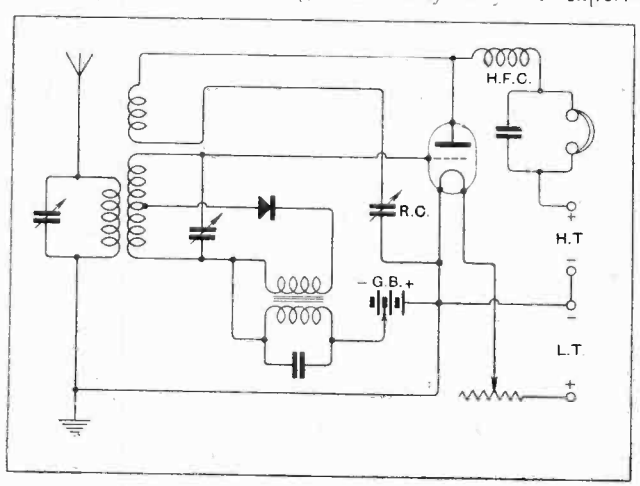


Fig. 3.—Another possible modification, with capacity-controlled reaction.

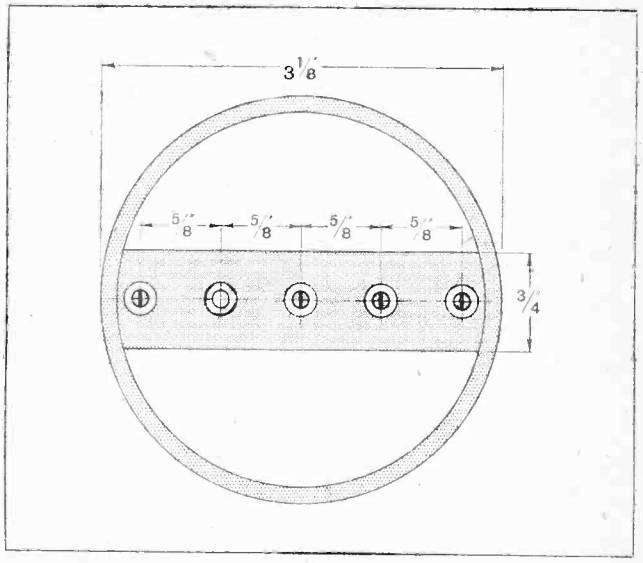


Fig. 4.—Construction of the aerial-grid transformer.

Assuming that the design given is to be followed in detail, it will be as well to start with the construction of the interchangeable aerial-grid transformers. Two of these will be required, the first covering the 350-550 metre broadcast waveband, and the second from approximately 1,200-2,000 metres, thus including Daventry, Radio-Paris, and several other Continental stations. Both are of similar construction, only differing in the windings, and are wound on ebonite tube formers 3in. in diameter and 3½in. long. Each former has an ebonite cross-piece, dimensioned as in Fig. 4, fitted with four valve pins and one valve socket, the latter being used to prevent the

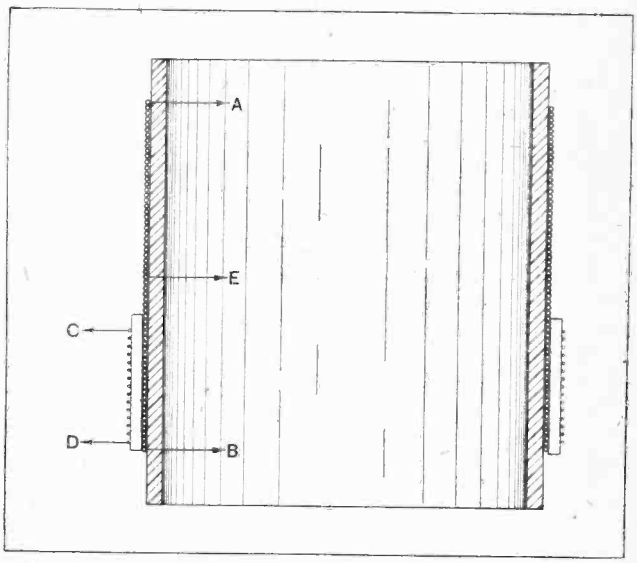


Fig. 5.—Connections of the aerial grid transformer: the lettering corresponds to Figs. 1 and 9.

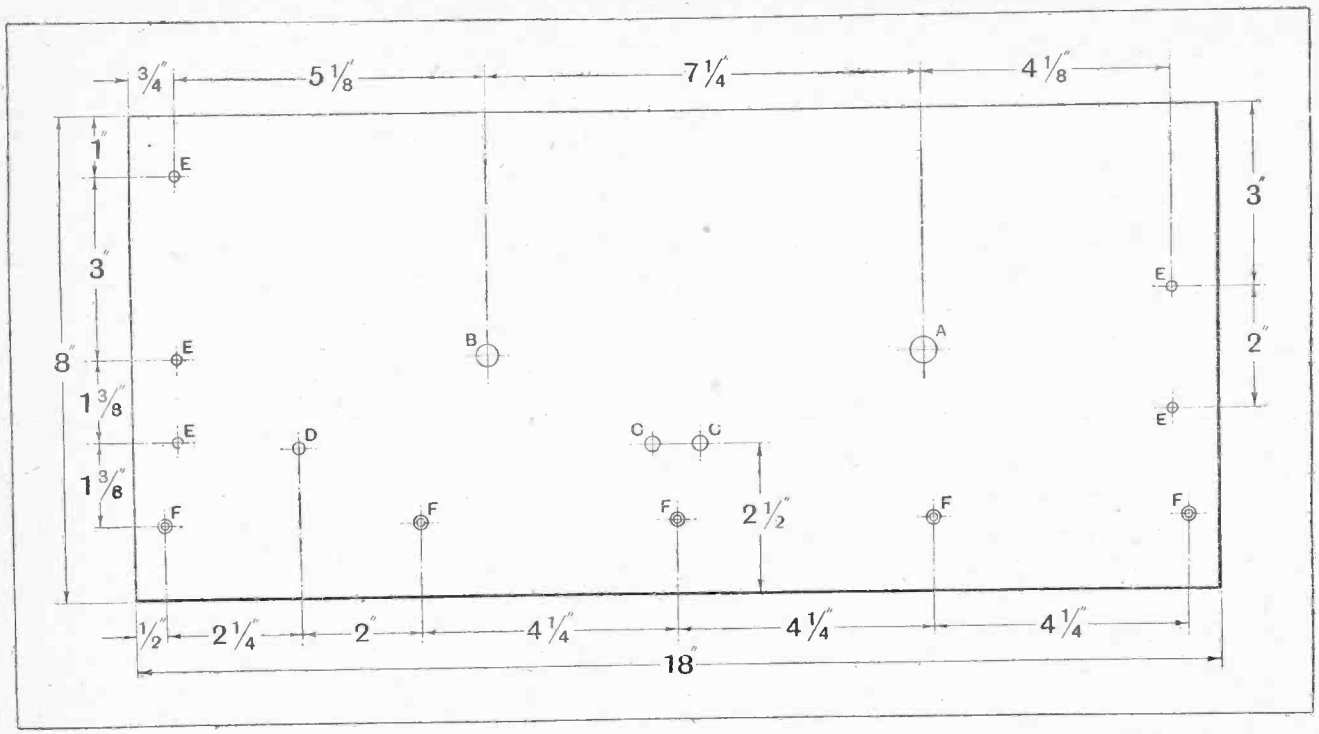
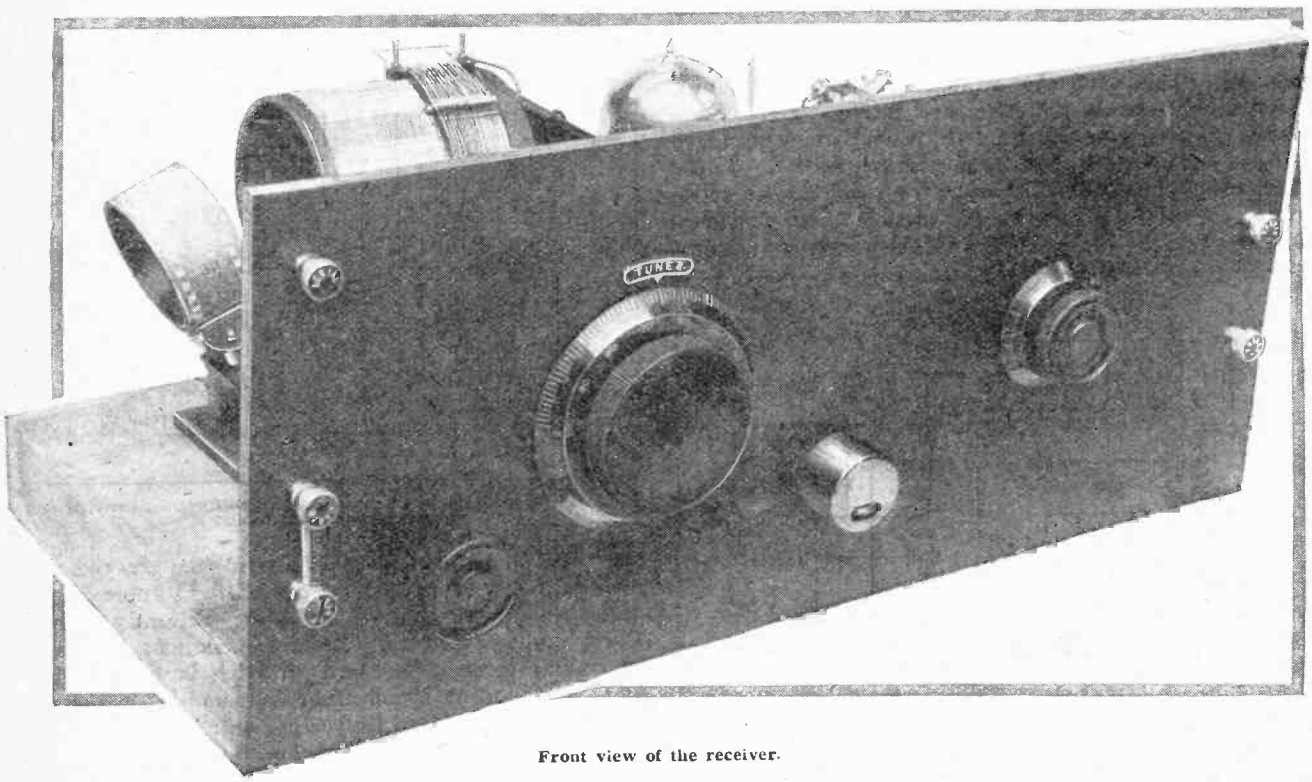


Fig. 6.—Drilling diagram of the front panel. A, 7/16 in. dia.; B, 3/8 in. dia.; C, 1/4 in. dia.; D, 3/16 in. dia.; E, 5/32 in. dia.; F, 1/8 in. dia. countersunk.

accidental reversal of the coil. This cross-piece is secured to the tube by two 6 B.A. screws at each end. If these are not available, wood screws may be used, if "undersize" holes are drilled and the screws heated by application of a soldering iron to their heads before they are driven in.

The secondary winding of the short-wave coil should be put on first, and consists of sixty-five turns of No. 22



Front view of the receiver.

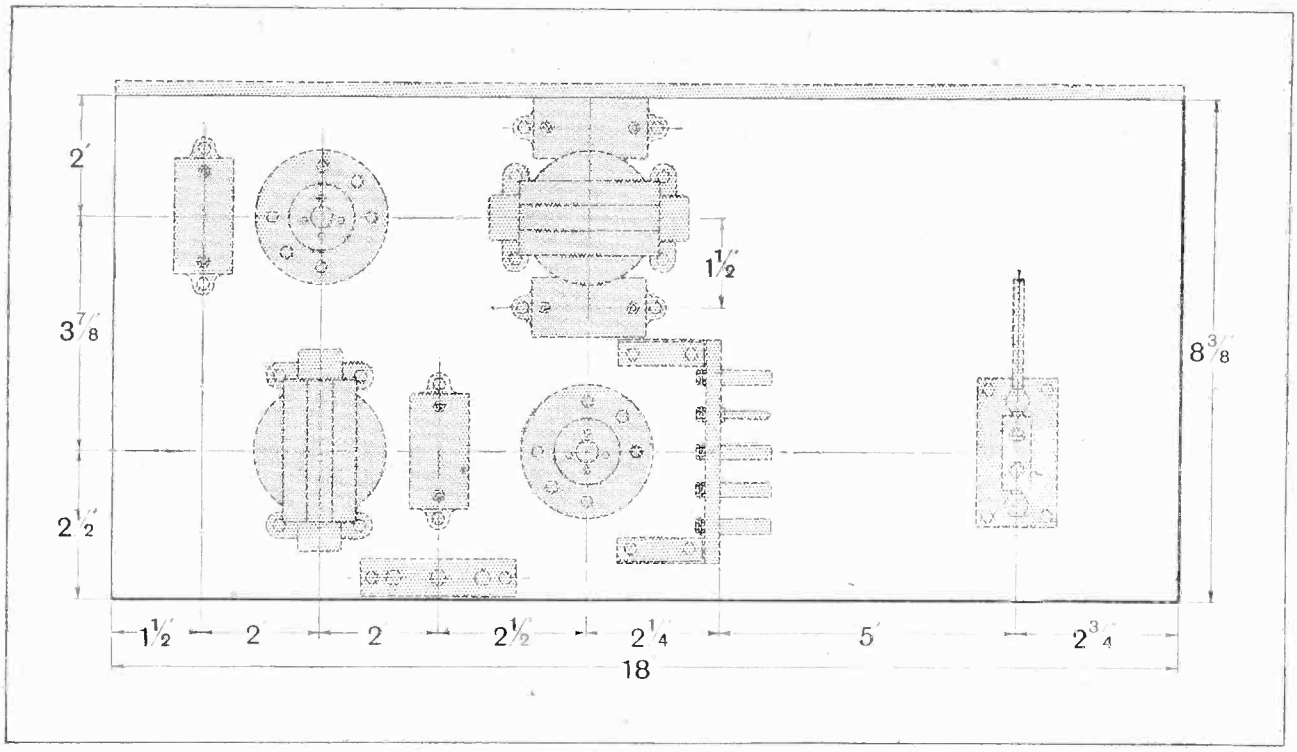
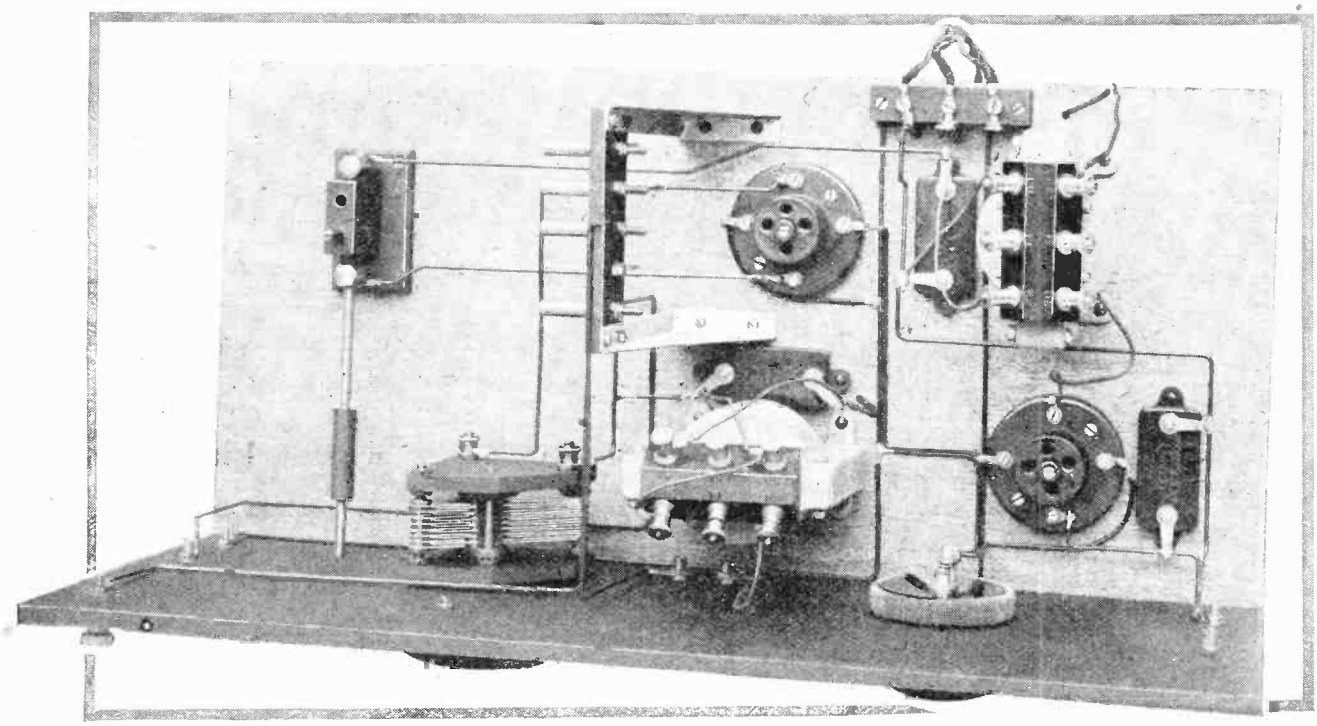


Fig. 7.—Positions of components on the baseboard.

D.S.C. wire. Taps should be taken at the 25th, 30th, 35th, and 45th turns from the grid end (marked A in Fig. 5; this diagram, considered in conjunction with Figs. 1 and 9, shows the ultimate connections of the various ends, the lettering corresponding in each case). The beginning and end of the winding and the tap con-



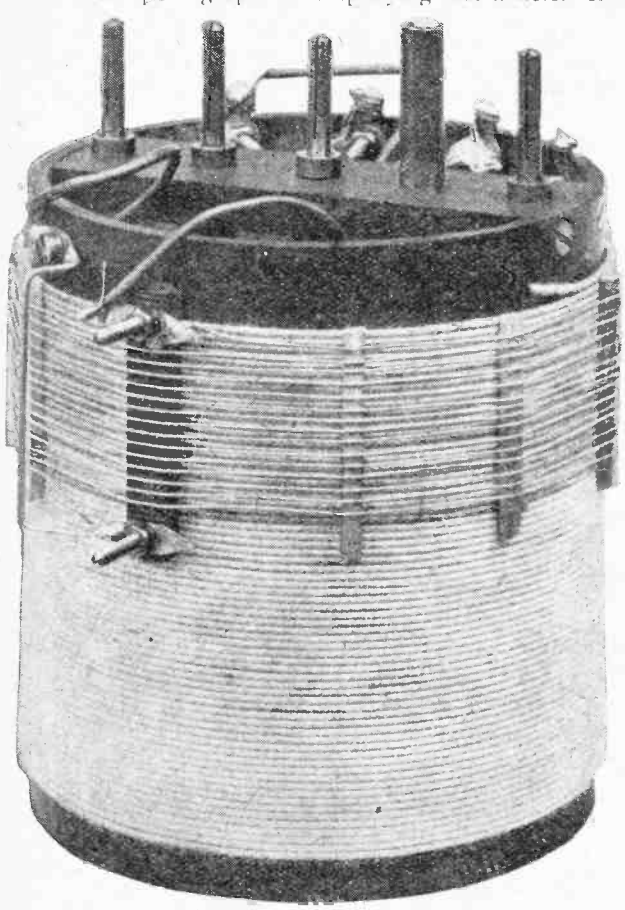
The set from above, showing positions of components.

The Simplest Reflex.—

nections should be passed through inside the tube. The aerial or primary winding of fifteen turns of No. 30 D S.C. wire, spaced $\frac{1}{16}$in. apart, is separated from the secondary by eleven wooden strips about $\frac{1}{8}$in. in cross-section and $1\frac{1}{4}$in. long, and an ebonite strip $1\frac{1}{2}$in. long, $\frac{1}{4}$in. wide, and $\frac{1}{8}$in. thick, which carries two projecting 8 B.A. screws, with deeply countersunk heads, for connection to each end of the winding.

The long-wave transformer has a secondary of 250 turns of No. 36 D.S.C. wire and a primary of 100 turns of No. 40 D.S.C. with adjacent turns touching, and spaced from the secondary in a similar manner. Tappings are made at the 100th, 125th, and 150th turns from the grid end.

The construction of the holder for these coils is clearly shown in the photographs accompanying this article. An



The short-wave aerial-grid transformer.

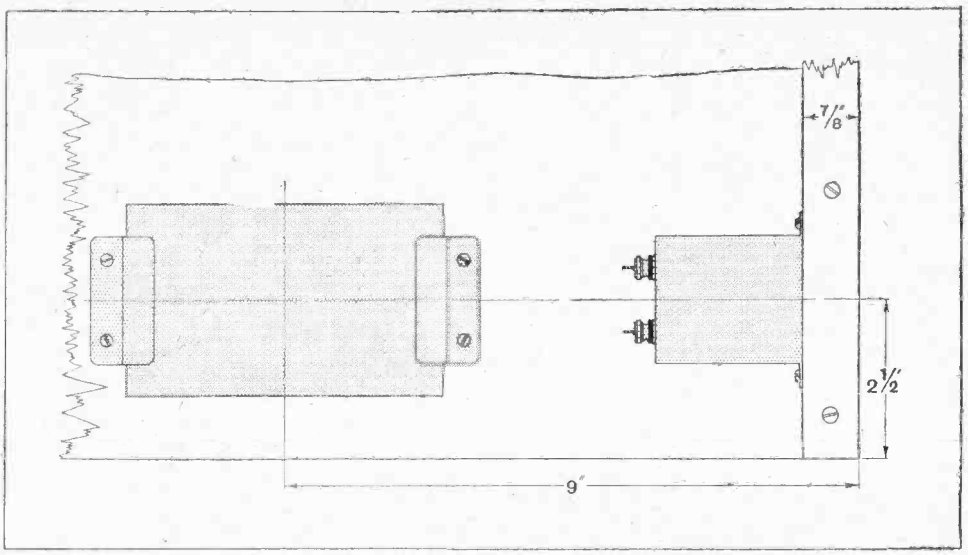


Fig. 8.—Mounting of grid-bias battery and by-pass condenser on the underside of the baseboard.

ebonite strip $3\frac{3}{4}$in. long, $1\frac{1}{4}$in. wide, and $\frac{1}{4}$in. thick, is fitted with four valve sockets and one pin, and is mounted on two brackets of a suitable height to bring the axis of the transformer to the level of that of the reaction coil. This will, of course, depend on the type of coil holder and coils used; in the set illustrated the overall height is $4\frac{1}{2}$in., the brackets being made of thick sheet tin (tinned mild steel). Those sold as panel supports are generally suitable; they may be raised on a wooden block if necessary.

In order to accommodate the grid battery and 1 mfd. by-pass condenser under the baseboard, and at the same time to give greater strength to the assembly, two wooden fillets, $\frac{7}{8}$in. wide by 1in. deep, are fitted to its underside. This is shown in Fig. 8, and the panel drilling diagram is given in Fig. 6.

Assembling Components on Panel and Baseboard.

The assembly of the panel and baseboard, and the mounting of the components on both, are indicated clearly in Fig. 7 and in the photographs on pages 327 and 330. It will be noticed that battery terminals are not used; instead, two pairs of twin flex leads are soldered to tags supported on a small rectangular ebonite strip measuring 3in. long, $\frac{3}{4}$in. wide, and $\frac{1}{4}$in. thick. This arrangement obviates the necessity of cutting a slot in the back of the cabinet, as all the leads may be brought out through a small hole.

The method of wiring will be obvious from Fig. 9, except that the connections to the components under the baseboard are shown by lettering; this point is explained in the caption under the drawing. Flexible leads fitted with wander plugs are used for the grid bias connections.

Before discussing the operation of the receiver, it is as well to consider one or two points which may arise if components of different type from those actually used by the writer are included. As usual in a reflex receiver, it will be found that low-impedance valves give best results in the dual stage, except when very weak signals are being dealt with. This particular circuit,

LIST OF PARTS REQUIRED.

1 Crystal detector (Harlie).
1 Variable condenser, 0·0005 mfd. (Polar).
2 L.F. transformers (R.I.).
2 Valve holders (Cosmos).
1 Filament rheostat (McMichael).
1 Fixed condenser, 0·0002 mfd. (Atlas.)
1 Fixed condenser, 0·0003 mfd. (Atlas).
1 Fixed condenser, 0·0005 mfd. (Atlas).
1 Fixed condenser, 0·001 mfd. (Atlas).
1 Fixed condenser, 1 mfd. (T.C.C.).
1 Ebonite panel, 18in. × 8in. × ¼in.
1 Baseboard, 18in. × 8⅜in.
1 Single coil holder.
2 Ebonite tubes, 3in. dia., 3½in. long.
1 Grid bias battery, 9 volt (Ever-Ready.)
Terminals, wire, ebonite, screws, etc.

Approximate cost, without cabinet or accessories - £5 10 0

however, is less exacting in this respect than are the majority, and, up to a point, practically any valves can be used, although only a power valve is really suitable for the L.F. amplifying stage.

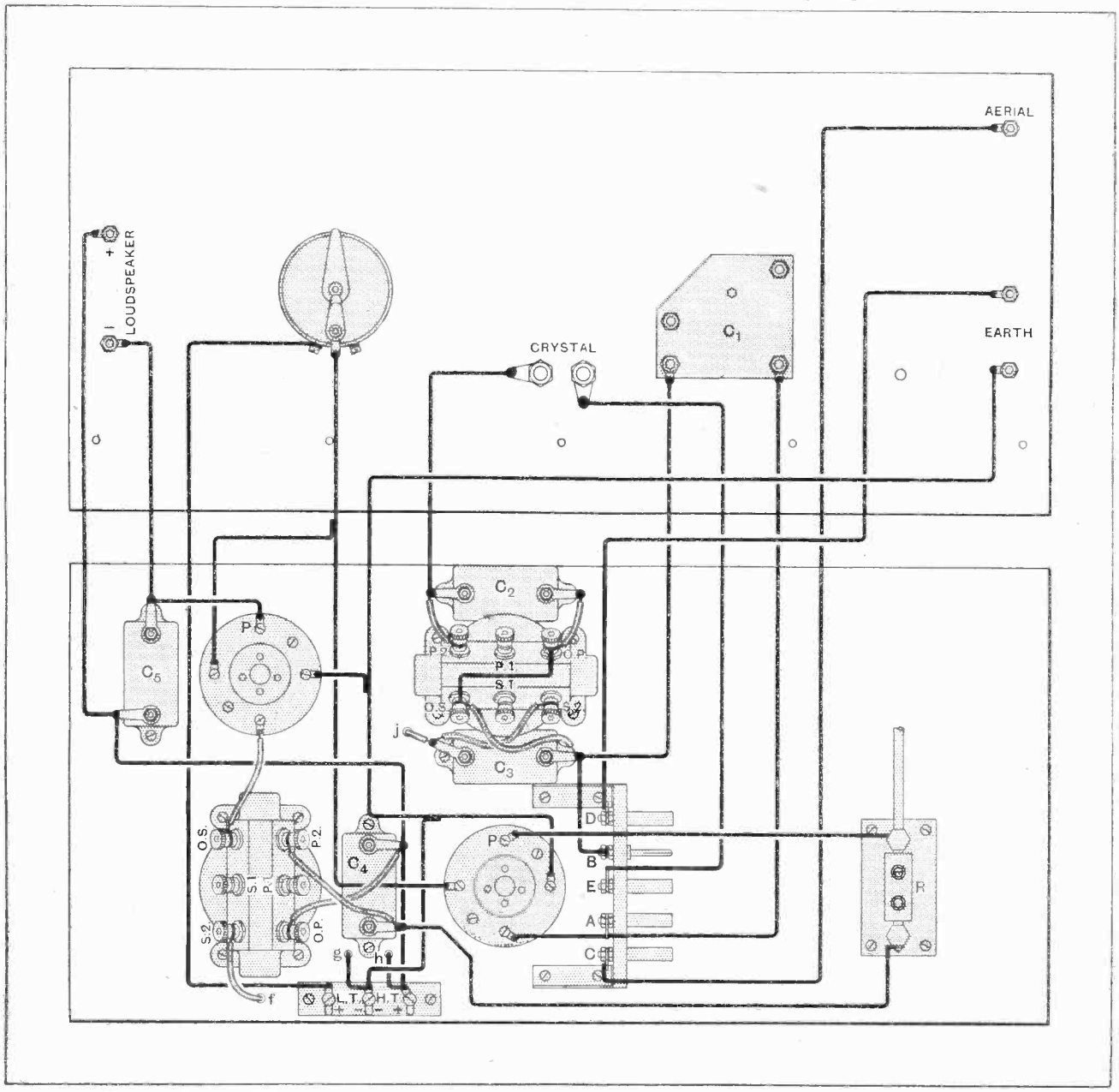


Fig. 9.—THE PRACTICAL WIRING PLAN. The letters (f), (g), (h) and (j) refer to connections under the baseboard, which are as follows:—(f) to grid battery negative; (g) to one side of by-pass condenser and to grid battery positive; (h) to other side of by-pass condenser; (j) to grid battery negative.

The Simplest Reflex.—

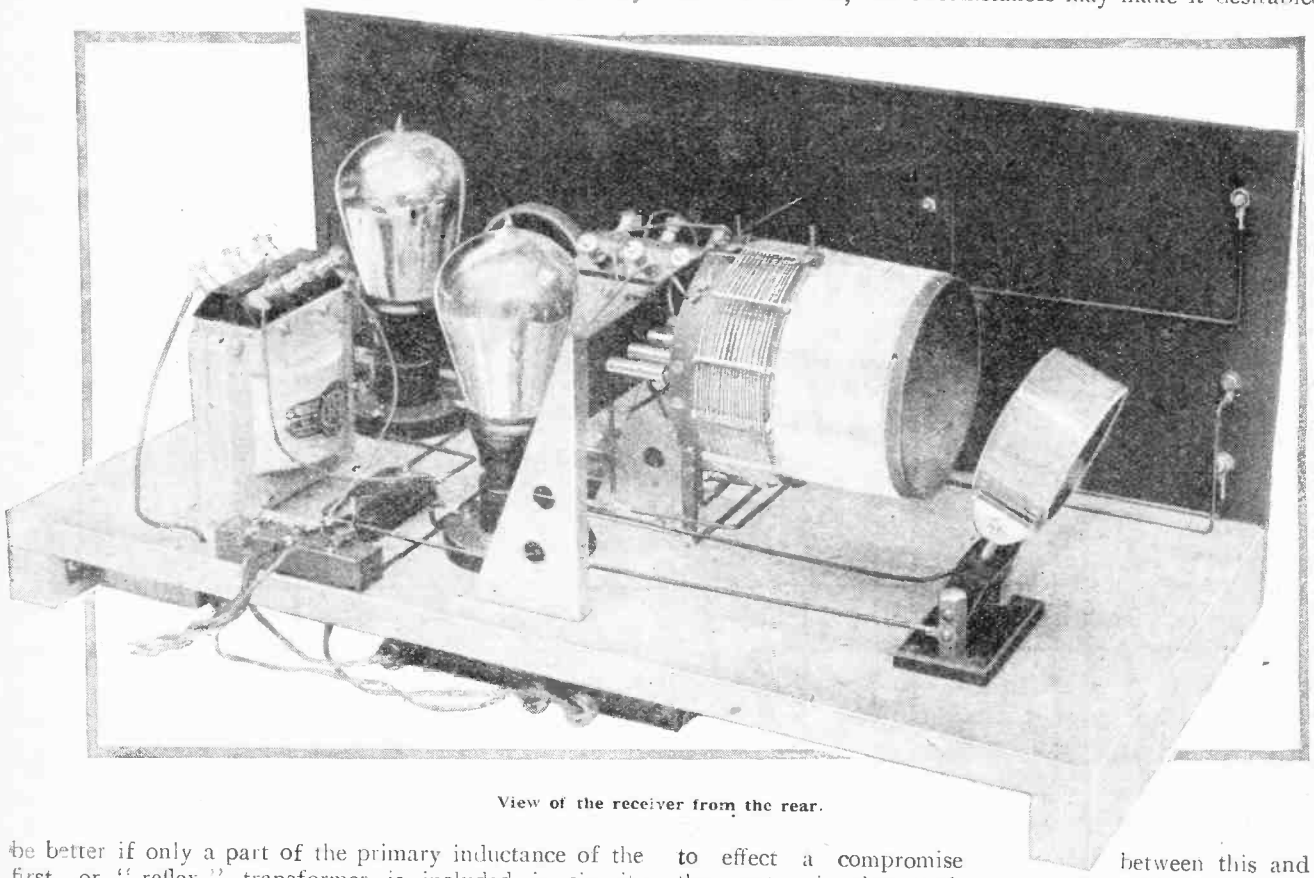
The value of the condenser C_3, shunting the secondary of the first L.F. transformer, is of some importance, and should be kept as small as possible, to reduce loss of L.F. amplification, particularly on the higher frequencies. This point has already been dealt with, and it will be found that a capacity of 0.0002 mfd. (that actually used) or 0.0003 mfd. is generally suitable. Similarly, too large a condenser should not be used across either primary.

L.F. Transformer Connections.

The R.I. transformers have tapped windings, and when a crystal of low resistance is used, results may be better if only a part of the primary inductance of the first, or "reflex," transformer is included in circuit. A high step-up in voltage is desirable, but it should be realised that when the transformer is connected to give this, the secondary shunting condenser will have a greater effect in lowering the tone of signals, and it will probably be better to use only a part of the secondary. Turning to the second transformer, which is in the anode circuit of the first valve, a reduction of primary inductance can only be justified when a valve of exceptionally low impedance is used in the first position. Under ordinary conditions the connections shown in Fig. 9 will be best, although one of the secondary taps may be moved as a form of volume control, when it is found that the last valve is being over-loaded by loud signals.

Another point which can best be decided by trial and error is the connection of the crystal to the secondary of the aerial-grid transformer. It has been suggested that a number of tappings should be provided on each coil, and, as a preliminary measure, a flexible lead from the pin corresponding to the socket marked E should be connected to approximately the centre point of the coil, afterwards trying experimental alterations. A low-resistance crystal, such as treated galena, generally works best when connected across only a small portion of the total inductance, while Perikon and similar combinations should be tapped on to a point nearer the grid end of the coil.

It will be found that selectivity is increased as the connection is moved down towards the "filament" end of the coil, and circumstances may make it desirable to effect a compromise between this and the greater signal strength obtainable with a larger proportion of inductance.



View of the receiver from the rear.

Final Adjustments.

A total of fifteen turns has been recommended for the primary winding of the short-wave tuning coil; here, again, it is impossible to lay down a hard-and-fast rule, as the constants of the aerial-earth system with which the set is to be used may call for a greater or smaller number of turns. This applies with greater force in the case of the long-wave transformer, and an appreciably larger primary winding than that specified may be required. Finally, the effect of a reversal in the connections to the crystal connections should be tried.

Very little need be said about the actual operation of the set, although the writer would emphasise the point,

The Simplest Reflex.—made in previous articles, that no attempt should be made to adjust the crystal when the valve is anywhere near the point of oscillation. This applies to all combinations of an H.F. amplifying valve and crystal.

The reaction coil used should be as small as possible, in order to obtain smooth control, and to avoid large changes in the wavelength of the tuned circuit when it is moved. A No. 25 "Lewcos" was found sufficient to give oscillation over the whole of the broadcast waveband, and a No. 100 of the same make is suitable for the long waves.

It will be noted that both the negative side of the L.T. battery and the earthed end of the aerial coil are connected to separate terminals; this is to facilitate the subsequent connection of an external H.F. amplifier. Normally these two terminals should be joined together and to earth. It is hoped that it will be possible to describe the construction of a suitable H.F. amplifier in a subsequent issue of this journal.

SHORT WAVE EXPERIMENTS

In the Land of the Midnight Sun.

By FLIGHT-LIEUT. R. F. DURRANT, A.F.C., R.A.F.

WE are slowly but surely emerging from the confusion of the maze of phenomena that surrounds long-distance short-wave transmission and reception. Reliable communication on the ultra-short waves during the whole of the twenty-four hours has been brought about by utilising a different frequency for day work, as compared with that required when darkness wholly or partly prevails between the two stations.

We also have learned by experience that the wavelength varies with the latitude and longitude of the stations concerned. No single wave between 15 and 50 metres remains constant during the whole twenty-four hours, over distances exceeding 1,500 miles. *Inter alia*, one naturally turns to the problem of screening (local and geographical), at the transmitting and receiving ends. Are short waves affected by local conditions, geographical or otherwise? I hope to show in this article that reliable communication can be maintained day and night on low power, over 600 miles, when the transmitting station is located in an area where ordinary long-wave spark and C.W. signalling will not penetrate beyond a few miles. The following tests between a yacht cruising in the Norwegian fjords and a station in Hampshire undoubtedly proved the case for the short waves.

Through the courtesy of Lieut.-Colonel B. S. Millard, R.E., the necessary facilities were placed at my disposal on board his motor yacht *Adventuress*.

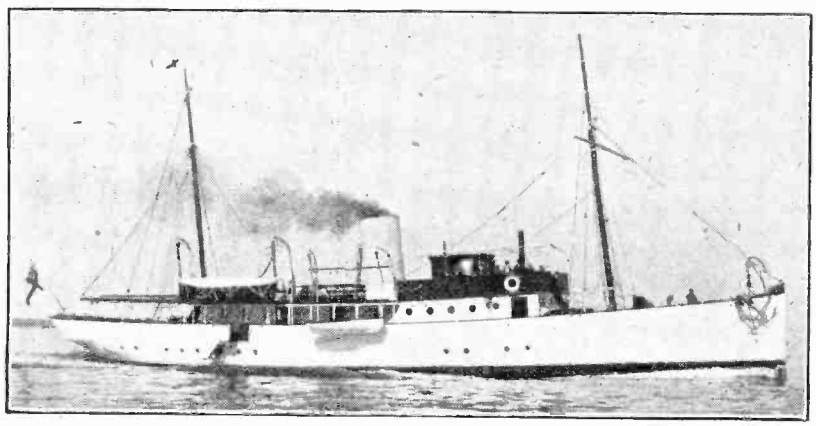
The aerials used were: No. 1, a single vertical wire slung from the top of the foremast and leading down through a skylight to the operating cabin; total length 65ft. No. 2, the outer wire of the yacht's inverted L 3-wire aerial, giving a top span of 70ft. and a lead-in of 35ft. The former was used up to 500 miles, the latter beyond that distance.

The Transmitting Apparatus.

The transmitting inductance consisted of two coils 4½in. in diameter of No. 12 S.W.G. bare copper wire and the pancake helix off an old spark transmitter, which was used for aerial coupling. Mullard 6-volt receiving valves were used and worked excellently. Wavelength was 43 metres and no contact to earth or counterpoise was used. One end of the aerial coil was taken direct to —H.T.

The H.T. supply consisted of three ordinary H.T. batteries as used on broadcast sets, totalling 250 volts, in series with the yacht's 100-volt D.C. mains.

An ordinary 2-valve receiver (Detector and L.F.) was used with low-loss coils, and geared condenser, originally constructed by G2IZ and used in my tests in Iraq.



S.Y. *Adventuress* from which the short-wave tests were conducted.

At the ground station in Hampshire the aerial (a single-wire Hertz) had an average height of 18ft. only, and was completely screened by telegraph wires and tin roofs. The location was badly placed in a hollow. The transmitter was identical with that used in the yacht, except the H.T. supply, which was obtained from a 200-volt accumulator in series with the 150-volt receiving H.T. battery. Two more valves were used in parallel, giving 80 milliamps, with key depressed, and lighting the 3.5 v. pea lamp in the centre of the Hertz aerial, which had a small resistance coil in parallel, when on the fundamental of the aerial. A wavelength 43.75 metres was used.

Short-wave Experiments.—

The yacht sailed from Southampton, and good QSO was maintained with England and Belgium, in the Channel. In the North Sea mid-day signals were first exchanged (see log). On the following day, when the island of Utsire was sighted, the yacht's signals were easily copied in England, when the ship was transmitting on vertical wire aerial.

We then had a glimpse of the region which we were to traverse, for the most important tests of all; narrow, winding stretches of placid waters, with picturesque mountains on all sides. From the ordinary radio point of view it appeared little short of a miracle if we could work the coast station of Bergen on spark (scarcely 50 miles off), and, viewing this great screening barrier of Nature, I needed no further incentive to go below and " try the air " on the 40-45 metre band. The British and Continental experimenters were coming in at good strength, unimpaired by the screening from the mountains. I had great qualms about the transmitter—the power at my disposal seemed ridiculously insufficient to cover the 700 miles to England, under these conditions. A test on the 600 metres spark set revealed that we were inaudible 50 miles away on that wave. Switching on the short-wave transmitter and tuning-up, no sign of a spark could be observed when the aerial switch was broken.

A flashlamp bulb in series with the aerial feeder refused to light. No shock or burn was experienced by touching the aerial, so that it can truly be said that I was on low power. I checked the wave by coupling the wavemeter to the set, and absorbing a few milliamps. After a preliminary call I switched over to receive, and was rewarded by the friendly chirrup of the station at home. It was 10 p.m. B.S.T. with me, and the Midnight Sun was still shining on the calm waters. Directly the sun had reached the level of the visible horizon (it never actually sets), England reported that my signal strength went up two points. The wavelength was 42.5 metres.

Screening on 600 Metres.

The following day a visit was paid to a liner at anchor in the fjords, near Merok. The Chief Operator demonstrated to me that, with 8 amps. in the aerial on 600 metres, it was quite impossible to raise the coast station 60 miles away, owing to the tremendous screening on all sides. With 12 amps. in the aerial, on C.W. on the longer wave, it was impossible to raise an English station. I confirmed these facts by independent tests on another Norwegian ship also anchored nearby, and on this vessel it was quite impossible to attract the attention of the coast station although 15 amps. was put in the aerial on 600 metres.

Returning to the yacht and resuming tests, no difficulty whatever was found in communicating with the testing station in England, with an input of 30 watts in daylight (1100 G.M.T.), the strength of reception both ends being R5. Confirmation of the signals from the yacht were also received from Poitiers in France, and from Holland, as well as from many British stations.

The mid-day and night tests lasted for ten days. As far as I am aware, these are the first transmissions of this nature to be made from a station actually in the North Western fjords. It was never dark during the evening transmissions—a book (in small print) could be easily read on deck.

The results obtained tend to show that the influence of geographical " screening " on the shorter waves is practically nil, Nature rendering the necessary assistance through the medium of the Heaviside layer.

The meteorological conditions during the day tests were as follows :—

Bright sunlight, with Cumulus Cloud.

Barometer steady at 29 millibars.

Up to 600 miles, only one valve was used for reception in England Daventry, on a 5-valve " Fada " Neutrodyne Receiver, came in at good loud-speaker strength as far as the Norwegian coast. Once inside the fjords this station was inaudible. Rugby and Nauen's signal strength was only R.5 at night!

LOG OF STATIONS HEARD AND WORKED DURING THE TESTS:

G.	2IP ('phone)	2NM ('phone)	2CC	2OG
	5BY	5DA	5FQ	5MQ
	5MU	5QB	5PZ	5TZ
	6BT	6IW	6OX	6YU
F.	8UDI	8VO	8OQP	
B.	S5	V2	Y8	
K.	K44	KW9		
Miscellaneous :	EAR9	NOPX	NOBL	YS7XX
	SMWQ	SMVJ		

NIGHT RANGES.—2100–0000 HOURS B.S.T.

Strength.	Fading.	Distance. Miles.	Remarks.
R6	Nil	250	In Channel. Rolling, but wave unaffected.
No Test.			
R5	Slight	500	O.K.
R5	Nil	550	O.K.
Sunday :	No Test.		
R6	Nil	720	Position : Ulvik. Screened.
R5	Nil	800	Position : Vadhem ; mountains all sides. Also worked Holland, milliamps. 80.
R6	Nil	750	Balholm ; low cloud, rain.
R6	Nil	750	Ditto.
R7	Nil	750	At Floro. Also worked G6BT. Signals reported R8.
Week-end :	No Test	with England, but worked France, 1,150 miles.	
R5	Nil	950	
R5 to R6	Nil	850	Very good communication.

DAYLIGHT RANGES (MID-DAY B.S.T.).
Ship's Wave, 43.75 metres.

Strength.	Fading.	Distance. Miles.	Remarks.
R7	Nil	200	Mid-Channel ; barometer rising ; bright sun ; 80 milliamps. in aerial.
R5	Slight	380	Off Newcastle ; ship rolling ; jamming from dynamos.
R4	Nil	500	Off Norway ; bright sun.
R4	Nil	650	Steaming in Fjords ; heavy screening ; bright sun ; high cloud.
R4	Nil	700	Heavy screening ; hills on all sides ; ships here unable to raise stations 50 miles off with 10 amps. on 600 m. or C.W. on 2,200 m.

EVERYMAN'S FOUR-VALVE RECEIVER.

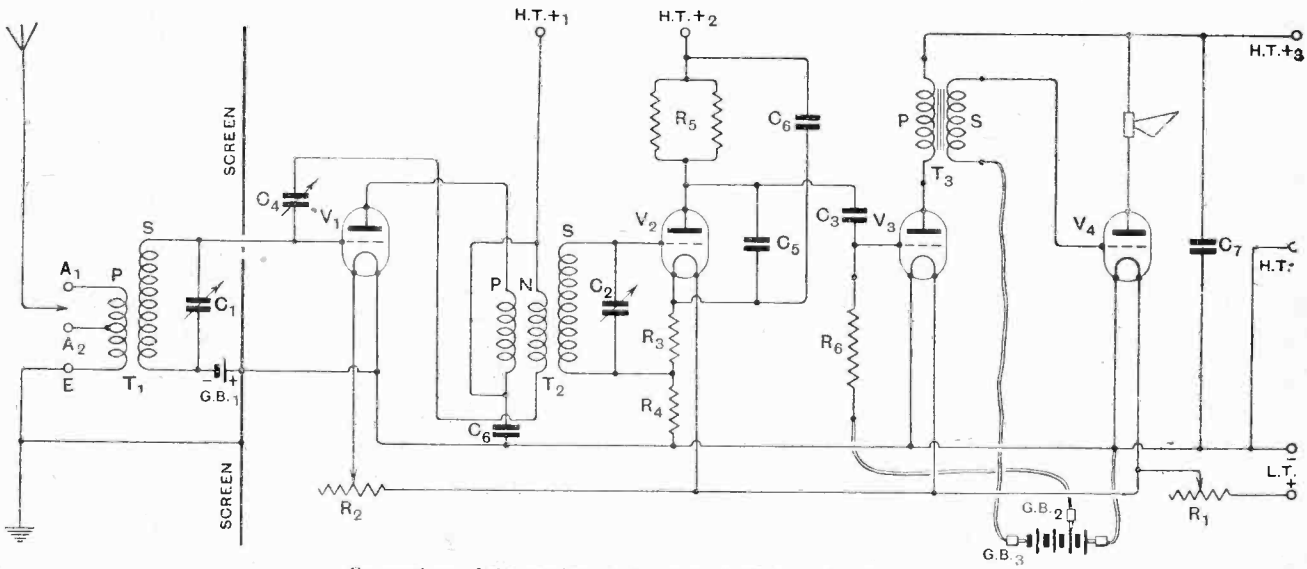
Further Notes on its Construction and Operation.

By W. JAMES.

WHEN describing this receiver in the issues of July 28th and August 4th we were quite aware that considerable interest would be aroused amongst amateurs and wireless enthusiasts in general. For one thing, the set is easily constructed and very easily operated; secondly, we stated, on page 145, that the set would receive about a dozen stations at good loud-speaker strength, although we knew all the time that a copy of this set in the hands of an amateur would receive twenty-five to thirty stations during an average evening.

Use New Components.

Now the reason for under-estimating the ability of the receiver was that we knew from experience that some readers do not feel inclined to buy new valves, even when those they have are old or of a very different type from the valves recommended, while others rush to try a new set, departing considerably from the lay-out of the original and use parts having, in some instances, very different electrical characteristics from those recommended.



Connections of the receiver, reproduced from the original article.

We felt, however, that the most inexperienced person could not fail to get a dozen stations if he did not depart too much from the specifications of the original and used valves not very different from those recommended.

We sympathise with those who wish to use parts they have by them or who wish to use cheaper parts or to use valves taking a small filament current, and these notes are written to assist them. We would suggest, however, that readers should carefully consider whether it is not wise to scrap parts and valves which are out of date.

The tuning condensers specified are of the corrected square law type, have a metal screen, and a maximum capacity of 0.00027 mfd. (C_1, C_2). Screening is always beneficial for electrical reasons, but a further great advantage possessed by screened condensers is that they are not likely to collect dust. When dust collects between the plates of a tuning condenser power is lost and the receiver will be noisy. The writer believes that all tuning condensers should have a covering of some sort, preferably of metal, for then the metal covering can be connected to the earthed side of the condenser and act as an electrical shield.

With condensers of 0.00027 mfd. and the parts arranged as indicated in the original article, the wavelength range is 220-570 metres. If 0.0003 mfd. tuning condensers are used, the wavelength range is 220 to above 600 metres; with many tuning condensers rated at 0.0003 mfd. of the square law type, the lower wavelength is about 200 metres.

Many readers have enquired whether straight line frequency condensers of 0.0003 mfd. capacity can be used. They can be used, of course, but at the present time the arrangement of the broadcast stations receivable at satisfactory volume is not such that straight line frequency condensers simplify tuning. If the reader has a decided preference for these condensers he should equip them with a high grade vernier dial or he will find tuning rather difficult.

High-frequency Transformers.

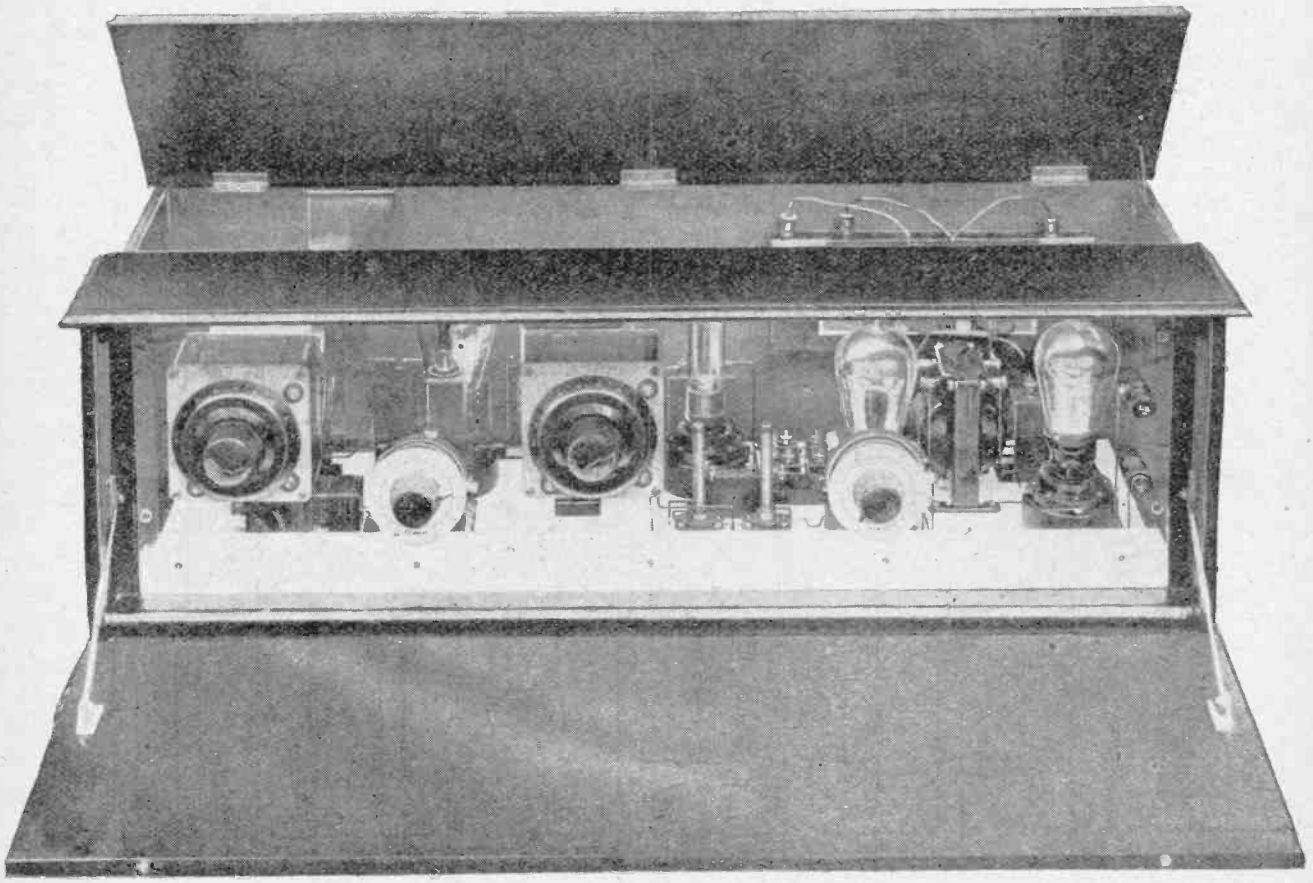
These transformers have a secondary winding of 27/42 D.S.C. Litzen wire wound on Paxolin tubes; cardboard or ebonite will not do, as terminals fastened to the ends of tubes of either of these materials raises the resistance of the circuit and so lowers the amplification and

Everyman's Four-valve Receiver.—

broadens the tuning. Neither can solid wire be used for winding the coils, nor Litzen wire having a different gauge or number of strands. The amplification of nearly 40 for the high-frequency stage is easily obtained by following the instructions.

A few readers have asked whether the two transformers (T_1, T_2) can be made movable by fitting them with plugs and whether other transformers for Daventry can be used. To fit plugs to the transformers lowers their efficiency considerably and is not advised.

The set was designed to work with a DE5b type of valve at V_1 and V_3, a Cosmos SP18 Green Spot at V_2 and a DE5 valve at V_4; obviously, valves having characteristics closely similar to these can be used.



EVERYMAN'S FOUR-VALVE. A reader's excellent reconstruction of the two control four-valve receiver described in "The Wireless World" of July 28th and August 4th. The outstanding features of the instrument are the simplicity of construction and even greater ease of operation. A reader referring to his experiences with the set within two days of its completion, writes: "There seem to be stations at loud-speaker strength all round the condensers, and selectivity is all that could be asked for." Note the glass panel in the example above.

Effect of Different Valves.

Let us examine the Mullard series of PM valves. The PM5 valve takes 5.5 volts at 0.11 ampere, has an amplification factor (μ) of 18 and A.C. resistance (R) of 19,000 ohms, which is practically identical with the characteristics of the valve described on page 111, except that it takes less than half the filament current. Also the PM6 has a μ of 7 and an R of 6,000 ohms, which is practically the same as a DE5. Here again the filament current is less.

For the detector (V_2) we have in the Mullard series a PM5a, a valve taking 5.5 volts at 0.11 ampere and having a μ of 40 and an R of 120,000 ohms. We can therefore recommend the PM5 for V_1 and V_3, the PM5a for V_2, and the PM6 for V_4, and these valves will give the same amplification and selectivity as the original ones. It should be noted, however, that when the PM5a valve is used as the detector, a short-circuiting plug should be inserted at R_4 and a 7.5 ohm resistor at R_3.

It was pointed out in the original article that 2-volt valves could be used, provided they were of a suitable type, and it was mentioned that as they differ in general from 6-volt valves (in that for a given μ they have a higher R) less amplification would be obtained; an exception is in the case of the Cosmos valves. When a fairly heavy filament current is not objected to, Cosmos SP18 Green Spot valves can be used at V_1, V_2, and V_3, with a Red Spot valve at V_4. These valves take a filament current of 0.3 ampere each. The Green Spot valves have a μ of 15 and an R of 17,000 ohms, while the Red Spot has a μ of 7 and an R of 8,000 ohms. These characteristics are not very different from those of the

Everyman's Four-valve Receiver.—

6-volt valves recommended, but it must be remembered that the plate battery voltage used should not exceed 120 and that both the resistors R_3 and R_4 should be short-circuited or removed from the set.

In the PM series we have the PM1 H.F. and the PM2. These valves take 0.1 and 0.15 ampere respectively at 2 volts and have a μ of 13.5 and 5.5 and an R of 28,000 and 9,000 ohms. With a PM1 at V_1, the amplification obtained is about half as much as when a PM5 is used but tuning is sharper. The L.F. stage, which includes V_3 and T_3, will also give less amplification than the standard arrangement. Even so, when it is essential that 2-volt valves taking a small current are used, the performance is quite satisfactory although the range and volume will not be so great as that of the standard set.

Other 2-volt valves are the Marconi or Osram DE2 H.F., DE2 L.F., DER and DE6. The DE2 series take 0.12 ampere, the H.F. type having a μ of 12 and an R of 45,000 ohms; the L.F. type has a μ of 7 and an R of 22,000 ohms, while the DER takes 0.3 ampere, has a μ of 9 and an R of 32,000 ohms. Thus the DE2 H.F. is not a suitable valve for this receiver, except as a detector and even here it would be better to use a DER. If a DE2 H.F. is used in the H.F. stage, tuning will be much sharper than in the standard set, but the amplification will be poor.

A suggested arrangement is DER valves for V_1, V_2 and V_3, with a DE6 for V_4; the latter valve takes 0.5 ampere, however; a further possible arrangement is a DE2 L.F. at V_1 and V_2, a DE2 H.F. at V_3 and a DE6 at V_4, but the amplification will be very poor.

Two valves of the Cossor series are also suitable for this receiver, Point One (plain top) and the Stentor Two (green top). The Point One takes 0.1 ampere, has a μ of 9 and an R of 22,000 ohms, while the Stentor Two takes 0.15 ampere, has a μ of 8 and an R of 8,000 ohms. Cossor Point One (plain top) valves can, therefore, be used at V_1, V_2, and V_3, and a Stentor Two at V_4. Here again the amplification will be much less than that given by the standard arrangement, using 6-volt valves, but those who prefer 2-volt valves will find the Cossor series satisfactory.

We wish to make it quite clear that for a given A.C. resistance the amplification obtained depends on the amplification factor of the valve; for example, the H.F. transformer is designed for a valve of about 20,000 ohms and if two valves having approximately this A.C. resistance are compared it will be found that the one having a μ of 18 will give at least twice as much amplification as another having a μ of 9. A further point is this, that it is not possible to redesign the circuit in any way (except by adding a valve) to compensate for the reduced amplification.

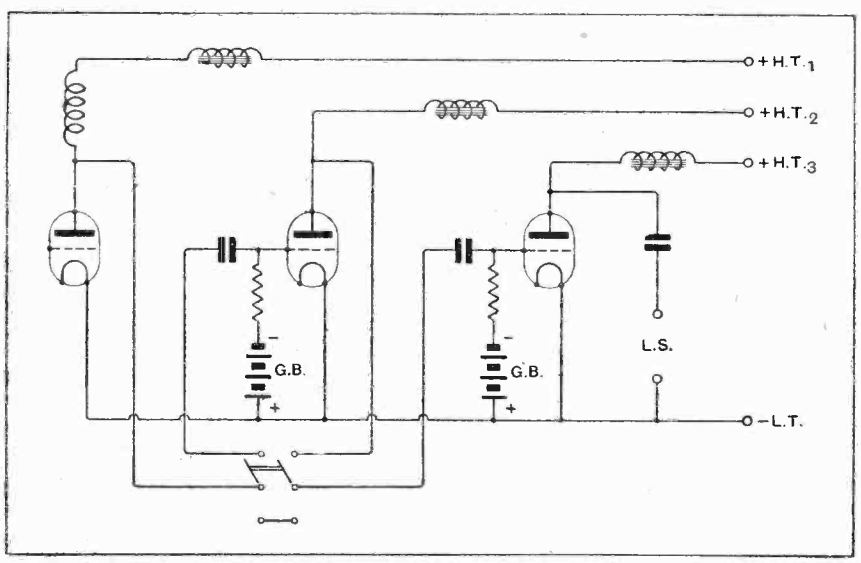
Valves having a very high A.C. resistance such as the PM5a or Cosmos SP18 Blue Spot, are not at all suitable for use with H.F. transformers of the type used in the standard receiver.

The Aerial.

Owing to the extremely high amplification obtained from the set it is possible in many instances to use quite a small aerial and still receive a large number of stations. Tuning will, of course, be sharper when a small outdoor aerial is used; consequently many users will find it advantageous to cut down their aerial.

A further point of interest is the detector. The plate voltage applied to this valve is not at all critical, and should be reduced to the point where a further reduction weakens the signals.

SWITCHING L.F. AMPLIFIERS.



Detector and two-valve amplifier with switch for cutting out the first L.F. valve.

THE advantages of switching out the intermediate stages of an L.F. amplifier are now universally recognised, but are, nevertheless, so important that reiteration is justifiable.

The last valve in an amplifier is a power converter and the intermediate stages are, or should be, designed purely as voltage amplifiers. For the intermediate stages high-impedance valves are often desirable; but valves of this type would be quite unsuitable if called upon to supply the loud-speaker with energy.

The circuit diagram shows an effective method of switching out the first stage of a two-stage choke-coupled amplifier. By fitting a third arm to the change over switch it would be possible to extinguish the filament of the first L.F. valve at the same time that it is switched out of circuit.—J. W. W.

READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

IMPROVING SURFACE INSULATION.

Where a receiver has to be worked in a damp atmosphere the interior of the cabinet may be kept free from moisture by a few lumps of calcium chloride placed in a suitable receptacle inside the cabinet. A small test tube clamped vertically to the side of the cabinet will be found best as the narrow neck will prevent the chemical from being spilled.

The calcium chloride should be examined from time to time and renewed when necessary. The need for renewal will be indicated by the fact that the solid lumps have entirely gone into solution with the moisture absorbed from the air.—W. S. C.

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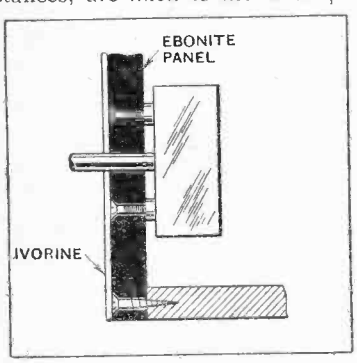
COVERED PANEL.

Many components, particularly variable condensers and filament resistances, are fixed to the front panel



Improving the appearance of a receiver panel.

by countersunk screws. The arrangement of these screws is seldom symmetrical and the appearance of the front of the panel is entirely spoiled.

By covering the panel with a thin sheet of ivorine cut exactly to the same size, through which only the essential shafts are carried, a very pleasing effect is obtained. A further advantage is that the same panel can be used in the building of a new set since the original holes will not be visible from the front.

It is, of course, essential that all heads of screws should be well countersunk to avoid contact with the ivorine.—E. J. H. R.

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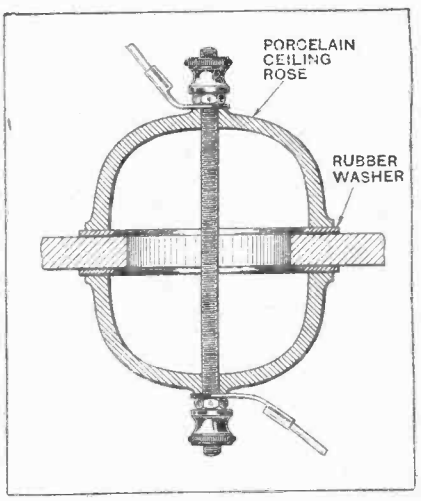
LEAD-IN INSULATOR.

The lead-in insulator shown in the diagram was improvised to bring in the aerial down-lead through the wooden roof of a hut.

Two glazed porcelain covers from electric light ceiling roses are clamped over a hole in the roof by means of a length of No. 2 B.A. screwed rod, the aerial down-lead and connection to the aerial terminal of the set being connected to terminals at each end of the rod. Rubber washers between the porcelain covers and the roof effectively prevent the ingress of water.

The method is equally applicable to a slate roof though more care and skill is required in cutting the hole.—D. P. D.



Roof insulator for the aerial down lead.

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BATTERY CASE.

Readers who may be in possession of run-down "Ever-Ready" 66-volt H.T. batteries will find that the tin container makes an excellent carrying case for D.T.G. cells.

The pitch covering on the top of the old battery should be chipped out and the zinc containers and spacers removed. A carrying strap, which may conveniently consist of a suitable length of 1-in. canvas belting, is then fitted to each end of the case. It will be found that three D.T.G. cells are an easy fit in the case and wooden packing pieces should be inserted at each end. If these are made equal to the height of a D.T.G. cell and are slotted at the top to locate the carrying strap the stability of the battery as a whole will be improved.—W. A. T.

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.

OPENING SCENES AT OLYMPIA.

THE National Radio Exhibition of 1926, which was formally opened at Olympia on Saturday last by Vice-Admiral Sir Alfred E. M. Chatfield, K.C.B., K.C.M.G., C.V.O., Third Sea Lord, undoubtedly eclipses its predecessors in general interest, and is more truly representative of the British radio industry as a whole. On this occasion the leading manufacturers, not only of complete sets but of component parts, have all combined to provide the ever-increasing multitude of wireless enthusiasts with a complete and comprehensive display of their latest achievements, which undoubtedly will prove to be not only of the greatest interest to the experimenter, the home constructor, and the general public, but also a powerful stimulant to the wireless trade.

The formal opening took place at noon, and, after a few introductory remarks by Mr. A. E. Moody, the Chairman of the Committee, Admiral Sir Alfred Chatfield formally declared the Exhibition open.

In the course of his speech he emphasised the immense changes that had taken place in naval and general sea-going life since the advent of wireless. Thirty years ago when a ship left port it was practically isolated until again within sight of land, whereas now ships in all parts of the world can keep in touch with one another and with land. Wireless has entirely changed the whole aspect of naval warfare. The Navy and the British Empire is kept in touch all over the world by the use of wireless telegraphy. The Admiralty in London is enabled to communicate with ships in the middle of the ocean and in all parts of the world. During the late war wireless was one of our greatest aids.

"The Exhibition," he continued, "is representative of all sections of Manufacturers and Traders, and people will be able to see not only the sets but the component parts for broadcast work.

"Selectivity can now be obtained with comparative ease of adjustment. Stability is assured without undue loss of efficiency and power. Reaction, that continual menace to the well-being of broadcasting, is gradually being improved. These are a few of the improvements which have engaged the attention of the manufacturers and their technical staffs. Much has been done, but much remains to be done. It must be remembered, however, that in any new scientific application such as wireless, progress, though relatively rapid at first, eventually slows up, and we must not expect every year to have some new and wonderful invention.

"The exhibition of component parts will be of great interest to that large body of enthusiasts commonly called wireless amateurs. This body includes many men and women who possess a far-reaching knowledge and experience of wireless theory and practice, and the achievements of these amateurs in the application of low-power, short-wave transmissions for long-distance communication is familiar to all of you. The value of their work has been fully appreciated by the Admiralty, and, I am sure, all Government establishments who are concerned with wireless communication.

"I would like to add, however, that the value of amateur experimenters will be greatly enhanced if careful record is kept of circuits and conditions attending any long-distance communication that they may be fortunate enough to achieve.

"In conclusion, may I draw your attention to the fact that this Exhibition of British wireless receivers and their accessories is a wonderful example of the finest British workmanship; in nothing is a high standard more necessary than in material which deals with wireless. No one is satisfied with his wireless set unless it is almost perfect, and, if you wish to be rewarded by as near as possible perfection in your purchases, I cannot do better than advise those who come to the Exhibition to confine their purchases always to British goods."

[*Photo: Claud Harris, Ltd.*

Vice-Admiral Sir Alfred E. M. Chatfield, K.C.B., K.C.M.G., C.V.O., Third Sea Lord.

Captain Richard, in moving a vote of thanks to Sir Alfred Chatfield for opening the Exhibition, expressed the appreciation of the British radio industry of the frank tribute paid by him to British workmanship and enterprise.

It is interesting to recollect that about this time twenty-five years ago the first wireless signals were received in St. John, Newfoundland, from Poldhu in Cornwall, and one of the most attractive of the historical exhibits is the representation of the scene outside the old barracks on Signal Hill, when the three dots of the Morse "S" proclaimed in feeble tones the conquest of the Atlantic by wireless.

The latest developments of the wireless industry are noted and described elsewhere in our columns, so, in this brief review, we will merely outline the various features likely to interest the casual visitor and to im-

Opening Scenes at Olympia.—

press on him the marvellous and rapid growth of wireless from the simple spark coil, with comparatively untuned transmitter, to the modern valve transmitter whose wavelengths are controllable to a fraction of a metre; from the early grunts and squeaks of radio telephony, which required an expert to interpret, to the almost perfect reproduction of speech and music to which we have now grown accustomed, and, finally, to the new possibilities of radio-television, which, however, is still in the purely experimental stage, and exemplified by the Baird Television transmitter of which a model is shown at the Osram Valve stand.

An Exhibition of this kind serves a two-fold purpose. First, and obviously, to enable the man engaged in serious research to see and compare the latest designs and inventions, and, secondly, to interest the average man or mere listener, to whom wireless is still an unfathomable mystery, and draw him quietly and imperceptibly into the ranks of the enthusiasts.

Though, in general, this Exhibition is chiefly concerned with the present developments, an interesting collection of past and present apparatus is shown at the stand of the Radio Society of Great Britain in the Gallery, where may be seen some of the original Round valves, the Langmuir valve, and a variety of old mercury coherers. Here, too, is the Standard Wavemeter constructed by several members of the Transmitter and Relay Section for use in calibrating members' transmitters.

The broadcast listener will be attracted by the B.B.C. exhibit in the Gallery, where he may see a replica of the main Studio at Savoy Hill, gain an idea of the routine work carried out by the announcer, and not only see many famous B.B.C. artists actually performing, but also hear them by means of a loud-speaker outside the Studio. In the adjoining room he will see the engineer actually controlling the volume of electrical power transmitted over the landline to the transmitter.

The listener and the wireless industry in general will be interested in the scheme promoted by the Joint Committee of the Radio Society of Great Britain and the Wireless League for the registration of wireless traders and repairers, particulars of which can be obtained at the stands of these respective bodies. It is well known that efficient traders and repairers have had a difficult task in gaining the confidence of the public, owing to the number of incompetent people claiming to be experts. It is, therefore, proposed to compile a register of those traders who can be depended upon to sell reliable goods and to give satisfactory service to the public, and, in addition, those who are competent to undertake repairs and the maintenance of wireless apparatus and accessories. Every registered trader will exhibit a sign on his premises, and will be supplied with a certificate.

Vice-Admiral Sir Alfred E. M. Chatfield opening the first National Radio Exhibition. Behind him may be seen Mr. A. E. Moody, Chairman of the Exhibition Committee, and Capt. Richard who proposed the vote of thanks.

THE WIRELESS SHOW

STAND TO STAND REVIEW of New Components and Accessories.

The Components described in the following pages have been selected either on account of the general merit of their design, or because they are being shown for the first time.

EUREKA H.F. COUPLINGS.

The broadcast band is covered by a transformer in which the windings are run on side by side on a ribbed former. The diameter of the former is about 3in., the length being the same, and the winding ratio is 1 to 1. To cover the wave band 150 to 3,500 metres five transformers are needed, those for the longer waves being of similar overall dimensions to the short wave transformers, though the winding is arranged in eight sections. The sections are wound alternately primary and secondary. Interchangeability is provided by means of pins and sockets, the latter being carried on an ebonite base piece. Two types of fitting are available, the standard four-pin base as well as one with more widely spaced pins. The windings are of green double silk wire, and are protected by a celluloid wrapping.

An aerial circuit coupler of somewhat similar construction is also available, as well as a range of transformers with tapped secondary windings for use in balanced circuits.

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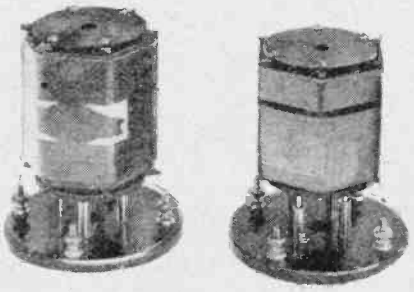
ORTHOCYCLIC CONDENSER.

This is a straight line frequency condenser of compact design. The end plates of polished aluminium are almost rectangular, and are held rigidly apart by means of three ebonite spacing rods. Support for the fixed plates is obtained by two sets of short ebonite stems. A ball race is fitted and a braided pig-tail connector is attached to the lower end of the shaft. In addition to the usual one-hole fixing, three screws with spacers are supplied to obviate the risk of distorting the end plate when tightening up on to the face of the instrument panel.



Eureka interchangeable transformer. On right, an aerial transformer, with "untuned" primary and tunable secondary winding.

The projecting end of the shaft is standard ¼in. This component is of attractive appearance.

Stand No. 107.—Portable Utilities Co., Ltd., Fisher Street, London, W.C.2.

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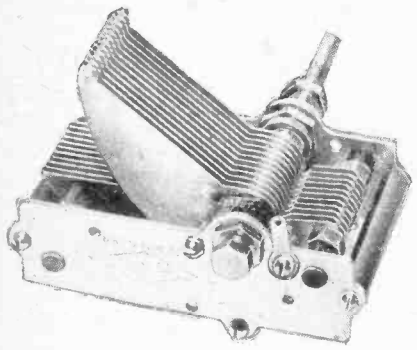
CYLDON S.L.F. CONDENSER.

The square law type Cyldon condenser is well known, and a new model has now been introduced, giving straight line frequency tuning. With the exception of the shape of the plates, the construction is exactly similar to the square law capacity type. The end plates are of thick aluminium and polished all over. Fixing is arranged by three screws suitable for either ¼in. or 3-16in. panels, a drilling template being supplied. The top bearing is of bronze, is ¾-in. in length, and is split, making an exceedingly good fit on the spindle. A thrust face ¾in. in diameter gives the necessary friction and controls the setting up of the moving plates, while the bottom bearing consists of a cone and steel ball. Hard No. 20 S.W.G. aluminium is used for the construction of the plates, and the edges are particularly clean. The moving plates are braced across at their extremities. Support for the fixed plates is obtained by

The Wireless Show.—

ebonite spacers well arranged in regard to the electrostatic field. A phosphor-bronze pigtail connector joins the spindle to the frame terminal.

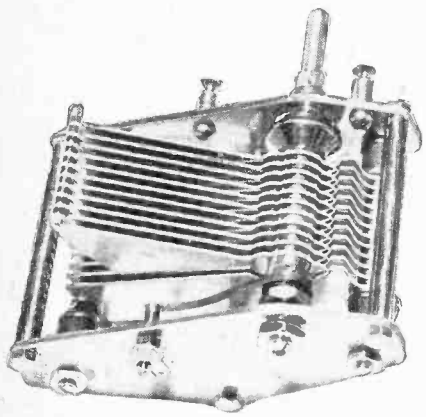


The new Eureka S.L.F. condenser is provided with three fixing screws as well as one-hole fixing.

TEMPRYTES.

A small fixed resistance is contained in an ebonite tubular case about 1in. overall. It is arranged to clip into a holder which is supplied separately. These should be useful as an aid to simplification and reduction of the number of controls.

Stand No. 101.—Sydney S. Bird and Sons, Cyldon Works, Sarnesfield Road, Enfield Town, Middlesex.



The Cyldon condenser is now produced with plates giving straight line frequency tuning.

VERNIER ATTACHMENT.

The drive is transmitted to an india-rubber ring which in turn engages on the edge of the instrument dial. It is so arranged that when the fine control is not required the dial is left free. The operating knobs project 2in. from the face of the panel.

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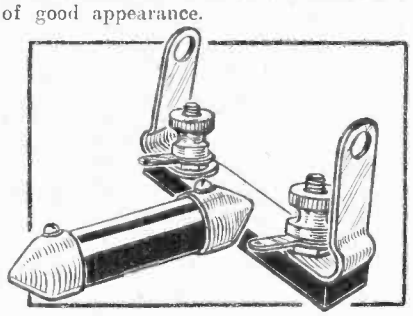
A.C. AND D.C. BATTERY ELIMINATORS.

Full-wave rectification is obtained either by the use of two half-wave valves or, owing to the provision of cross-over connectors between the valve sockets, a single full-wave rectifying valve may be inserted in either holder. The power transformer is of large size with high insulation between the sections and mid-point tappings on both output windings. After rectification by the use of Mullard D.U.5 or D.U.10 type valves smoothing is accomplished by the usual chokes and condensers, though it is interesting to note that both open and closed core transformers are fitted and series connected. The shunts are very liberal in size. Various voltage outputs are produced by shunting the rectified output across a potentiometer, and two fixed tappings are made to give approximately 60 and 150 volts. A third output voltage is controlled by a multi-contact switch, which gives any potential in small steps up to the maximum of 150 volts. Four tappings are also provided to give grid biasing potentials of 4, 8, 12, and 16 volts. The entire outfit is accommodated in a steel box and is of good appearance.



Fixed-value resistances for filament current regulation are becoming increasingly popular. This is the new Tempryte made by the manufacturers of the Cyldon condenser.

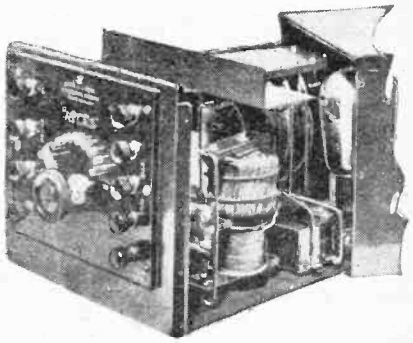
Consisting of smoothing equipment and a potentiometer voltage control, a D.C. mains unit is available which is similar to the A.C. set except that the rectifying apparatus is omitted. A protecting condenser is fitted for connection in the aerial circuit, and a connecting strap in the grid bias circuit is changed over, depending upon whether the positive or the negative of the mains is connected to earth.

Stand No. 80.—H. Clarke and Co. (Manchester), Ltd., Atlas Works, Eastnor, Old Trafford, Manchester.

The easily-attached critical control device of H. Clarke & Co. (Manchester), Ltd., the Atlas Verniaknob.

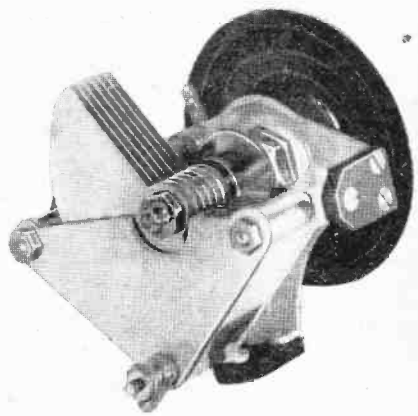
UTILITY MICRO-DIAL.

Careful examination of the dial reveals entire absence of backlash, the drive being positive in either direction for the merest movement of the slow adjustment knob. Three rollers are rotated by the fine control knob, which revolves on the rim of a large diameter cup-shaped pressing, producing a reduction ratio of about



Atlas H.T battery eliminator for use with A.C. supply. It is a full-wave rectifier with liberal smoothing equipment and totally enclosed in a steel box. Grid biasing potentials are also provided.

70 to 1 with a perfectly positive drive. Propulsion is obtained by contact with a stationary piece which is held in position by a washer and a small upright clamped down under the nut used for one hole fixing. A ball race is fitted as a thrust bearing, and a substantial aluminium plate is clamped to the underside of the large dial. The mouldings are of good, clean appearance, and the dial,



New type Utility Variable Condenser.

which is 4in. in diameter, can be used with all makes of condensers.

An improved form of Utility condenser is also shown, and, like the earlier types, is fitted with a bearing at only one end of the shaft. In the construction of this bearing, which is of liberal length, a double ball race is fitted with ¼in. balls, large sized balls being a distinct advantage. A pigtail connector joins the spindle to the end.

Stand No. 74.—Wilkins and Wright, Ltd., Utility Works, Kenyon Street, Birmingham.

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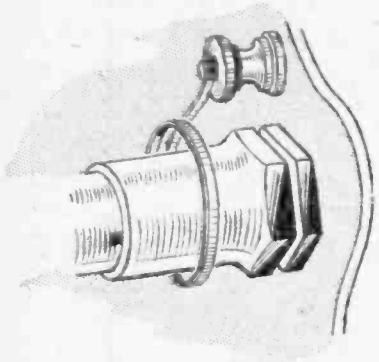
INTERCHANGEABLE AERIAL COUPLINGS.

A range of four interchangeable aerial couplers covers the broadcasting band of

The Wireless Show.—

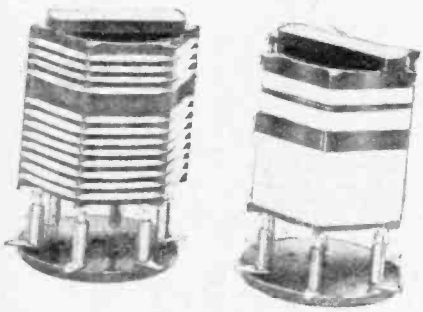
wavelengths, including the long-wave stations. Single-layer windings are used for the shorter wavelengths, and the long-wave coils are built in sections. The



The Utility condenser has a bearing at one end only. It is of substaptial cnnstruction and is fitted with a double ball race

formers are nearly 3in. in height, and are ribbed to support the turns out of contact with the face of the insulating cylinder. These inductances are intended for use in the untuned aerial circuit arrangement.

A range of centre-tapped coils of similar construction is also shown. These should be useful in the various modifications of the Hartley and Schnell circuits and neutralised tuned anode arrangements.



Radiax plug-in tuning inductances consisting of coupled windings.

An oscillator coupler on similar lines has a tunable grid winding and fixed plate and "pick-up" coils, the latter being readily accessible for regulating the extent of coupling by adjusting the number of turns. All coils are wound with double silk-covered wire, and supplied with a screw-down base piece for baseboard mounting.

RADIAX D.C. UNIT.

On the same stand is shown an H.T. battery eliminator for operation on D.C. supply mains. The various potential outputs are obtained by the potentiometer method, the resistance winding being carried on a spool inside a perforated aluminium case. The wire used for the potentiometer is liberal in gauge, arranged as a single layer and well ventilated. The terminal strip is supported between end plates, which are of cast aluminium, and provision is made for a liberal range of output voltages. The smoothing condensers and chokes are concealed inside the coil.

Stand No. 97.—Radiax, Ltd., 16, Palmer Place, Holloway Road, N.7.

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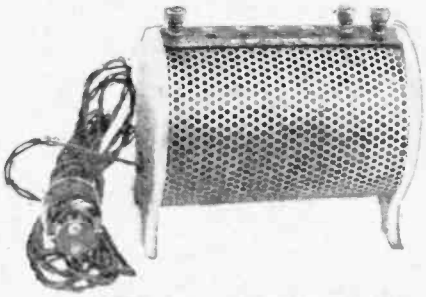
PEERLESS SWITCHES AND RHEOSTATS.

The increasing popularity of battery eliminators as a source of H.T. supply has created the need for a switch designed for making the H.T. circuit after the filaments are switched on. If the H.T. potential is applied directly to the receiver before the valve filaments are heated there is a danger of the smoothing condensers breaking down. This difficulty is overcome in the design of the Peerless Master Switch, which consists of a rheostat for bringing the filament brightness slowly to a maximum, after which the H.T. supply circuit is closed. This switch is the only one of its kind, and should find application in receiving

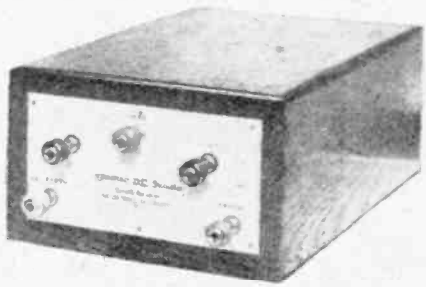


Radiax H.T. battery eliminator for D.C. supply. The smoothing apparatus is enclosed inside the cover which carries the potentiometer winding

sets designed for operation from the mains. The knob and dial are of attractive appearance, being of small diameter with indications engraved on a silvered scale.

Of similar external design is a two-pole change-over switch fitted with five contacts useful for switching valve stages in and out of circuit. The contacts are arranged so that a minimum of stray capacity is presented between them, and the switch can safely be used in radio frequency circuits.

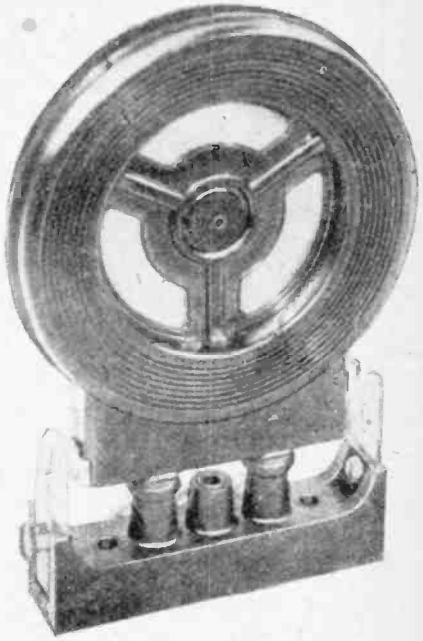
Stand No. 76.—Bedford Electrical and Radio Co., Ltd., 3-22, Campbell Road, Bedford.



Wates Bros. D.C. battery eliminator

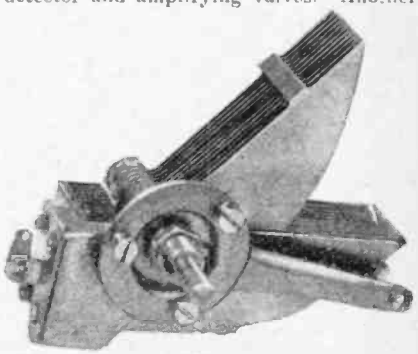
D.C. BATTERY ELIMINATOR.

The leads from the mains are led to a smoothing equipment, consisting of chokes in both main leads and large-capacity bridging condensers. A potentiometer shunts the smoothed output, and by means of three plugs and sockets, two



Two windings are accommodated in the new type Igranic coil. They may be connected separately or linked together to form a tapped winding.

H.T. potentials are available for the detector and amplifying valves. Another



Igranic Pacent S.L.F. condenser is now entirely British made. The plates are of brass and the insulating material is Isolantite.

pair of terminals provides for connecting a protecting condenser in the earth leads. The outfit is enclosed in a polished oak case, the connections being carried on an insulating strip.

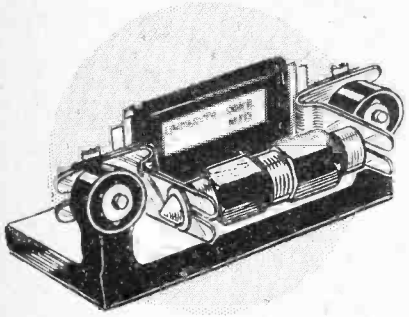
At this stand is also shown the Wates Microstat which, although not new, having been introduced in the early days of broadcasting, has undergone minor internal modifications. The particular merit of this form of filament rheostat is that it may be used with either bright or dull emitter valves, and this is shown on two demonstration sets, one rheostat being connected to control a valve of the 0.06 type, and another regulating the filament current of a bright emitter. The rheostats are sectioned to show the construction.

Stand No. 19.—Wates Bros., Ltd., 12-14 Great Queen Street, London, W.C.

The Wireless Show.—

IGRANIC CENTRE-TAPPED COILS.

These are a special type of "Xllos" coil, in which the winding is built up in

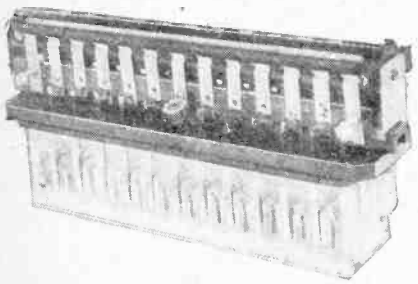


Grid leak and Igranic-Freshman condenser attached to the new type moulded supporting bracket.

two halves, the ends of each half being brought out to separate contacts. With the ends of each winding available for connection as separate coils, this new component is useful in a number of ways in connection with the making up of stabilised intervalve couplings. The two halves of the coil may be joined in series to form a single coil without the centre tapping, or each half may be used singly. A four-connector base is supplied for use with this coil and is designed for baseboard mounting. A wavelength minimum of 110 metres is provided in the series which extends to a maximum wavelength of 3,500 metres.

S.L.F. IGRANIC-PACENT CONDENSER.

It is interesting to observe that this condenser, built somewhat on American



The "Hylo" Battery in which the cells may be either series or parallel connected by a large barrel type switch.

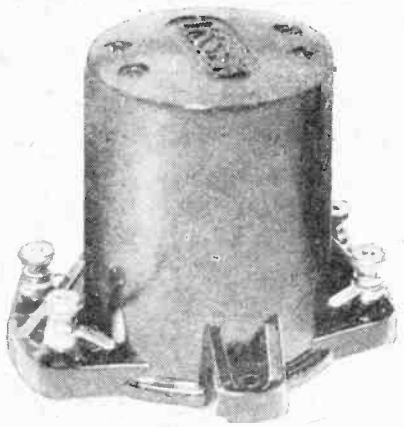
lines, is now entirely of British manufacture.

Igranic-Pacent condensers are of high-grade construction with low loss characteristics and negligible minimum capacity. The fixed and moving plates are of brass, riveted together and soldered, ensuring permanent alignment and sound electrical connection. The channel-shaped frame is particularly rigid, and a reliable system of connection with the moving plates is adopted. The insulating material is Isolantite which is probably one of the best dielectric materials available for use in variable condenser construction. Only two small pieces are fitted, and they are arranged so that the absorption losses are reduced to an extremely low value. Positive stops are provided at minimum and maximum. The bearings are dustproof and particularly well set up, giving a smooth rotation to the moving plates. In addition to a reliable single hole fixing, a flange is provided so that attachment to the panel can, if desired, be made by three screws. This condenser is available in two capacities of 0.00035 and 0.0005 mfd., the former being suitable for tuning a closed circuit for H.F. intervalve coupling over the entire short-wave broadcast band.

Square law condensers of similar construction are available, with capacities of 0.0003, 0.0005 and 0.001 mfd. The condensers are supplied without dials.

IGRANIC GRID CONDENSER AND LEAK.

To facilitate the mounting of the Igranic-Freshman fixed-capacity condensers in association with a leak resistance, a moulded bracket is now avail-



One of the lowest priced intervalve transformers on the market, the new Lissen 1·3 transformer.

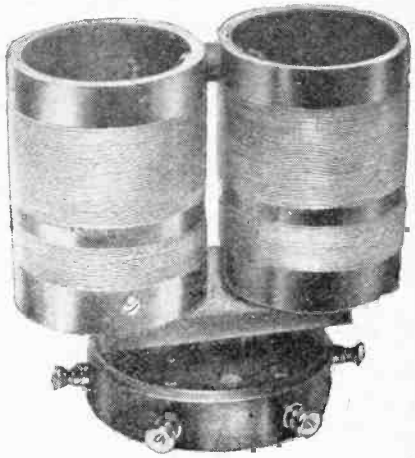
able, suitable for screwing down to a baseboard. The condenser is supported edgewise so that this system of mounting can quite safely be made use of when the panel or baseboard to which it is attached is of metal or wood possessing poor insulating properties and the undesirable effects of capacity to earth eliminated.

Stand Nos. 72 and 73.—Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4.

Lissen, Ltd., now produce a Mansbridge condenser. It is enclosed in a moulded case and is of good appearance.

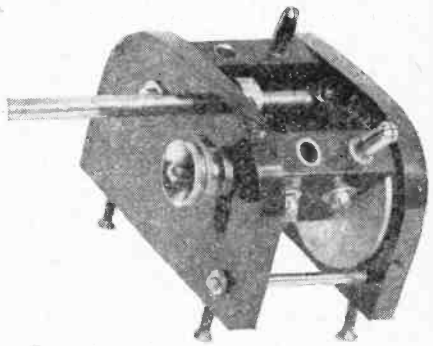
THE "HYLO" BATTERIES.

The D.P. Battery Co., Ltd., have introduced an entirely new form of secon-



The Lissen binocular coil has a limited external field.

dary high-tension battery. The principal feature is the provision of a large barrel type switch extending the full length of each bank of twelve cells, which, when rotated, will provide on the output terminals 24 volts, 6 volts, or 2 volts, or disconnect the battery, leaving all cells open-circuited. The scheme is rather an ambitious one, and, in consequence, the moving parts, in order to overcome the difficulties of corrosion, are of necessity robustly constructed and liberal in size. The contact strips are carried on a moulding, and move between a large number of springs connected to the terminals

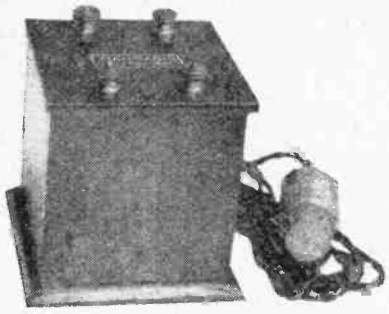


The "Penton" coil holder, with adjustable helical gearing and locking device.

of the individual cells. Considerable advantage is gained by the provision of the switching system. It is, for instance, much more economical to charge a high-voltage battery at a slow charging rate when the source of supply is direct-current mains than it is to wastefully cut down the voltage of the supply through resistances, at the same time needing a much heavier charging current. On the other hand, it is often inconvenient to provide the slow charging rate required for the small cells of a high-tension accumulator battery, and thus the sections can be series or series-parallel connected so that a much heavier charging rate can

The Wireless Show.—

be employed and the battery connected up on charge with large filament heating accumulators. The new battery is therefore useful either for filament or H.T.

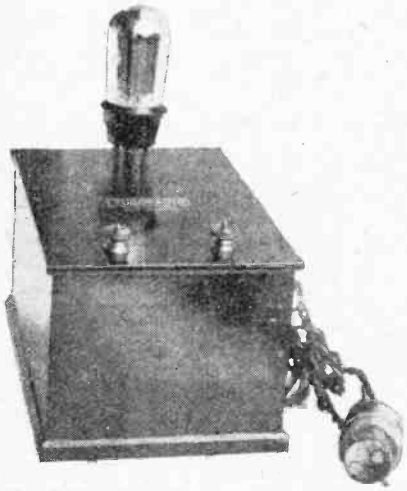


The simplified Tudoradio H.T. battery eliminator, for D.C. supply.

supply, is economical and convenient to run, while the simple filling device permits of the correct acid level being obtained in all cells. The idea is an exceedingly good one, though the user must take reasonable care with regard to maintaining the battery in a clean condition.

KATHANODE WIRELESS BATTERIES.

An interesting feature in this type of filament heating battery is that not only are wooden separators used between the plates, but they are faced on either side with glass wool, which effectively prevents



The Tudoradio Junior A.C. unit, for H.T. supply to receivers with three valves or less.

the falling away of positive paste in the form of sediment. After being charged and discharged a number of times the glass wool incorporates itself into the face of the positive plates, acting as a binder for the paste, and the manufacturers claim that this feature results in the maintenance of the full ampere-hour capacity of the battery.

Stand No. 104.—The D.P. Battery Co., Ltd., Bakewell, Derbyshire.

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NEW LISSEN L.F. TRANSFORMER.

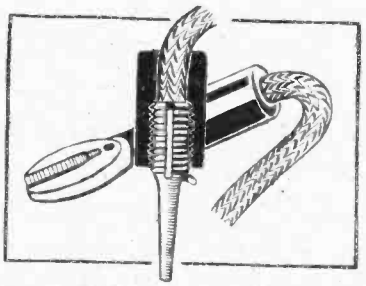
Although of reliable construction, this transformer is probably the lowest priced on the market. It is enclosed in a black moulded cylindrical case of good appearance about 3¼in. in height with terminals low down near the bottom of the case so that the connecting-up wires lie near the baseboard. The winding ratio is 1 to 3, and the primary impedance is stated to be 40,000 ohms at a note frequency of 1,000.

LISSEN MANSBRIDGE CONDENSERS.

A new and attractive form of mounting is adopted in the Mansbridge condensers now manufactured by Lissen, Ltd. The case is of smooth moulded material with extension pieces for baseboard mounting. The insulation resistance is up to a high standard, being stated as approximately 2,500 megohms per microfarad.

NEW BINOCULAR COIL.

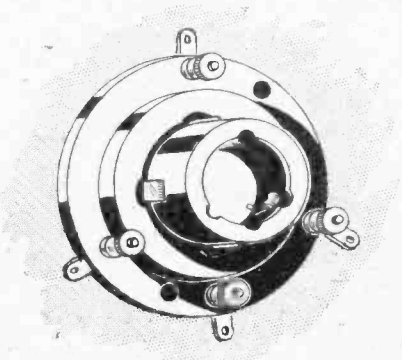
This is another new product of the Lissen Company, the windings being arranged on two formers standing side by side and connected up in such a direction



Clix pin and spade terminals, showing easy connection to flexible leads.

as to limit the external field to prevent interaction with other inductances. Both the primary and secondary windings are in two sections, and tapping points are available for connecting the coil as an H.F. intervalve coupling in a stabilised circuit. Coils of this type are usually of somewhat higher resistance than a well-designed single-layer solenoid, and the manufacturers state that the high frequency resistance at 300 metres is 6.5 ohms, which is a reasonably low value when one is gaining the advantage of having an inductance with a very limited stray field.

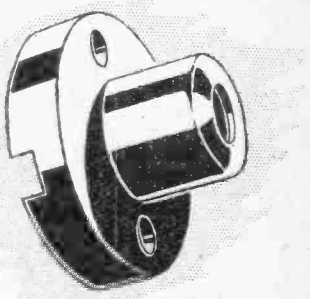
Stand No. 160.—Lissen, Ltd., 18-22, Friars Lane, Richmond, Surrey.



The Wearite shock-absorbing valve holder, with safety top.

XTRATONE L.F. AMPLIFIER.

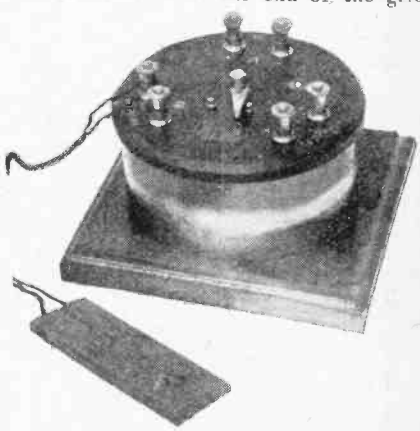
A device intended to be plugged into the output valve holder of an existing



A socket for telephone extensions, taking a standard plug.

receiver, thus giving an extra stage of resistance-coupled L.F. amplification without any alteration to the wiring or the need for connecting up a parallel set of battery leads.

The coupling condenser, leak, and resistance are contained in a cylindrical ebonite case about 3in. in diameter and of approximately the same height. In order to economise space and to allow the use of valves of the largest physical dimensions, the holders are staggered. An extra H.T. positive terminal is fitted, together with a switch for changing the connection of the lower end of the grid



The H.B. H. Remote Control Unit, with a spring grip contact switch, by means of which a receiver may be put in or out of operation from another room.

leak to either side of the filament. Thus this attachment can be adapted for use with any receiver, irrespective of the system of filament wiring adopted. It is understood that a modification of the same device with provision for the addition of a grid bias battery is also available.

GEARED COIL HOLDER.

The use of helical gearing accounts largely for the smoothness of operation of the Penton coil-holder. An extension of the control rod is fitted to a bearing carried in an eccentric bush, in order that the gears may be more closely engaged to compensate for wear. A demonstration with a dummy coil weighing over 4 lbs. showed that there is no possibility of any coil falling down with its own weight.

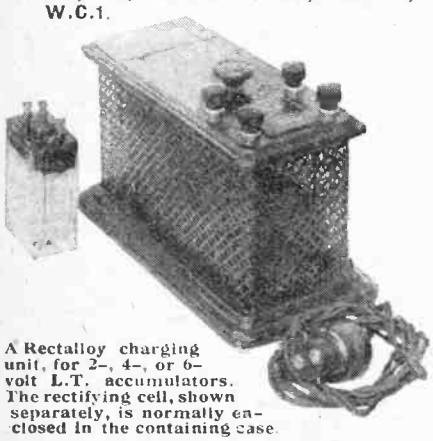
The Wireless Show.—

The extension handle is of unusually long length and should be adequate to prevent capacity effects, while provision is made

A single Lithanode cell, in a teak crate with carrying strap.

for firmly locking the moving coil-holder in any desired position. The component is suitable for mounting on the baseboard of sets constructed on the so-called American principle; with this object in view, two special drilled ebonite strips are supplied.

Stand No. 5.—The Penton Engineering Co., 15, Cromer Street, London, W.C.1.



A Rectalloy charging unit, for 2-, 4-, or 6-volt L.T. accumulators. The rectifying cell, shown separately, is normally enclosed in the containing case.

"JUNIOR" H.T. ELIMINATORS.

A simplified form of the Tudor H.T. battery eliminator for use on D.C. mains is now available. It comprises a series choke wound to a high ohmic resistance together with the usual arrangement of smoothing condensers. The resistance of the windings is so proportioned that a voltage of 100 will be applied to the average 3-valve receiver using one power valve. The apparatus is contained in a very small wooden box with an ebonite top. It is fitted with a flexible lead and adaptor for connection to the electric lighting system.

A Junior A.C. Unit suitable for a similar output load and using a valve rectifier is also supplied. It is available in types suitable for voltages of 200-210, 220-230 and 240-250. Although naturally somewhat larger than the A.C. Unit it is quite small and compact, measuring overall some 6in. × 4in. and 3½in. high.

Both these units are intended for sets with not more than three valves and in the D.C. unit provision is made for earthing the receiver through a large condenser (which is incorporated in the unit itself) as a measure of safety.

Stand No. 10.—Tudoradio Co., Ltd., Tudor Works, Park Royal, London, N.W.10.

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THE NEW CLIX SOCKETS.

The ordinary Clix plug has a tapered pin on which a worm thread is turned to assure firm contact with its socket. A new form of this device has a parallel slotted pin cut in such a way as to give extra resiliency. A polished insulator is fitted and the upper part of the plug is drilled and slotted for easy attachment of the connecting wire. Suitable sockets for panel mounting are also supplied, while insulating bushes are available for use on wooden panels.

Spade and pin terminals made by the same firm are of similar construction, as far as the connection is concerned. The pin tapers from No. 16 to No. 18 gauge and is nickel plated and polished.

Stand No. 20.—Autoveyors, Ltd., 82-84, Victoria Street, London, S.W.1.

RADIO WORLD'S FAIR, NEW YORK.

September 13th.

A special representative of THE WIRELESS WORLD has just sailed for New York to visit the Radio World's Fair, which opens on September 13th.

Full details will be given in a future issue of all outstanding features of the Fair. This review will give our readers first-hand information on what America is doing.

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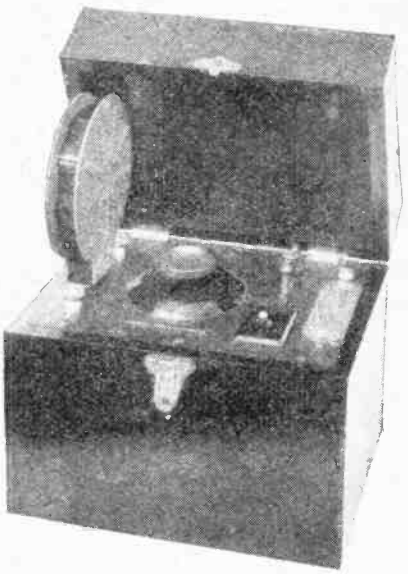
THE WEARITE SHOCK ABSORBING VALVE HOLDER.

An anti-microphonic valve holder with arched metal springs and of low-loss construction. There is no solid dielectric between the valve pins, and the top of the holder is slotted in such a way that an attempt to insert the valve incorrectly will not have the usual effect of short-circuiting the H.T. battery through the filament. A continuation of the U-sectioned metal strip which holds and makes contact with the valve pin forms the spring, and is extended to act as a soldering tag. As there are no joints, the possibility of a faulty connection internally is obviated. Stops are so arranged that there is no risk of an internal short circuit, whether the valve is twisted, pulled or pushed down in its holder. The holder is cleanly moulded in Bakelite with nickel plated fittings.



Wavemeter with interchangeable inductances. It can be supplied with extra coils for long wavelengths.

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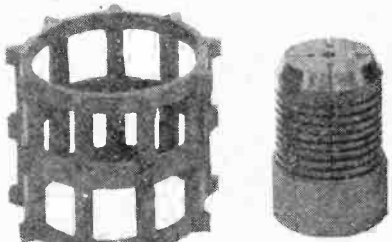
'PHONE EXTENSION SOCKET.

The provision of a connection for a phone extension is always a matter of some little difficulty. If the ordinary wall plugs are used there exists the probability of a reversal of connections, and it becomes impossible to connect a number of phones or loud-speakers in series unless short-circuiting plugs are used. The Wearite extension phone socket consists of a modified form of jack mounted in a conspicuous ebonite case with holes for attachment to a wall or skirting board and slots on its underside to pass the connecting wires. Any ordinary plug may be used with this component, and in its normal form the withdrawal of the plug will short-circuit the connection. A special form of socket is, however,

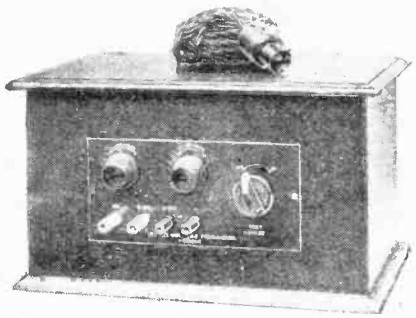


An ebonite former for short-wave coils, and also one for sectionally-wound long wave transformers and H.F. chokes.

The Wireless Show.—

available for use when the phones are connected in parallel.

Stand No. 224.—Wright & Weaire, Ltd., 740, High Road, Tottenham, London, N.17.

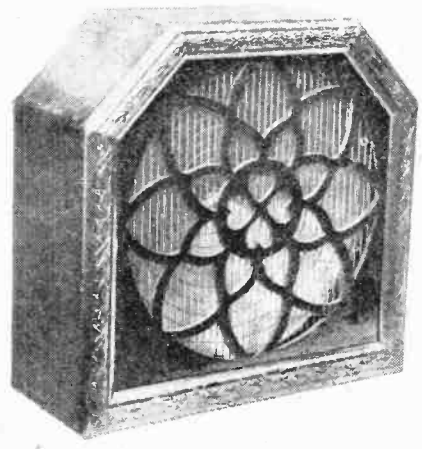


Ecko mains unit giving one fixed and two adjustable output potentials.

H.B.H. REMOTE CONTROL UNIT.

This unit, manufactured by the Goswell Engineering Co., Ltd., is constructed on the principle which probably offers the most satisfactory solution of the problem of controlling a receiving set from a distance. It comprises an electro-magnetic mechanism so arranged that alternate contacts of the distant control switch close and open the L.T. battery circuit. The mechanism is contained in a small circular oxidised metal case mounted on a wooden base and fitted with an ebonite top panel carrying terminals for connection to the set, the L.T. battery and the two remote control leads. The unit is normally mounted in close proximity to the receiver, and does not require an extra local battery. It only passes a momentary current when the set is actually switched on or off; there is no continuous flow and consequently no wastage of battery current. Neat grip contacts are supplied for use with this unit.

Stand No. 256.—Goswell Engineering Co., Ltd., White Lion Stret, London, N.1.



Celestion cone type loud speaker in walnut case. The method of stiffening the thin diaphragm by means of a spiral can be seen.

LITHANODE BATTERIES.

The manufacturers of the Lithanode accumulators claim that many of the troubles experienced with the ordinary type of cell are overcome by the special form of construction of their plates. They claim perfect contact between the active metal and the frame of the plate with an exceptionally long life and, moreover, guarantee that the cells will hold their charge if left idle for a period of twelve months with a loss of not more than 15%. Their type 36-6H4 cell, which is supplied in a polished teak wood case with carrying handle, should be particularly useful to those using the popular two-volt valves. The container is of stout ebonite, with a porcelain vent plug, and the terminals are fitted with brass wing nuts. The cell has a capacity of 36 ampere hours.

Stand No. 204.—The Lithanode Co., Ltd., 190, Queen's Road, Battersea, London, S.W.8.

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THE RECTALLOY TRICKLE CHARGER.

This unit operates on A.C. current. Model C is for pressures of 100-110 volts and model D for 200-250 volts. It includes a full wave electrolytic rectifier having two "Rectalloy" electrodes and one lead electrode. The rectifier cell is easily removable from the unit. The necessary step-down transformer as well as the cell are contained in a perforated steel case with wooden base and top. Terminals for connection to batteries and set and a controlling switch are mounted on the top panel. The switch is arranged to totally disconnect the rectifier, to transfer the battery from the set to the charging position and also to insert series resistances of three different values to suit two-volt, four-volt, and six-volt batteries.

Stand No. 202.—Rectalloy, Ltd., Vulcan House, 56, Ludgate Hill, London, E.C.4.

THE BERLIN RADIO EXHIBITION.

September 3rd–12th.

A review of all important features of this Exhibition will appear in an early issue.

Prof. G. W. O. Howe, D.Sc., M.I.E.E. (Technical Editor of EXPERIMENTAL WIRELESS) is at present in Berlin on a visit to the Exhibition on behalf of THE WIRELESS WORLD and our sister monthly Journal, EXPERIMENTAL WIRELESS.

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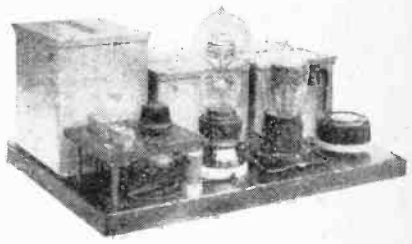
A GAMBRELL WAVEMETER.

The Gambrell wavemeter, type D, covers a wavelength range of from 50 to 500 metres, and is of the buzzer type, thus being suitable for use with receivers not in an oscillating condition. A new type buzzer giving a constant note and, it is claimed, a constant amplitude, is fitted. Two Gambrell coils are supplied with the wavemeter, and are independently calibrated. The buzzer is operated from a small 4½-volt flash lamp battery which is contained inside the case, being easily accessible for replacement by removing the metal cover with which its compartment is fitted.



G.E.C. Rectifier built up from parts supplied for home construction. An important feature is the use of a gas discharge full wave rectifier, constant voltage regulation being obtained by a neon lamp.

GAMBRELL HIGH NOTE BUZZER.

The buzzer used in the Gambrell wavemeter is sold separately. It is of neat and compact construction, being mounted on an ebonite base 2in. long × ¾in. wide. A plated metal cover is fitted. It is noted that the fixed contact, instead of being rigidly mounted, is in the form of a spring, and this form of construction probably accounts for the high note which is a distinctive feature of the instrument.

Stand No. 90.—Gambrell Bros., Ltd., 76, Victoria Street, London, S.W.1.

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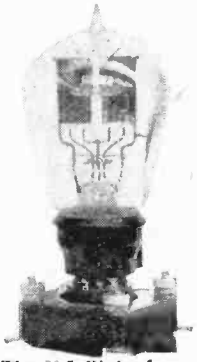
TRELLEBORG COIL FORMERS.

A useful skeleton former suitable for short wave coils with a mean diameter of approximately 2½in., and a winding length of 2¾in. There are nine ribs and three supporting rings. On the same stand is shown a barrel type former as used in the construction of H.F. transformers. This component would appear to be useful in the home construction of transformers for the long waves or in an intermediate frequency amplifier.

Stand No. 31.—Trelleborg Ebonite Works, Ltd., Audrey House, Ely Place, Holborn, London, E.C.1.



The U.5 Biphase Rectifying Valve.

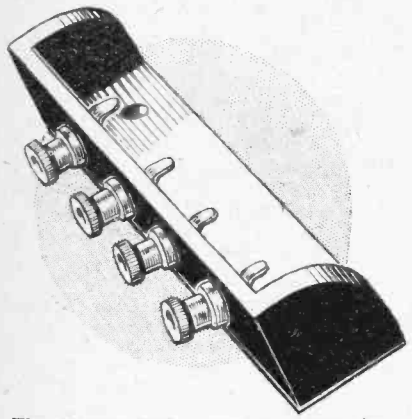
The new Osram Gas discharge rectifier type G.R.1.

ECKO H.T. UNIT.

In the D.C. models smoothing is effected by chokes and condensers, the leads passing on the maximum voltage to

The Wireless Show.—

the output terminals. To obtain a reduced voltage for the detector valve a high resistance, shunted with a large capacity condenser, is connected between an additional terminal and the maximum



The Edison Bell Terminal Strip for baseboard mounting.

voltage terminal. The detector valve plate voltage is rendered adjustable by the use of a variable resistance for dropping the potential. This is a good feature, for a continuously variable detector voltage is obtained and can be regulated, depending upon the plate current passed by the valve. In the several types of H.T. units working from D.C. supply this method of voltage dropping by a series resistance is adopted, and thus where three different H.T. potentials are required two variable voltage controls are fitted, though in one model, the V3a, the three output voltages are all adjustable.

Stand No. 9.—E. K. Cole, 513, London Road, Westcliff-on-Sea.

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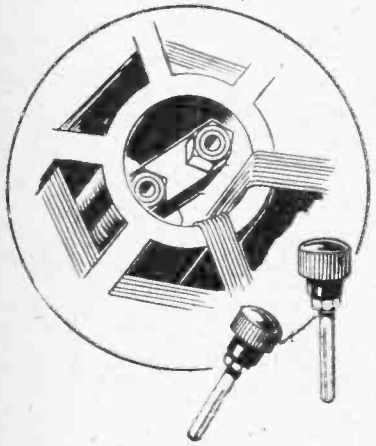
HEDGELAND PICTORIAL LOUD-SPEAKER.

That the horn type of loud-speaker is considered to be unsightly is evidenced



Edison Bell tapped coil.

by the several cabinet and hornless models which have been lately introduced. If the loud-speaker cannot be made to harmonise in appearance with the decorations of the room in which it is used, it may be rendered invisible by building it into one of the articles of furniture. Lamp-shade models are well known, but an entirely new departure is the fitting of the loud-speaker mechanism behind a picture. Amateurs seeing the new picture loud-speaker for the first time might form the opinion that the front of the picture, which is unglazed, is driven by the usual movement and acts as the sound emitter, though actually the front, which is of canvas, covers the flare. The movement is of the ordinary diaphragm type, and the canvas front to which the picture is pasted has no detrimental effect on the quality, while the damping action produced on the sound waves may even be advantageous for improving sound reproduction.

The two wires from which the picture is hung serve as the leads, and are further concealed in the picture-rail, thus avoiding loose wires. Being out of the way it is less liable to be damaged, while probably an advantage is gained by projecting the sound from the wall of a room not far down from the ceiling.

The pictures are in imitation oils, etchings, or japanese style in black, gold, or wood frames.

Stand No. 11.—J. W. See and Sons, Maidstone.

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SET BUILDING SYSTEM.

All components are standardised in the system as regards terminal points and methods of fixing, so that they can be readily bolted down to an insulating panel carrying a large number of regularly spaced holes. Apart from simplicity of construction, the system lends itself to the drafting of explicit instructions with regard to making up and wiring as every fixing hole carries a number which is used for reference purposes. A range of components is available though the holes will actually suit many components of other manufacture. Pamphlets are supplied showing how to construct a number of sets.

Stand No. 15.—Blackadda Radio Co., Ltd., 48, Sadler Gate, Derby.

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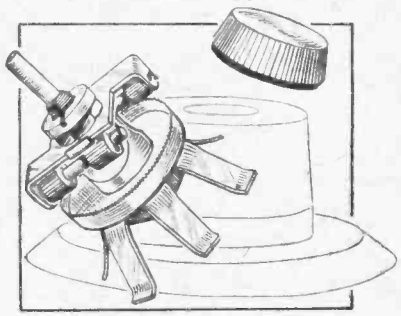
CELESTION LOUD-SPEAKERS.

The Celestion was one of the first cabinet type loud-speakers in which the sound is emitted from a large conical diaphragm. The driving armature, which is operated by a compound magnet system, is attached to the centre of the diaphragm. A very thin parchment-like material is used for constructing the cone, which is stiffened by a spiral. The case represents high-class cabinet work and is obtainable either in oak, walnut or mahogany. Although it is difficult here to make comment on the performance of a loud-speaker, its merit is evidenced by the high reputation it has achieved in the comparatively short time that it has been on the market.

Stand No. 28.—Celestion Radio Co., 21-39, High Street, Hampton Wick, Kingston-on-Thames.

NEW BATTERY ELIMINATOR FEATURES.

This A.C. battery eliminator differs essentially from other types in that a



Mechanism of the Edison Bell Slow Motion Dial.

gas discharge rectifier is employed. It is designed to give full-wave rectification, and, apart from the usual combination of chokes and condensers for smoothing, which, by the way, are of very liberal dimensions, voltage rectification is obtained by the varying conductivity of a neon lamp. The rated output is 20 to 25 mA., with a maximum voltage of 135. Heavier loads can, of course, be imposed on the rectifier accompanied by a fall in voltage, and hum is entirely eliminated up to the rated capacity.

Two output voltages are provided, one being variable and the other fixed, the lower voltage being controlled by an adjustable rheostat of high resistance. The current taken from the mains is infinitesimal. The running cost, in fact, cannot be computed, and may be considered as negligible. It is distinctly less than with units employing thermionic valves for rectifying.

Eliminators for direct current supply are also shown, and, like the A.C. model, are enclosed in crystalline enamelled metal cases.

The design of the Fellophone high tension unit renders it suitable, as regards over all dimensions, for taking the place of the high tension battery.

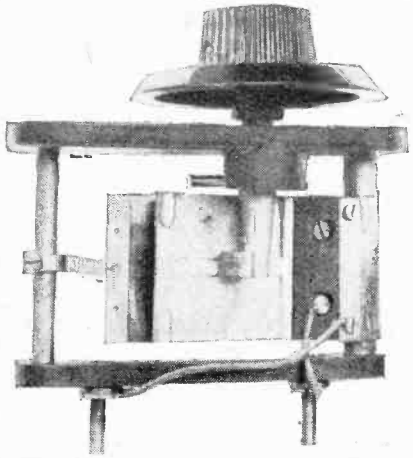
GAS DISCHARGE RECTIFYING VALVE.

This new Osram valve, type GR1, is a gas discharge rectifier intended for use in apparatus for obtaining D.C. supply from A.C. mains. It has the outstanding merit that it cannot be overrun, since it has no filament, and will therefore give prolonged service. Valves of this type become heated in operation, while, compared with the thermionic rectifier give a wave form that necessitates the use of larger reservoir condensers in the smoothing equipment, though the use of a neon tube voltage regulator is a simple way of obtaining a smooth output.

The Wireless Show.—

OSRAM U5 RECTIFYING VALVE.

A double anode rectifying system is enclosed in one bulb giving full-wave rectification, simplifying smoothing.



The Fellows variable condenser is of unusual design. A cam is used to regulate the overlap of the plates. It has mica dielectric.

Series-connected dull emitting filaments are fitted, rated at 5 volts 1.6 amperes. The valve will withstand an applied anode potential of 500+500 (R.M.S.) maximum, and will provide a direct current up to 50 milliamperes.

This valve is recommended for use in a rectifier which is required to feed a receiving set employing one or more low impedance power valves. An interesting point in the operation of the valve is that the filament must be operated at full 5 volts, or otherwise its life may be considerably shortened.

Stand No. 63.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

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USEFUL TERMINAL STRIP.

When assembling a receiver in which the components are screwed down to a baseboard the home constructor encounters difficulty in the making up of a suitable terminal strip. The new Edison Bell terminal strip will save a lot of trouble in this direction, and it is surprising that a component of this kind has not before made its appearance on

Fellows aerial lead-in insulator. It is adjustable within wide limits. Porcelain is used as an insulator.

the market. Strips are supplied carrying varying numbers of terminals.

Instead of screwing on to the edge of the baseboard it is arranged to screw down with two fixing screws, which is an exceedingly good feature, particularly when it is necessary to bring the strip flush through a slot in the back of the cabinet.

A TAPPED EDISON BELL COIL.

Modern practice tends towards the elimination of a multiplicity of controls, and the use of a tightly coupled aerial winding, without a separate tuning condenser, is gradually coming into favour. A new type of Edison Bell coil, supplied with the standard plug and socket mount, and having two extra sockets fitted to its centre, should be useful in circuits of this description. The ends of the winding are connected in the normal manner, while connections to the centre sockets are taken from tapping points 15 per cent. and 25 per cent. (in turns) of the total winding, starting from one end. The most obvious use of the coils is in auto-coupled aerial circuits, but they will have various other applications.

Of similar construction are a range of plug-in coils, tapped at their electrical centres.

EDISON BELL GEARED DIAL.

The auxiliary knob in the centre of the dial drives through a worm-wheel on to a pair of pinions which, in turn, engage on the toothed edge of a cup-shaped stamping, propulsion for the condenser spindle being obtained from a friction washer resting on the face of the panel. A reduction gearing of nearly 90 to 1 is obtained. Backlash in the pinions is prevented by meshing them in a manner which avoids play, though care must be taken in the adjustment of the receiver spindle which carries the worm-wheel to avoid end play.

Stand No. 75.—Edison Bell, Ltd., Edison Bell Works, London, S.E.15.

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FELLOPHONE HIGH-TENSION UNITS.

Single-wave rectification is employed and combined with liberal smoothing equipment, has a stated potential output of either 50 or 100 volts at a current of 10 to 15 milliamperes. The manufacturers state that this model is suitable for operating a three-valve set including a power valve. The special two-electrode valve used for rectification is low-priced. H.T. mains units giving several potential outputs from D.C. supply are also shown.

NOVEL VARIABLE CONDENSER.

Of rather unorthodox appearance, the Fellows variable condenser is operated by driving the curved face of a small aluminium casting in contact with a mica-faced copper foil. The movement is obtained by means of a cam having a suitable profile to produce either straight line capacity or straight line frequency tuning.

Stand No. 110.—Fellows Magneto Co., Ltd., Cumberland Avenue, Park Royal, London, N.W.10.

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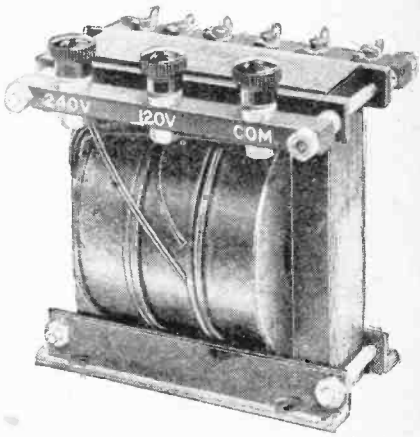
MARCONIPHONE POWER TRANSFORMER.

This instrument has been designed for the home construction of rectifiers for H.T. supply, and is intended for use with the U.5 type rectifying valve. The primary winding has a centre tap so that it can be used on supply voltages of 100 to 120 or 200 to 240. The anode circuit winding is intended to give 160+160 volts, while a third winding supplies the filament heating current.

HIGH- AND LOW-TENSION SWITCH.

It cannot be too strongly emphasised that leaving the H.T. battery permanently connected across a receiver may have a detrimental effect upon the windings of transformers, for in the event of the slightest low insulation a prolonged electrolytic corrosive action ensues.



Marconiphone power transformer for the construction of an A.C. battery eliminator using the U 5 type valve.

A convenient form of single knob switch has been designed by the Marconiphone Company, and, by rotating a small knob, both high- and low-tension battery supply is disconnected. A special feature in the design is that the high-tension circuit is disconnected first, which is a very necessary precaution when deriving plate current from the mains, so that the bridging condensers will be discharged.

Stand No. 121.—The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1.

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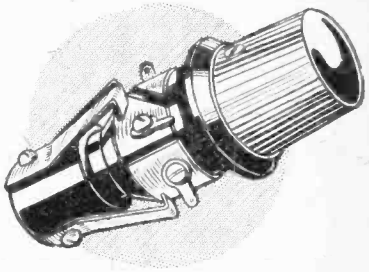
NEUTRALISING CONDENSERS.

Two models are available, one for panel mounting and the other screwing down to the baseboard. Good points in design are long double cone bearings, the elevation of the fixed plates away from the panel or baseboard by means of a pillar, long ebonite operating handle, and the shaping of the plates so that



Marconiphone Rotary Switch for disconnecting the battery supply. It is arranged to cut off the high tension current before breaking the filament circuit.

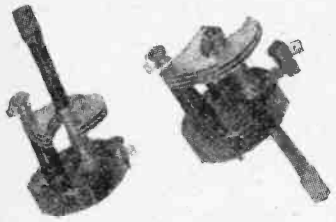
the capacity charge is small near the minimum in either direction of rotation.

INTERCHANGEABLE H.F. CHOKES.

It is almost as necessary to be able to interchange high-frequency choke coils in

The Wireless Show.—

a receiving set when tuning over a wide wavelength range as it is to change the tuning inductances. On short wavelengths, where a small choke only is re-



Bowyer-Lowe stabilising condensers for panel or baseboard mounting.

quired, a small winding of low self-capacity is desirable, a larger coil being required on the broadcast band. The size of choke also depends, of course, on its position in the circuit.

The windings are carried on spools with ebonite end cheeks, are ebonite covered, and engraved with the inductance value. Six sizes are available of 2, 5, 10, 20, 40, and 60 millihenries. The base piece is supplied separately.

Stand No. 126.—Bowyer-Lowe Co., Ltd., Radio Works, Letchworth, Herts.

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BROWN DISC LOUD-SPEAKER.

An entirely new type of Brown loud-speaker is shown for the first time. Details of the internal construction are not available, but it would appear to be a recessed disc driven from the centre. It is totally enclosed in a metal framework with a perforated front grating. Adjust-

Burndept H.T. accumulator charger for use on A.C. supply. The charging rate is regulated by the filament brightness and is indicated by means of a glow lamp.

ment of the diaphragm is effected by a milled screw at the back. The finish is particularly beautiful, in either oxidised silver or black and gold. Approximate diameter 13 inches.

Probably no manufacturer has more experience in the production of speech amplifiers of the microphone type than S. G. Brown, Ltd., and a new two-stage model is now available stated to be suitable for loud-speaker operation when connected to a crystal receiving set within 15 miles of a B.B.C. station or 80 miles from Daventry. Simplicity of operation and the avoidance of critical adjustments are features of the design.

Stand No 128.—S. G. Brown, Ltd., Western Avenue, North Acton, London, W.3.

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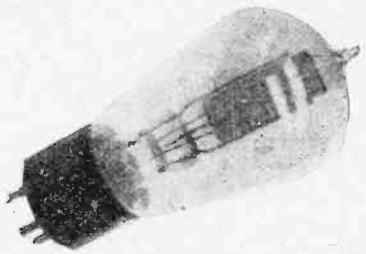
BURNDEPT H.T. BATTERY CHARGER.

Although the use of H.T. accumulator batteries for the operation of multi-valve receivers is becoming popular, users soon



The U.695 rectifying valve for charging H.T. accumulators.

realise that frequent and careful charging is necessary to keep the battery in good condition, and that such batteries are very liable to become damaged and corroded in the hands of the local charging station. For use on A.C. supplies, Burndept Wireless, Ltd., offer a useful unit which will provide the necessary slow changing rate and, in effect, will cause the high-tension accumulator to function in the same way as a mains battery eliminator without the uncertainty as to the effectiveness of the smoothing equipment or the need for voltage regulating resistances. The unit is a simple half-wave rectifier making use of a thermionic valve. The charging rate is regulated by controlling the filament brightness. A 120-volt battery can be charged at a maximum rate of 60 milliamperes, and a pilot lamp, according to its brightness, indicates the value of the charging current, a visible glow being obtained at 35 mA. It is built into a walnut cabinet with ebonite front, and, when installed, no high voltage terminals are exposed.

A set of parts is available for the home construction of the rectifier, which is described, with circuit diagrams, in a pamphlet obtainable at the stand.

BURNDEPT HALF-WAVE RECTIFYING VALVE.

Developed essentially for use in a low current battery charging circuit, the U695 valve is a half-wave rectifier with a dull emitting filament. The filament current is 0.9 to 0.95 amp. on potentials of between 4.5 and 6 volts. The maximum rectified current output is 70 mA. and the resistance 800 ohms.

THE ETHOPOWER H.T. UNIT.

A full-wave gas discharge rectifier is incorporated in this instrument, which

Ethopower A.C. unit for H.T. supply. It is fitted with a gas discharge rectifier.

provides one of the most economical methods for H.T. supply from A.C. mains. The valve is the new "Ethotron," and is capable of giving a liberal output. The smoothing circuit includes shunt condensers to the total value of 13 mfds. in conjunction with inductances having total value of 60 henries.

Two voltage outputs are obtainable, the lower potential being obtained from a tapping on a high resistance potentiometer. Details of the circuit arrangement, showing values of all components, are given in a descriptive pamphlet.

Stand No. 144.—Burndept Wireless, Ltd., Blackheath, London, S.E.3.

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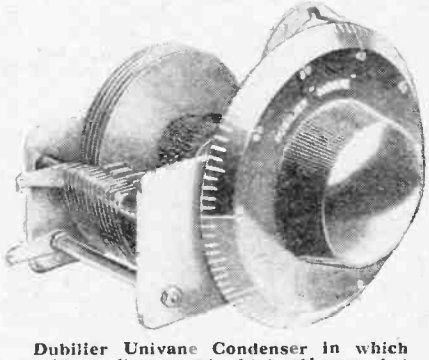
DUBILIER UNIVANE CONDENSER.

By an exceedingly ingenious arrangement, a very critical adjustment of capacity is obtained. Instead of the usual reduction gearing each moving plate is separately controlled, and by rotating the dial they are picked up in turn and carried from the position of minimum to

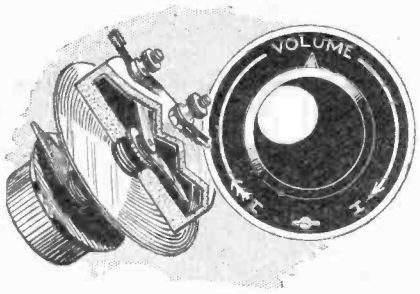


Dubilier Univane Condenser in which critical adjustment is obtained by rotating the moving plates singly.

maximum capacity. On completing one revolution of the dial another plate is picked up, and an auxiliary indicator shows the number of plates carried over to the position of maximum capacity.

Although sold at a popular price, this condenser represents an exceedingly good specimen of high grade instrument work.

Stand No. 154.—Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.



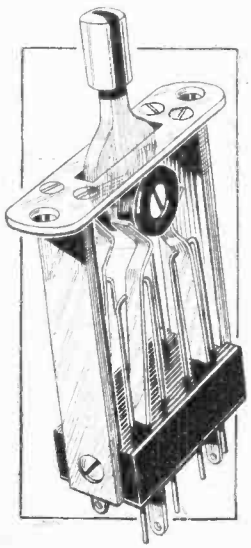
Lamplugh adjustable high resistance for volume control.

LAMPLUGH VOLUME CONTROL.

A critical control of the volume delivered from a loud-speaker is best arranged by means of an adjustable resistance connected across the input to the amplifier. The Lamplugh variable high resistance is designed for this purpose, variation in resistance being obtained by a contact moving over a semi-conducting surface.

The scale is attractively finished in bronze, chemically engraved, and the moulded case completely encloses the movement, protecting the resistance material from the action of the air.

Stand No. 253.—S. A. Lamplugh, Ltd., King's Road, Tyseley, Birmingham.



T.M.C. Key switches are manufactured with various combinations of contacts and are suitable for controlling radio- or audio-frequency circuits.

KEY SWITCHES.

These switches are exceptionally well made and embody a number of features which permit of innumerable circuits and combinations being effected. They are manufactured in several models up to twenty-four contacts incorporated in a three-position key. A smooth roller action operates on the spring blades, and the contacts are of "gold-silver." To facilitate soldering, the ends of the contact springs are tinned. The top plate is heavily nickelled, and the lever is tipped with a small black or white handle.

Stand No. 1.—Jonathan Fallowfield, Ltd., 61-62, Newman Street, W.1.

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COSMOS RESISTANCE-CAPACITY UNIT.

Among the range of components manufactured by Metro-Vick Supplies, Ltd., is a complete resistance-capacity coupling unit. The condenser and resistances are contained in a moulded case, and with the valve holder attached to the top forms a complete L.F. amplifying stage. If fitted in a receiving set as a substitute for a transformer coupled stage, the use of a valve having a high amplification factor is essential, and the S.P.13/B has been specially developed for the purpose.

R.S.G.B. TRADERS' SIGN. The sign just issued by the Radio Society of Great Britain and the Wireless League to be exhibited by wireless traders as a protection to the public and to raise the status of the industry. Details of the service are available at Stands 117 and 239.

The unit, which is clearly moulded and well finished, is supplied also without the valve holder.

Stand No. 162.—Metro-Vick Supplies, Ltd., Trafford Park, Manchester.

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THE DETEX DIAL.

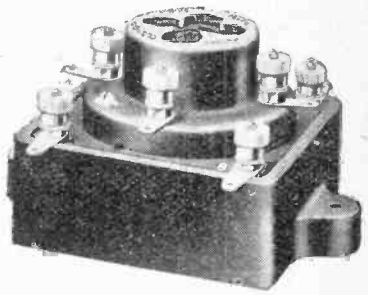
A new and improved dial of large size, with a diameter of 4in. A circular nickel plated disc carries an indicating pointer and is secured to the condenser shaft by a set screw. Movement is transmitted from the control knob to this disc through a simple form of friction reduction gear. Pencil markings may be made on a xylonite backing disc through a slot cut in the rotating disc, in order to keep a permanent record of the adjustment corresponding to any particular station.

DETEX SWITCH-OVER PLUG.

A plug of standard size, fitted with a special body containing a change-over switch. This device has several obvious applications, and is useful for making a rapid change from the phones to loud-speaker, both of which may be permanently connected to the plug.

The makers also exhibit a coil holder with a geared worm drive.

Stand No. 2.—Detex Distributors, Ltd., 110, Victoria Street, S.W.1.

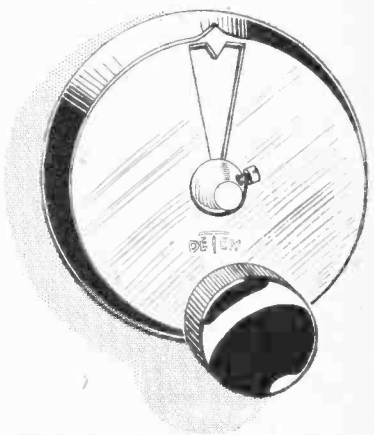


The new Cosmos resistance-coupled L.F. amplifying stage.

A COUPLING INDICATOR.

The London and Provincial Radio Co., Ltd., exhibit a well-made coil holder with a geared movement and a direct reading dial showing the actual angular relation in degrees between the axes of the fixed and moving coils. It is primarily intended for mounting behind the panel, to which it may be attached by a single-hole fixing. The fact that a record may be kept of the coupling adjustment corresponding to the adjustment for a given station is a distinct advantage, and facilitates the tuning-in of this transmission on subsequent occasions.

Stand No. 6.—London and Provincial Radio Co., Ltd., 32, Colne Lane, Colne, Lancs.

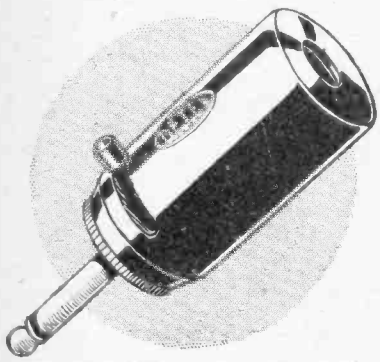


Detex geared dial. The bevelled scale remains stationary and station settings are recorded on a xylonite disc.

WOODHALL VALVE UNIT.

An aid to the neat assembly of a receiving set, comprising a valve holder with a metal bracket arranged for attachment to the back of a panel by two holes, the upper of which serves as an inspection window. A five-point jack is mounted below the valve holder, and may be wired to permit of the elimina-

The Wireless Show.—
tion of an L.F. amplifying stage by simultaneously controlling the filament



Detex plug fitted with a lever switch for changing over telephone and loud-speaker connections.

circuit and changing over the anode output of the preceding valve.

Stand No. 32.—Woodhall Products (Proprietor, Clifford Pressland, A.M.I.E.E.), Hampton-on-Thames.

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THE QUARTERMAINE EARTH TUBE.

A device of slightly larger dimensions than usual, having in consequence a larger surface in contact with the earth. To give a further slight increase in surface, and to facilitate the circulation of moisture, the tube is covered, for a part of its length, with open-meshed netting. Holes are drilled through the sides, and the top is provided with a detachable wide-mouthed cup, which serves either to catch the rain or to allow water to be poured in, as may be desirable in dry weather. A substantial terminal is fitted for connection to the receiver. To prevent damage to the netting during the process of driving in the tube, the steel head is of slightly larger diameter.

Stand No. 45.—H. Quartermaine, Bath Road, Woking, Surrey.

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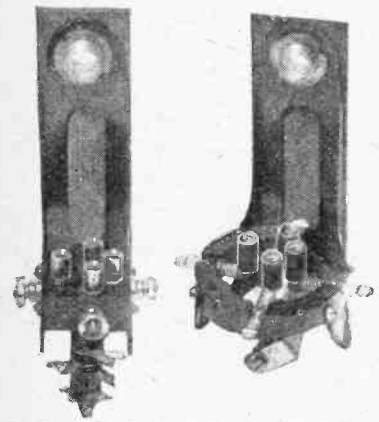
COLVEN COIL FORMERS.

Collinson's Precision Screw Co. has produced a new former with a 6-pin



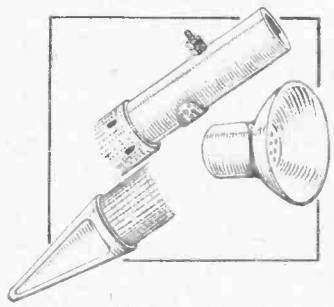
Woodhall valve brackets combined with jack and rheostat.

base and socket to fit, which is primarily designed for interchangeable super-heterodyne oscillator couplers, but should have a number of other applications, such as for H.F. couplings and "untuned aerial" transformers. It is cleanly moulded in Bakelite and has six ridges of a height sufficient to raise the windings clear of the body of the former. Slots may be cut in these ridges to carry additional windings, magnetically coupled to the main section, as may be required in certain circuit arrangements.

The winding space has a mean diameter of $2\frac{1}{4}$ inches and a length of $2\frac{3}{8}$ inches.

On the same stand there are displayed several multiple condensers designed for the simultaneous tuning of cascade H.F. amplifiers with from two to five stages. Both the fixed and moving plates of each unit are completely insulated. The latter are individually adjustable and may be given a "lead" or "lag" to compensate for imperfectly matched coils, etc.

Stand No. 51.—Collinson's Precision Screw Co., Ltd., Prevost Works, Macdonald Road, E.17.



Constructed from copper tube and covered with copper gauze to improve the earth contact. The Quartermaine earth tube is provided with holes so that the surrounding soil can be periodically watered.

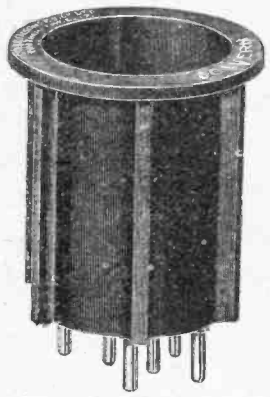
THE HART H.T. ACCUMULATOR.

These batteries are made up in 20-volt units, individual cells being in cylindrical glass containers with sealed tops and rubber plugs, fitted with glass vents. Each cell is mounted in a hole drilled in a substantial waxed teak base, with vertical end-pieces which carry the terminals. The connectors, of ample size and apparently of a lead alloy, are "burnt" to the lugs, and provide a convenient point of connection when a fine adjustment of voltage becomes necessary. The arrangement of the units allows of easy interconnection. They may be stood side by side, or placed one on top of the other, thus effecting a considerable economy in space.

Other high-tension accumulator batteries, of greater ampere-hour capacity, are also shown, together with a very

Colvern Coil Socket for baseboard mounting.

comprehensive range of cells for filament lighting, a large proportion of which are in glass containers, with the plates sup-



The Colvern moulded Bakelite former for the construction of interchangeable H.F. couplings.

ported by ribs moulded as a part of the boxes.

Stand No. 56.—Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, E.15.

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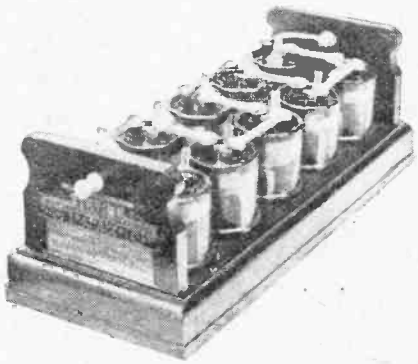
EDDYSTONE SHORT-WAVE UNIT.

This unit should help to popularise the reception of short-wave telephony, as it may be either incorporated in a special set, or used as an external addition to an ordinary broadcast receiver of suitable type. A special base is fitted with sockets for three interchangeable plug-in coils, four of which are supplied. These are of "low-loss" construction, with practically self-supporting windings and a minimum of solid dielectric. Several different arrangements are possible as tapping connections may be made on the coils. Probably one of the most effective is the conventional modification of the Reinartz circuit, with an "untuned"



20-volt Hart H.T. accumulator unit.

aerial coil, fixed secondary, and a fixed reaction condenser fed through a variable condenser.

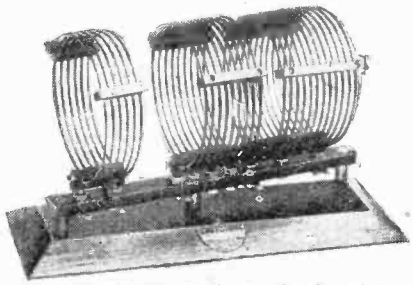
The set of coils, as supplied, is stated to cover a wavelength range of from 15 to 200 metres.

Stand No. 71.—Stratton & Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.

The Wireless Show.—

THE TANGENT H.T. ELIMINATOR.

This unit is designed to operate on an A.C. supply, and to give an output of 20 milliamperes at two voltages. The

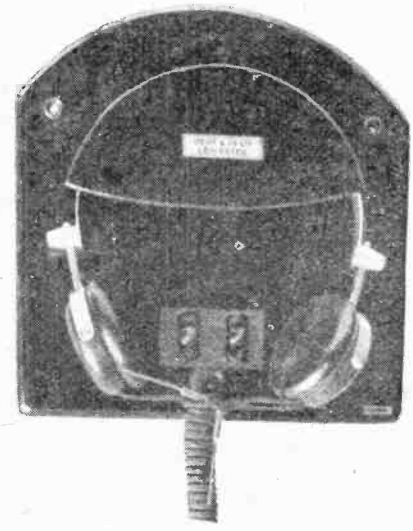


The Eddystone low-loss coils for short wave reception.

higher of these (for the L.F. amplifier) is fixed, while that for the detector and any other valves requiring a lower anode pressure may be adjusted by a variable control. Two separate H.T. voltages are, in practice, sufficient for the great majority of modern receivers. The transformer and smoothing chokes are under the panel, above which the Mullard D.U.10 rectifying valve is mounted horizontally. The whole is contained in an enamelled metal box.

THE TANGENT PHONE BRACKET.

Gent and Co. are now producing headphones with cases and caps of red Bakelite, which are exceptionally free from awkward projections and are light in weight. Twisted leads should not



A useful bracket for accommodating the telephone receivers.

give trouble, as the method of mounting allows only a partial rotation of the earpieces.

They also manufacture a supporting bracket for a pair of headphones, which, although principally used in hospital installations, would seem to have a large field of usefulness in the home of the ordinary listener. It is intended for mounting on a wall, and is constructed of polished hard wood, with terminals for connection to the phones and receiving apparatus.

Stand No. 115.—Gent & Co., Ltd., 25, Victoria Street, S.W.1.

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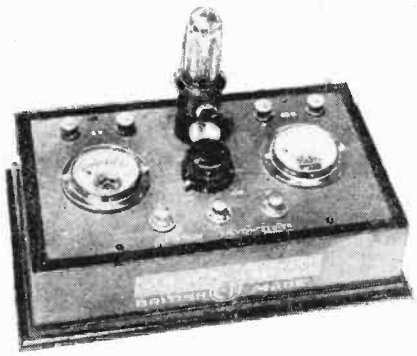
THE CLEARTRON VALVE TESTER.

The useful life of modern valves is ended more often by failure of emission than by actual burning out of the filament. The majority of listeners, without elaborate testing equipment, are hardly in a position to decide whether poor signals are to be attributed to a valve which is apparently in good order, or to other causes. Some form of measuring instrument is at times almost a necessity to settle this point

The tester manufactured by the Cleartron Radio Co. gives a visual indication as to whether the emission, with predetermined values of grid filament and



The simple valve-testing set designed by Cleartron Radio, Ltd.

anode voltages, is up to the required standard. A variable rheostat and filament voltmeter are included, so that adjustments may be made to suit any type of valve.

It seems that this instrument is mainly intended for the wireless dealer, but it will no doubt be in demand by amateur users of Cleartron valves, as its price is low.

Stand No. 135.—Cleartron Radio, Ltd., 1, Charing Cross, London, S.W.

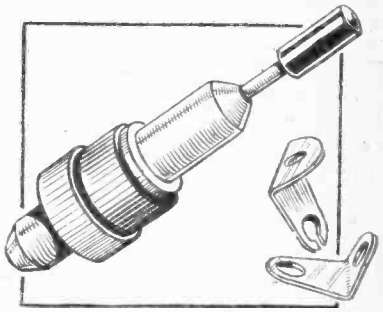
o o o o

THE BROWNIE AMPLIFIER.

Users of the Brownie crystal set who wish to add to their equipment in order to obtain sufficiently loud signals to operate a loud-speaker will be interested in the two-valve L.F. amplifier produced by the same firm. Although it is arranged for easy connection to this particular crystal set, it can be attached to any other receiver, either valve or crystal; with this object in view, there is a special arrangement whereby the connections between the H.T. and L.T. batteries may be adjusted to correspond with that adopted in the instrument to which it is added.

All the parts are enclosed in a case moulded in insulating material. The battery terminals are mounted on the back; the necessary connections may thus be fitted in an inconspicuous manner.

A new type of enclosed detector is also shown; this is equally suitable for the Brownie or other crystal sets. It is of small size, the body being constructed



Enclosed type Brownie crystal detector.

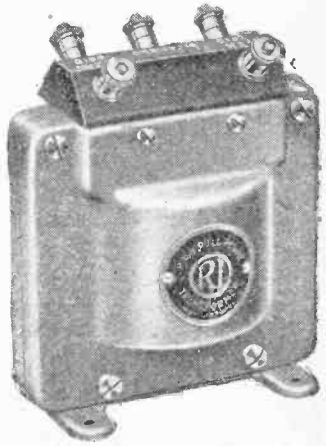
mainly of nickelled brass, with an insulated section and adjusting knob. It is claimed that it will hold its adjustment for long periods, and is easier to reset than is the catwhisker type of detector.

Stand No. 143.—Brownie Wireless Co. (of Great Britain), Ltd., 310a, 312a, Euston Road, London, N.W.1.

o o o o

R.I. PUSH-PULL TRANSFORMERS.

The fact that larger input voltages can be handled without overloading by the "push-pull" system of L.F. amplification than by the more conventional arrangement has been explained in the pages of this journal. Hitherto, these transformers have not been generally available in this country, and it is now noted with interest that Radio Instruments, Ltd., are producing a set of input and output transformers for this circuit. They are somewhat similar in appearance to their well-known multi-ratio instruments.



R.I. push-pull low frequency transformer.

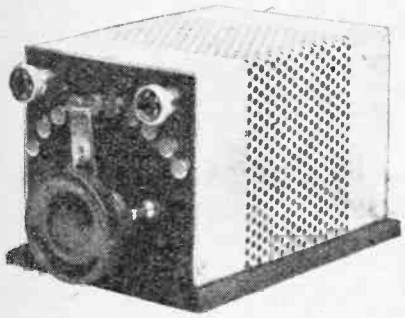
R.I. CHOKE COILS.

The present popularity of H.T. battery eliminators has, no doubt, influenced the R.I. Company in their decision to manufacture a wide range of L.F. choke coils with inductances of from 10 to 500 henries. Many of these chokes are equally suitable for use in L.F. amplifiers, and it is certainly more satisfactory for the user to

The Wireless Show.—

obtain a choke with a definitely stated inductance value.

Stands Nos. 145, 147.—Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.1.



Though only a single output H.T. potential is obtainable, critical adjustment is obtained by a multi-contact switch in the Cable D.C. battery eliminator.

THE "CABLE" H.T. UNIT.

A neat type of H.T. battery eliminator, for D.C. supply circuits, giving a single output voltage, which can, however, be closely adjusted, as there are nine tappings on the potential-dividing resistance. This is wound with double silk-covered resistance wire on a grooved boxwood former. The resistor, together with the smoothing apparatus, is contained in a perforated aluminium case. Terminals and a selector switch are fitted on an insulated panel mounted at one end. The unit measures only 5½ inches long, 3½ inches wide, and is slightly over 3 inches high.

Stand No. 151.—Cables and Electrical Supplies, Ltd., 234, Pentonville Road, London, N.1.

New Elliptical diaphragm model of Brandes Loud-speaker.

SIEMENS H.T. BATTERIES.

Most users of up-to-date receivers have discovered that the small dry cells so largely used as a source of H.T. voltage are unsuitable for supplying anode current to power valves of even moderate consumption. Although batteries of large cells are more costly in the first instance, they will generally be found cheaper in the long run. The new type of Siemens battery is composed of cells even larger than those included in their earlier heavy-duty units.

A model giving a visual indication of the economy in anode current effected by the use of a suitable grid bias voltage is also shown.

Stand No. 155.—Siemens Bros. & Co., Ltd., Caxton House, Westminster, S.W.1.

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THE BRANDES CONE LOUD-SPEAKER.

The new Brandes loud-speaker is of particularly attractive appearance, and has an elliptical paper diaphragm driven from the centre and partially concealed by a fretted wooden grille. The whole is contained in a polished hardwood case some 14in. high and 10in. wide. This firm also shows a similar model with a circular conical diaphragm contained in a sloping case.

Stand No. 157.—Brandes, Ltd., 296, Regent Street, London, W.1.

A REVIEW OF SETS.

The next issue of THE WIRELESS WORLD will contain a comprehensive survey of the Sets on show at the Exhibition, with details of novel and important features of special interest to readers.

THE B.S.A. KONE LOUD-SPEAKER.

The new model C loud-speaker is of considerably smaller size than the well-known standard model of the same type. The handsome and well-finished casing has an oxidised silver finish, and it is noted with interest that the edge of the single-cone diaphragm is "free." Unlike some of the larger instruments, it has windings of comparatively high impedance, and is consequently suitable for connection directly in the anode circuit of the output valve, and does not require a special transformer.

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B.S.A. STANDARD VALVES.

A number of the new valves, with heavy tape filaments, operating at a low temperature, are also shown. The Type P.425 is a power valve, consuming 0.25 ampere at about 4 volts, and capable of handling large input voltages with a moderate value of high-tension voltage. Its impedance is given as 5,000 to 7,000 ohms, with an amplification factor of 6.4 to 6.8.

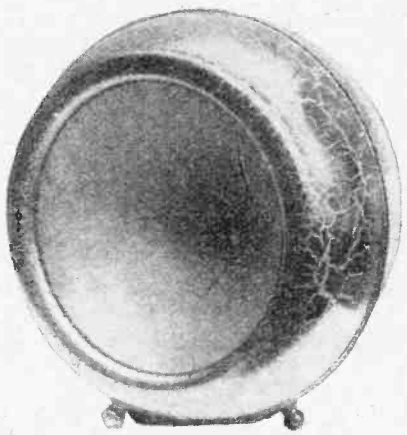
The type P.612 has similar characteristics, but consumes only 0.12 to 0.14 ampere with approximately six volts applied to its filament.

Both valves have pins of unusual construction; a slot is cut in such a way that it does not reach either end of the pin, which should retain its springiness, thus ensuring a good contact with the socket.

Stand No. 163.—B.S.A. Radio, Ltd., Small Heath, Birmingham.

LITZENDRAHT WIRE.

Samples of Litz multi-stranded wire, as used in some of the high-efficiency H.F. transformers recently described in this journal, are shown on the stand of the London Electric Wire Co.

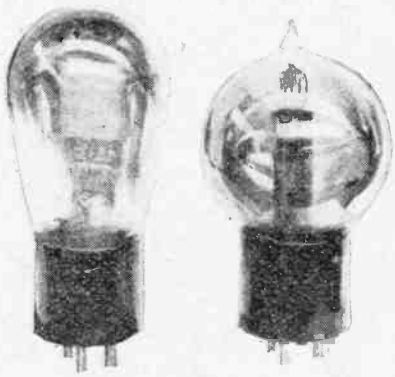


The B.S.A. Model C" loud-speaker is fitted with conical diaphragm, small in diameter, having a free edge.

Their special frame-aerial wire, made up of stranded copper with braided silk covering in a number of colours, is eminently suitable for the purpose for which it is supplied.

"Lewcoflex" is a flexible multi-stranded conductor with rubber insulation in five colours, and is particularly adapted for battery and other connections.

Stand No. 216.—The London Electric Wire Company and Smiths, Ltd., Playhouse Yard, Golden Lane, London, E.C.



B.S.A. power valves types P.425 and P.612.

THE NEON TESTER.

A source of pressure of about 180 volts is required; this voltage can be obtained from D.C. mains or an H.T. battery.

Measurements can be carried out with a sufficient degree of accuracy to satisfy the great majority of experimenters, to whom the instrument will specially appeal.

A new type of H.T. battery eliminator for A.C. mains is shown, with two special units for use with D.C. supply.

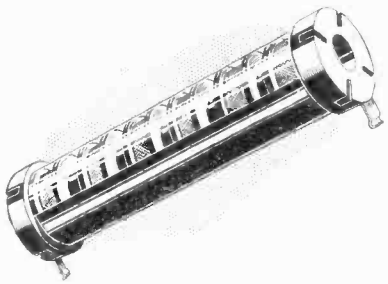
Stand No. 242.—W. J. Henderson & Co., Ltd., 351, Fulham Road, London, S.W.10.

The Wireless Show.—

VARLEY H.F. CHOKE.

Intended for use in the plate circuit of Reinartz receivers, grid tuned H.F. amplifiers, dual amplification circuits, small transmitters, etc.

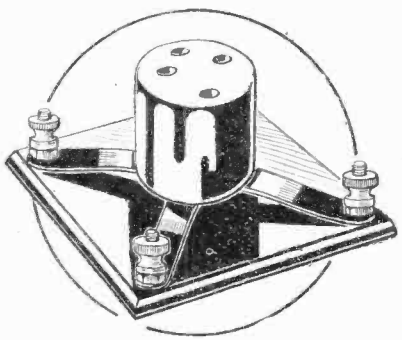
One of the first chokes to be designed so that the winding possesses a high inductance value combined with low self-



The Varley choke is built in six sections. Both turns and layers are practically air spaced.

capacity and small stray field. Consists of six series connected sections each ¼in. in width and spaced about $\frac{3}{16}$in. apart. Each section comprises eleven paper separated layers of ten turns wound with No. 38 S.S.C. The mean diameter of the sections is ⅞in., and the total number of turns 660. Cotton separation is provided between the turns, which are all carefully arranged, and the practice of indiscriminately running on the turns so often adopted in H.F. choke construction is avoided. The spool is of ebonite, turned and polished, and the winding is protected by a transparent wrapping. It can be mounted vertically by screwing down to the baseboard, or secured to the back of the panel by a 4B.A. screw, a tapped hole being provided.

Another exhibit at the same stand is the Varley anode resistance, which is wire wound and spaced turn by turn



Strips of celluloid are used in the Clackson valve holder in place of the usual metal springs.

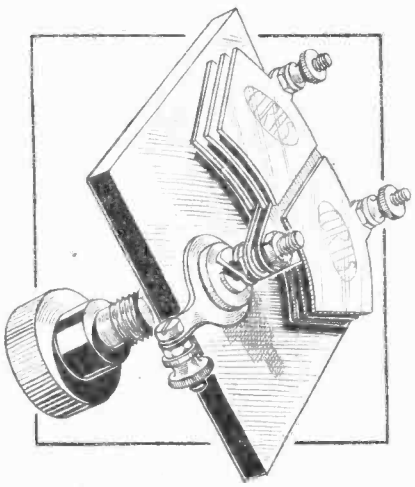
and layer by layer. It is obtainable in resistance values up to 200,000 ohms, and the winding is practically non-inductive. A new type is now available having heavier current carrying capacity.

Stand No. 36.—Oliver Pell Control, Ltd., Granville House, Arundel Street, London, W.C.2.

SPRING-SUPPORTED BASEBOARD VALVE HOLDER.

The valve holder is carried by a base, being supported from it by four flexible strips which are attached by means of the terminal connections. The valve sockets are recessed to prevent accidental contact between the filament pins and the high tension supply. Insulating parts are highly polished, giving a good appearance. It is advisable when screwing down to the baseboard to insert a thin piece of insulating material under the holder to prevent the heads of the terminal screws coming into contact with the wood.

Other exhibits on the same stand include the Triumph two-coil holder, designed for back of panel mounting, and secured with a one-hole fixing. Very little space is occupied by the component, and it is driven by a worm and pinion. The "Lowforma" is a frame intended for the construction of an air-spaced coil. The winding is carried on



Three-section Curtis stabilising condenser designed for panel mounting and provided with one hole fixing.

six threaded stems supported on three insulating rings. Coil holders, coil mounts, crystal detectors, shorting plugs and switches are also shown.

Stand No. 238.—A. H. Clackson, Ltd., 119, Fleet Street, London, E.C.4.

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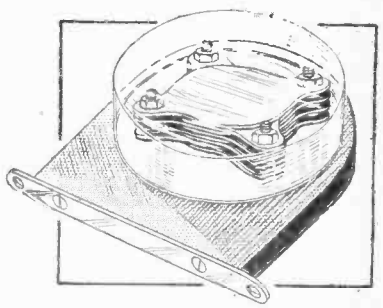
STRAIGHT LINE CAPACITY BALANCING CONDENSER.

Balancing condensers for stabilising high frequency amplifying circuits frequently consist of a pair of circular plates, the capacity being controlled by adjusting the distance between them. The capacity change, therefore, is much greater when the plates are near together than when separated, and balancing condensers constructed on the more usual revolving plate arrangement will provide much better control, as the capacity change is almost uniform for a given movement of the operating knob.

The Curtis balancing condenser consists of two fixed sections, so that when used in a neutralised circuit it is not necessary to make connection to the moving plate. A terminal is, however, provided on the moving plate which is necessary for use in certain balanced circuit systems.

The condenser is attached to the panel by one-hole fixing. Fixed and moving plates are of aluminium, terminals and other metal parts nickel-plated.



Ormond fixed capacity air dielectric condenser intended particularly for use in radio-frequency circuits.

Other components and accessories include H.F. intervalve couplings for super-heterodyne receiver construction, oscillator units, folding frame aerials for the 200-600 metre wavebands, as well as 500-2,750 metres, intervalve L.F. transformers of ratios 3 and 5 to 1, filament rheostats, 5, 15 and 30 ohms, and anti-capacity switches.

Stand No. 159.—Peter Curtis, Ltd., 11, Red Lion Square, London, W.C.1.

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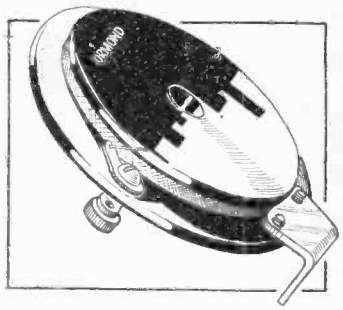
FIXED CAPACITY AIR CONDENSERS.

Condensers of small capacity having air dielectric have for some time been a speciality of the Ormond Engineering Co., Ltd. The principal application of a condenser of this type is in the tuned oscillatory circuit. It may be connected in series in the aerial lead in preference to using a small mica condenser and in closed circuits having fixed tuning. It may even with advantage be used as a grid condenser following a tuned high-frequency amplifier where there is a



Another form of radio frequency choke coil, wound with enamelled wire in a narrow slot.

danger of an excessive positive bias reaching the grid of the detector valve owing to faulty insulation, which sometimes arises in condensers having poor solid

The Wireless Show.—

dielectrics. An essential feature is the use of a cover to prevent dust accumulating between the plates. The capacity ranges are from 0.000025 to 0.0003 mfd.

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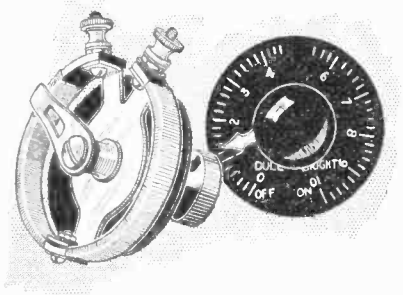
HIGH FREQUENCY CHOKE.

A narrow spool of ebonite carries a winding of enamelled wire, connection



Two-range Ormond filament rheostat, fitted with liberal and well ventilated windings.

being brought out to a pair of tags with multi-strand leads. An aluminium base bracket is provided for screwing down to the baseboard. Other metal parts are nickel plated, and the ebonite spool is polished and engraved.

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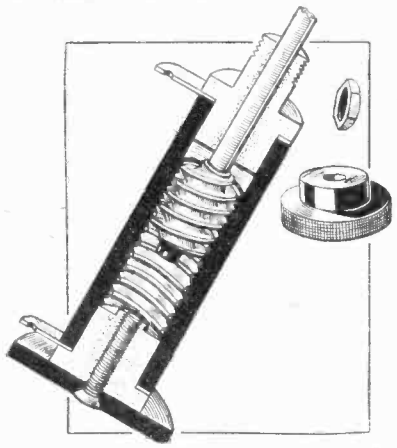
THE NEW ORMOND RHEOSTAT.

An insulating former supports the double winding and is well ventilated by being carried on an aluminium frame. The dual model has resistance values up to 5 and 30 ohms, and is fitted with a small attractive knob with grub screw fixing. A black ivorine dial is provided with clean and distinct figures filled in white.

Exceedingly good value is represented in other Ormond products, including various straight line frequency variable con-



The novel form of construction adopted in the McMichael balancing condenser. The moving element engages in one spiral of a two-start thread and a spring forming the fixed plate is fitted in the other spiral.

densers, slow motion dial, and neutrodyne condenser.

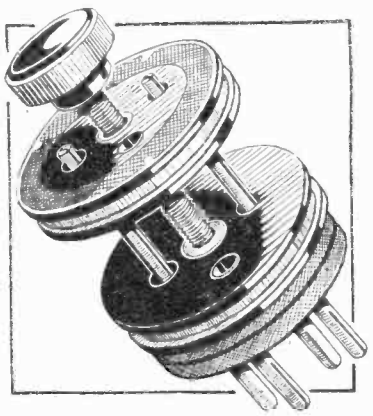
Stand No. 70.—Ormond Engineering Coy., Ltd., 199-205, Pentonville Road, London, N.W.1.

McMICHAEL BALANCING CONDENSER.

Although of the tubular construction and conveniently designed for baseboard mounting, this condenser is not of the type where one plate advances towards the other by the action of a screw, and in which the adjustment becomes more critical as the plates get near together. In this instance the moving element advances in a double thread, whilst the fixed plate is composed of a spiral spring resting in one thread only, so that the area of overlap increases as the screw advances in the thread.

The upper bush is fitted with a nut for one-hole fixing as an alternative to baseboard mounting. The spindle is marked off in divisions representing rotations of the knob, the calibration enabling the setting once obtained to be found again without difficulty.

Other McMichael components include the well-known Dimic coils, mica fixed



Interchangeable Polar tuning unit for use as aerial coil with reaction coupling.

capacity condensers, grid leaks, and condensers and H.F. intervalve transformers.

Stand No. 142.—McMichael, Ltd., Wexham Road, Slough, Bucks.

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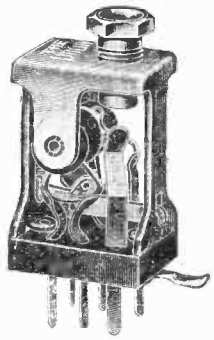
POLAR COIL UNIT.

The plug-in interchangeable tuning units represent a very simple system for tuning over a wide wavelength range. The unit is fitted with a four-pin base, the pins being arranged to fit in the standard valve holder and give support to a pair of spool wound coils arranged by means of a screwed spindle to give adjustable coupling.

For aerial circuit tuning, where one of the inductances is used as a reaction coil, one need feel no prejudice in regard to the method of winding, which results in the coil possessing a slightly higher resistance than many of the more bulky types. The losses in the coil are probably small compared with other losses in the aerial circuit, to which it is connected, and arising out of the grid current of the valve detector, while the losses are largely compensated for by the use of reaction.

The unit consists of four separate parts, a carrier base, the threaded spindle, aerial coil and reaction coil, which take apart to permit of the interchanging of the inductances. The coils are labelled to indicate the tuning range obtainable when shunted with a 0.0005 mfd variable condenser, and a table of tuning data shows that wavelengths of from about 175 to 4,720 metres can be covered.



An entirely new type of break jack, making use of the Utility switch movement.

Another interesting component, the Polar cam vernier variable condenser, gives a critical adjustment for a limited movement in either direction of the tuning dial, while further movement gives direct rotation to the moving vanes. Critical adjustment is obtainable with entire freedom from backlash.

Stand No. 149.—Radio Communication Company, Ltd., 34-35, Norfolk Street, Strand, London, W.C.2.

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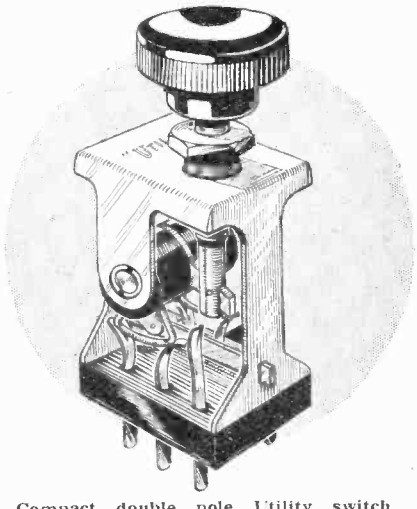
UTILITY PLUG AND JACK.

An entirely new form of jack switching is employed. The plug, which is of special design, engages in a notch on the ebonite roller carrying the contact pieces, causing it to rotate so as to operate a switch action similar to that fitted in the well-known "Utility"



Compact double pole Utility switch operated by a plunger action.

switches and equivalent to a double-pole two-position movement.

Perfect rubbing contact and low intercontact capacity are the outstanding

The Wireless Show.—

advantages of this type of jack. It is very compact, the dimensions being $1\frac{3}{4}$in. long × $1\frac{1}{8}$in. × $\frac{7}{8}$in.

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PUSH PULL SWITCH.

Here again the Utility lever switch movement has been adopted for operation

Liberty testing set for voltage determinations, insulation and continuity tests.

by a plunger. A smooth action is obtained. It can be connected to control radio as well as audio-frequency circuits. The switch is a two-pole change-over and occupies very little space on the face of the panel.

Utility products include variable condensers, geared dials, multi-contact switches, coil changing unit, valve switch unit and an automatic crystal detector.

Stand No. 74.—Wilkins and Wright, Ltd., Utility Works, Kenyon Street, Birmingham.

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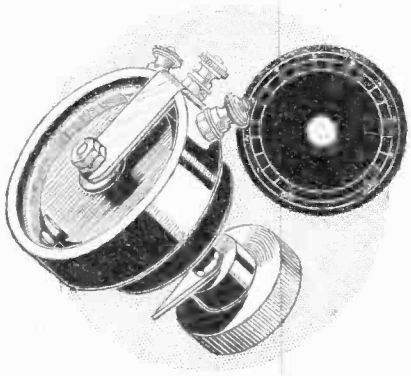

The Liberty potentiometer. The filament rheostats are of similar construction.

RADIO TESTER.

Incorporating a double reading voltmeter for determining battery voltages, this instrument provides also for insulation and continuity tests. By means of a socket connection is made to the electric light supply for providing a high potential and a neon lamp is used as an indicator.

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THE LIBERTY RHEOSTAT.

A clean moulding is employed to house the winding which is carried on the usual fibre strip. An attractive feature is the design of the rubbing contact, which consists of a spring-operated plunger, producing a particularly smooth action. A black scale clearly marked and filled in in white is supplied, and the operating knob, which has a polished recessed face, is fitted with a white ivorine pointer. The centre bush is fitted with a nut for one-hole fixing, which is particularly useful in this instance, as the body of the rheostat is so substantially constructed.

Among accessories are the Liberty heterodyne wavemeter, tuning from 250 to 3,000 metres, micrometer coil holder, and permanent detector.

Stand No. 89.—Radiac Electrical Company, Ltd., Bennett Street, Chiswick, London, W.4.

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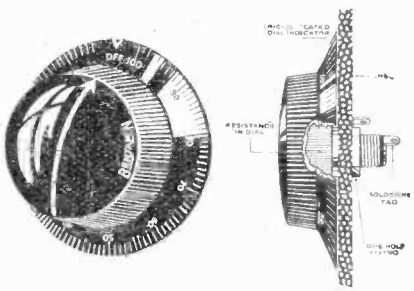
NEW BENJAMIN RHEOSTAT.

The resistance unit is contained within the dial, having the advantage that no space is occupied behind the panel. It



The new type Benjamin filament rheostat for mounting flush against the panel with the resistance winding enclosed under the operating knobs.

is attached by means of a screw bush and lock nut very similar to one-hole fixing, whilst the rim, which is marked from 0 to 100, is slightly raised above the face of the panel to give clearance to a nickel-plated indicator. The winding is of the usual form, being carried on a fibre strip, and is enclosed in the very small space under the bush, the total dial diameter being $2\frac{5}{8}$in. It is obtainable in resistance values of either 6 or 30 ohms. The mouldings are of Bakelite.

Modified Benjamin anti-microphonic valve holders are shown, in which provision is made for attaching a Dubilier grid condenser and leak resistance, or another type is equipped only with a resistance.

The Benjamin Electric Company is also exhibiting for the first time a complete range of valves. These are of high grade manufacture and of the coated filament type.

Stand No. 105.—Benjamin Electric Company, Brentwood Works, Tariff Road, Tottenham, London, N.17.

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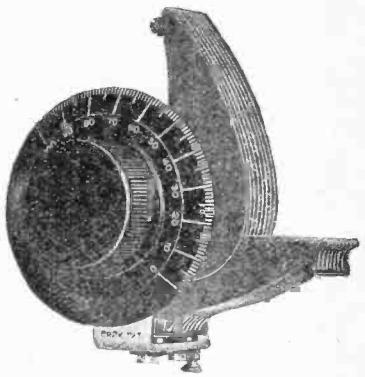
S.L.F. CONDENSER.

The centre spindle is mounted on cone bearings at one end only, having a posi-



An entirely new method is employed in the Formo straight line frequency condenser for supporting the fixed plates.

tive pigtail connector at its free end and a standard $\frac{1}{4}$in. diameter extension shaft at the other. The bearings are adjustable to permit of the centring of the moving plates, and also for obtaining the required degree of friction on the shaft. No spacing washers are used, the plates being fixed in slots under pressure, and, in addition, are braced with a tie rod at their extremities.

One hole fixing is employed for mounting and distortion of the condenser when clamping down tightly cannot occur. A well-finished 3in. dial is provided.

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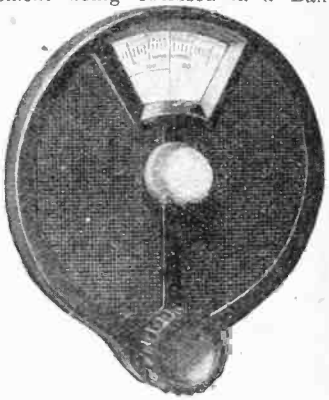
NEW FORMO DIAL.

The reduction ratio is 16 to 1, the movement being enclosed in a Bakelite



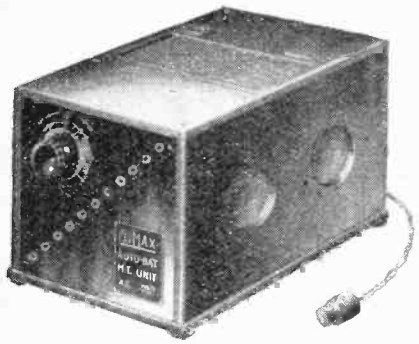
Formo geared dial. Backlash is overcome by the avoidance of toothed pinions. The scale which is marked in both directions of rotation is suitable for use with S.L. frequency or S.L. wavelength condensers.

moulding, in which a window forms a guide for the pencil when logging stations. The dial reads in both direc-

The Wireless Show.—

tions, and the two scales indicate wavelength in one direction, and frequency in the other, and, in consequence, can be used with either straight-line frequency or straight-line wavelength condensers.

The movement is smooth, noiseless and free from backlash. No extra screws or



A solution to the H.T. battery problem. Climax full rectifier for giving a range of D.C. potentials from A.C. supply.

drilling are required for attaching the dial, it being sufficient to make a small indentation with a drill point or centre punch.

Stand No. 78.—The Formo Company, Crown Works, Cricklewood Lane, London, N.W.2.

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CLIMAX AUTO-BAT TRANSFORMER.

Designed for use in the construction of an H.T. battery eliminator, operating from alternating current mains. Both plate circuits and filament heating windings are provided. The transformer is of liberal size, and insulation is particularly

Battery eliminator for use on D.C. supply mains. It consists of a smoothing circuit and potential divider.

good. The windings are arranged for giving full wave rectification and used in conjunction with Osram U.4 type valves, a liberal H.T. supply is obtainable.

Auxiliary apparatus for use in battery eliminator construction includes the Climax smoothing choke and potential divider, the latter being wire wound to a resistance of 20,000 ohms and tapped in 10 sections. It can be connected across a 250-volt supply without overheating.

Complete units are also available ready for connecting to A.C. and D.C. mains.

Stand No. 148.—Climax Radio Electric, Ltd., Quill Works, Putney, London, S.W.15.

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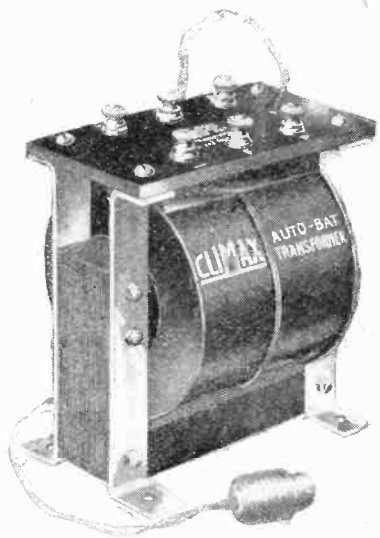
ROSE BOWL LOUD-SPEAKER.

An entirely new idea in loud-speaker design is the use of a rose bowl, in which



Climax power transformer giving two outputs for heating the filaments of the rectifiers and supplying the anode potentials required in the construction of an A.C. battery eliminator. Mid-point tappings are provided.

the loud-speaker action is incorporated in the base. The diameter of the bowl is 10in. and the depth from base to rim, 7in. The sound reproduced by the loud-speaker is deflected by a false bottom through the pierced aperture to be seen round the base of the bowl. It is supplied either with an electro-plated nickel silver finish or in oxydised silver, or in antique bronze. The bowl can be filled with water without interfering with the operation of the instrument.

Stand No. 58.—British Electrical Sales Organisation, 623, Australia House, Strand, W.C.2.

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EDISWAN HYMEG H.T. ACCUMULATOR.

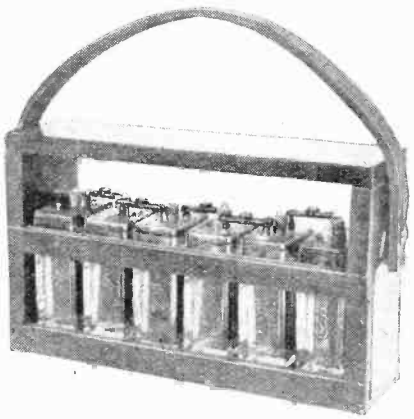
High insulation between the cells of the new Ediswan H.T. battery is ensured by means of glass cross-bars projecting from the sides of the glass boxes. The plates, which have a 2-ampere hour capacity, are supported in grooves and are specially designed so as not to deteriorate when left on open circuit for exceptionally long periods. The form of plate construction adopted is such that the use of separators to prevent shedding of paste is unnecessary. Cemented on glass tops provided with india-rubber filling cork and vent

Rose bowl loud-speaker. The sound is emitted from the perforations in the base and the bowl may be filled with water.

cover the cells and the sections are bridged across with lead bars treated with anti-sulphuric paint and provided with a hole for a wander plug. The batteries are supplied in anti-sulphuric black-enamelled hard wood crates with carrying handles, and a filler is also included with each battery.

Apart from the very competitive price at which this battery is sold, it can be relied upon to be thoroughly serviceable, its particular merit being good cell-to-cell insulation and absence of sulphuric acid about the tops of the cells.

A battery which has been in use for some three months after its first charge still shows a full 2 volts per cell, and is quite clean, with entire absence of corro-



12-volt section of the new Ediswan H.T. secondary battery.

sion. The brass connecting plugs, however, supplied with the battery rapidly become dirty in the presence of traces of acid, and some other method might be adopted for tapping out intermediate voltages, though the system of using brass wander plugs is, however, in general use in many of the batteries on the market.

Stand Nos. 3 and 134.—Edison Swan Electric Co., Ltd., 123, Queen Victoria Street, London, E.C.4.

PRACTICAL HINTS AND TIPS

A Section Mainly for the New Reader.

A SIMPLE TESTER.

A pair of phones and a dry battery are widely used when testing for continuity and insulation in the various component parts of a wireless receiver, and after a little practice this simple arrangement is very helpful as an aid to the tracing of faults. It is inconvenient, however, to connect up the necessary circuit whenever a test becomes necessary, and a unit on the lines of that shown in Fig. 1 will be found to save both time and trouble, as terminals are provided for the phones and flexible testing leads.

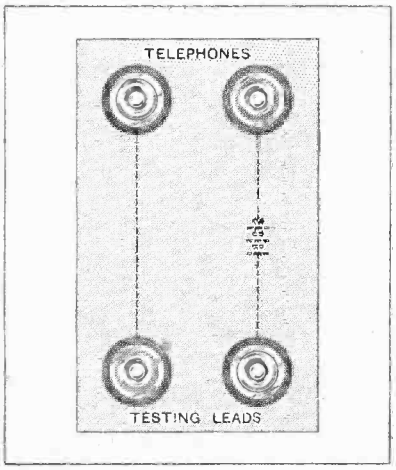


Fig. 1.—Ebonite panel for a testing unit.

A small piece of "scrap" ebonite, measuring about 5 inches long and 3 inches broad, is fitted with clips on its underside to take a 3-cell flash-lamp battery. Terminals are mounted in the positions indicated, and are wired to the battery as shown. Other and more elaborate methods of construction will suggest themselves in cases where a better-looking instrument is desired; for example, a small wooden box, with an ebonite terminal panel, may be used.

When testing small condensers it is necessary that the insulation of the associated circuits should be beyond suspicion, and it is, therefore, desirable that the ends of the testing leads should be fitted with metal electrodes having insulated handles, to avoid leakage through the body of the user. Wander plugs with an Erinoid or ebonite sleeve will serve this purpose.

A few hints as to the correct procedure to be adopted in testing fixed condensers may be given. On completing the circuit through the condenser, quite a noticeable click will be observed (of a loudness depending on the capacity), while practically no click should be produced when the circuit is broken, provided that the insulation is adequate. If no click is observed as the circuit is "made," it may safely be assumed that the condenser plates are disconnected internally.

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BIASSING A DETECTOR VALVE.

Some form of control over the steady working voltage of a detector valve operating on the "leaky grid condenser" principle is distinctly desirable, from the point of view both of good detection and critical adjustment of reaction. This, as has already been suggested, is most easily carried out by connecting the lower end of the grid leak to the slider of a potentiometer, the windings of which are joined across the filament. This arrangement, which is shown in Fig. 2 (a), obviates the use of any special switch as the circuit from the L.T. battery through the winding is automatically broken when the rheostat is at the "off" position.

This system of connection permits of the application to the grid of the full voltage of the L.T. battery, *less* the drop of voltage in the rheostat; this will, as a rule, give a sufficiently positive grid under ordinary conditions. A possible exception may occur when using certain two-volt dull-emitter valves, in which the grid currents necessary for this method of rectification start late (i.e., not until the grid is appreciably positive with respect to the negative end of the filament). Under these conditions it may be necessary to wire the potentiometer directly across the L.T. battery, as shown in Fig. 2, and to insert a switch preferably in the positive lead,

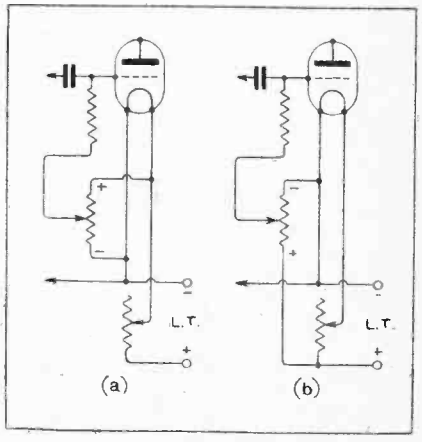

Fig. 2.—Alternative potentiometer connections.

to prevent waste of current when the set is not being used.

A certain amount of care should be used in making the preliminary adjustments, as it is easy to be misled by the fact that a decrease of positive voltage may give louder signals, due to decreased damping, and a consequent increase of incidental reaction, although the valve may actually be

carrying out its functions as detector less efficiently. It is desirable first to adjust the slider with all possible sources of reaction eliminated, and then to make a compromise between this setting and the one found to permit of the smoothest control of regeneration. No subsequent adjustment will be necessary provided that the operating conditions of the valve remain unchanged.

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READING BATTERY VOLTAGES.

It should be realised that the voltage indicated by a meter connected to its terminals is almost valueless as an indication of the condition of a battery—particularly of an accumulator. This reading, if it is to supply any really useful information, should be taken when the normal working current is being drawn from the cells.

The above statement, however, requires some modification when dry-cell H.T. batteries are in question. Most moving iron meters of the cheaper pattern pass a current considerably in excess of that taken by the valves; in this case the indicated voltage will probably be somewhat less than that actually existing under working conditions, even though the battery is doing no useful work when the meter is connected. On the other hand, when a high-resistance moving coil instrument is used, readings may err on the high side, and it should accordingly be used when the cells are delivering current to the receiver—preferably after they have been doing so for some little time.

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HIGH-AMPLIFICATION VALVES.

The fact that valves with an exceptionally high amplification factor and a reasonably low impedance are now becoming available is likely to have a considerable effect on the design of both high- and low-frequency amplifiers.

There are certain difficulties, however, in designing efficient couplings for such valves, and it would be incorrect to assume that the full benefit of this high valve amplification can be obtained without special precautions, particularly on the high-frequency side. The beginner, at any rate, will be wise to be guided by articles on this subject which have already appeared in *The Wireless World*.[1] He will not go far wrong in using them as "bottom bend" rectifiers with a high anode resistance, but before adopting them for even the first stage of an L.F. amplifier, he should assure himself that the valve is capable of handling voltage swings of the amplitude to be expected in this position.

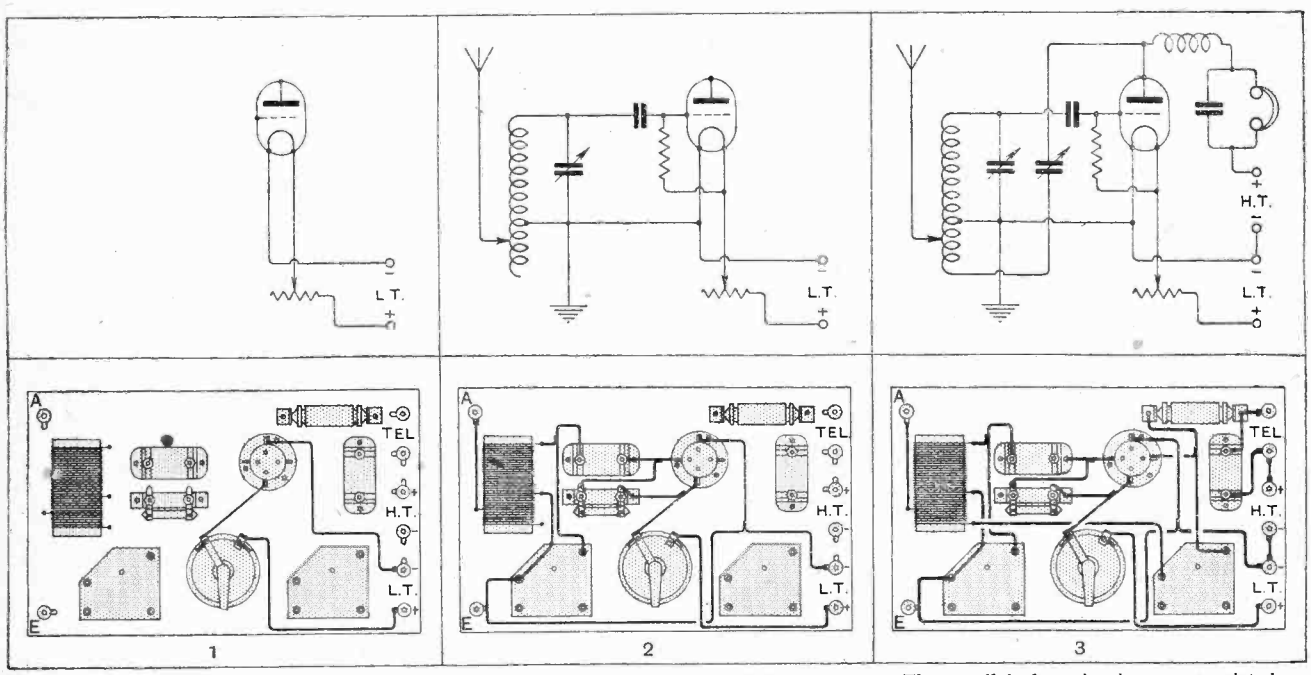
[1] *The Wireless World*, Aug. 11, 1926, p. 177; Aug. 25, p. 253.

DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 43.—A Single-coil Reinartz Receiver.

In this series of diagrams it is hoped to make clear the steps to be taken in converting theory into practice in the construction of various typical receivers. The simplified type of Reinartz receiver shown below has been popular with readers, and has the advantage that it works well on the short waves as well as on the normal broadcast wave band.

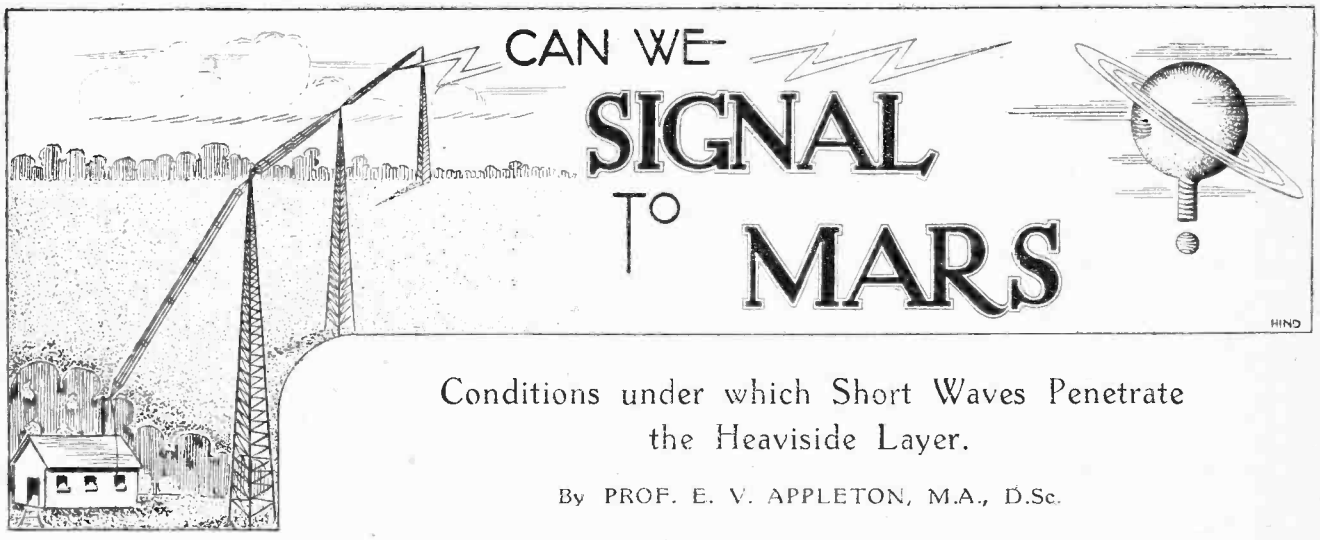


The low-tension battery circuit is completed in the normal manner through a controlling rheostat, which is inserted in the positive lead as usual.

The tuned circuit is connected between the grid and filament, a leaky grid condenser being inserted to give rectification. Aerial and earth terminals are connected.

The parallel plate circuits are completed, one through the phones and H.T. battery, and the other through the reaction condenser and the lower section of the coil.

A 40



Conditions under which Short Waves Penetrate the Heaviside Layer.

By PROF. E. V. APPLETON, M.A., D.Sc.

WHEN it was shown by Marconi that wireless messages could be sent over large distances without the use of intervening conductors, it was natural that many people should ask whether wireless could not be used for signalling to other planets. It seemed, at that time, that it was only a question of increasing the power of the transmitter to get greater and greater ranges. Of course, everyone familiar with the technical details of wireless telegraphy realised that there were two aspects of the question. There was one problem of transmission which would concern us on the earth, but there was also the problem of reception at the other end. The problem of reception was evidently two-fold. If Mars were inhabited, had the science of wireless telegraphy developed there to the same extent as on this planet? Also, would the Martians know what wavelengths we used? The fact that some American scientists considered that the Martians had developed sufficient intelligence to develop a wonderful system of waterways in the form of canals made it, at least, an interesting speculation that a Martian Marconi had been born, and imagination was allowed to do the rest.

Reflection from the Heaviside Layer.

But with increased knowledge of the conditions of long-distance reception there came a certain amount of scepticism with regard to the problem of Earth-to-Mars communication. It was gradually realised that to account for the success of terrestrial transmission it was necessary to assume that the upper atmosphere was a conductor which sent back to the ground wireless waves which reached it, and all recent work has tended to increase our confidence in the Heaviside layer theory. Many people, therefore, felt that the problem of communicating with Mars was settled if there was a Heaviside layer, for, they said, this layer would send back all waves and act as a complete shield so far as the earth is concerned. There was certainly much to be said for this conclusion, for, so far as long wavelengths are concerned, the conductivity of the ionised layer appears to be very much the same as that of the earth, which we know is a good reflector of the longer wavelengths. To the wireless evidence there was added evidence of a totally different kind from another branch of physics. Students of terrestrial magnetism (Sir Arthur Schuster and Professor S. Chapman in particular) showed, from their study of variations in the earth's magnetism, that the upper atmosphere must have a very large electrical conductivity. In fact, their results indicated that the conductivity of the upper atmosphere was equivalent to that of a sheet of copper one metre thick. Such conductivity obviously meant that at any rate long waves would not penetrate the layer—and that the problem of inter-planetary communication by wireless was more difficult than had at first been realised. It seemed that Nature by giving us efficient terrestrial communication had, at the same time and by the same means, prevented us from ever communicating with the neighbouring planets.

But with the recent progress in the development of short-wave transmission, I think that the problem should be discussed afresh. I do not want this to be interpreted as meaning that I consider it to be a profitable experiment to try to send short-wave signals to Mars, because, personally, I should be very sceptical about the reception part of the experiment. But I do want to point out that in view of recent progress in wireless theory we cannot regard the Heaviside layer as a complete shield for all wavelengths.

Penetrative Powers of Short Waves.

To understand how the possibility of inter-planetary communication has, once again, become a subject of serious discussion from the transmission standpoint, we must consider some of the remarkable properties of short waves which have been discovered by wireless amateurs within the last few years. In particular we must consider the significance of the "skipped distance" which occurs with short waves in transmissions of, say, 30 metres. It is now a familiar fact that, in the case of a 30-metre transmitter, signals die off in intensity very rapidly as the distance of the receiver is increased, so that with increasing distance up to about 500 miles the signal intensity becomes negligible. At a distance of about 500 miles, however, the signals become suddenly stronger, and are detectable up to 1,500 miles, beyond which reception becomes uncertain. The

Can We Signal to Mars?—

explanation of this skipped distance has been given by Mr. Barnett and the writer,[1] and also by Taylor and Hulbert,[2] in terms of the ionised layer theory, and it has been shown that the experimental results indicate that there is a definite limited concentration of electricity in the upper atmosphere which makes only a limited amount of bending of short waves possible. The results of these theoretical investigations can be best explained by means of Fig. 1. In this

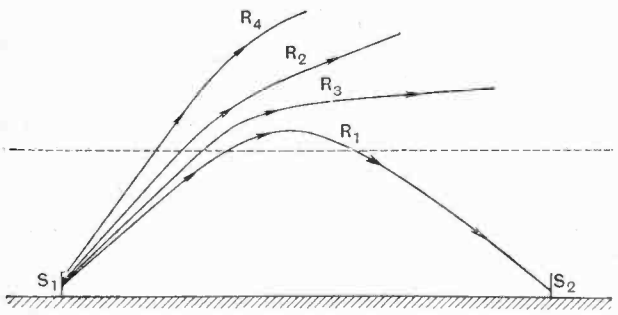


Fig. 1.—Diagram showing the critical angle of reflection of short waves by the Heaviside layer.

diagram a station S_1 is sending to a station S_2, which is situated at the skipped distance. If S_2 were a little nearer to S_1 than is indicated by its present position, it would receive no signal at all. Now let us consider the rays R_1, R_2, etc., sent out by the station S_1. If the atmosphere only contains a limited amount of electricity per cubic centimetre (a million electrons per c.c. is the estimate) the rays can only be bent a certain amount, and the ray R_1 must therefore be regarded as critical in that rays such as R_2, R_3, and R_4, which meet the ionised layer more nearly perpendicularly, are not brought horizontal, and thus escape from the atmosphere. Now it can also be shown that the lower the wavelength the smaller the amount it can be bent back by the ionised layer. It is for this reason that the skipped distance increases as the wavelength is reduced. Theory, therefore, very definitely suggests that if wavelengths are decreased still further the atmosphere will be unable to deflect them back even the small amount necessary for long-distance transmission. *In this case all the rays sent from the transmitter will leave the earth and escape from the Heaviside layer.* Such wavelengths would therefore be specially suitable for transmissions to other planets.

Calculations have been made to find the order of magnitude of the wavelengths of waves which would penetrate the Heaviside layer. Such calculations are obviously very approximate in view of our uncertainty of the conditions in the upper atmosphere, but my estimate suggests that somewhere between 1 and 10 metres we should find that long-distance transmission becomes impossible because all the waves leave the earth. If this calculation is correct we require an immense one-metre wavelength transmitter to send to Mars.

[1] Appleton and Barnett, *Proc. Roy. Soc. A.*, Vol 109. 1925; Appleton, *Proc. Camb. Phil. Soc.*, 1926.
[2] Taylor and Hulbert, *Phys. Rev.*, Feb., 1926.

S.S. "Lord Antrim."

(At sea, between Dublin and Montreal.)
Great Britain :—G 2KZ, 2IT, 2NM, 2SZ, 2XY, 5JW, 6KO, 6NF, 6YD, 5NJ, 6YW. France :—F 8CS, 8HU, 8TBY, 8CT. Switzerland :—H 9XD. Italy :— I 1AY. Various : — 2CNP, YS 7XX, B 4ZZ, N OWC.

E. Megaw
(GX 6MU).

Friern Barnet.

(Aug. 24th.)
United States :—U 1AAQ, 1AWE, 1AKZ, 1BHS, 1BJK, 1BEZ. 1DU, 1KMS, 1SE, 2ARM, 2AGO, 2BUR, 2??V, 3AFQ, 3AZ, 3BQZ, 3CD, 3MV, 3NR. 3ZO. 4CVI, 4KJ, 4JK, 4OY, 5AMD, 8CUG, 8JBR, 8CXI, 8CUQ, 8PL, 9BPD.

J. Clarricoats
(G 6CL).

English Channel.

(July 17th and 18th, 1926.)
British :—5JW, 5DA. 5WQ, 5HS, 6OG, 6BD. Others : — SMUS. D 7MT, N OPM, T PAV, B K12, K 4XY.

Hamburg.

(July 21st-24th, 1926.)
British :—2LZ. 2VS, 2IT ('phone), 2OG, 2QB, 2SO, 2VJ, 2MS. 2UD, 2JJ, 2NT, 5WV. 5HS, 5WQ, 5JW, 5DA, 5MS, 5SW, 5TD, 5UW ('phone), 5XY, 5QZ, 5FQ, 5TZ, 5LB, 6IW, 6FA, 6YV, 6KO, 6BD, 6OG, 6QB, 6IZ, 6LB, 6YQ, 6YD, 6OX, 6RY, 6RL, 6TY, 6OU, 6VP, 6RD, 6JO, 6CJ, 6QH, 6YC, 6KA, 6NX, GI 6YW, 6UT, 6VO, GW 19B, 6OO.

Calls Heard.

Extracts from Readers' Logs.

Others :—LA 1X, SMTO, 7ZG, W7, LA 1E, CIT, H6, 2AB, D2, KV8, SPM, B7, WRT, SGT, I 1DA, O FA, AC8, OWC, U 1CCZ, K 4YA, SMUS. SMUV, T PAX, OUC, GFR, O8, B 2SSK, OBL, OTH, A4, OPM, BVJ, OPX, WIZ, 7MT, YST, SGR, 7ZM, OXX, K5,
(0-v-0). Seafarer.

Moseley, Birmingham.

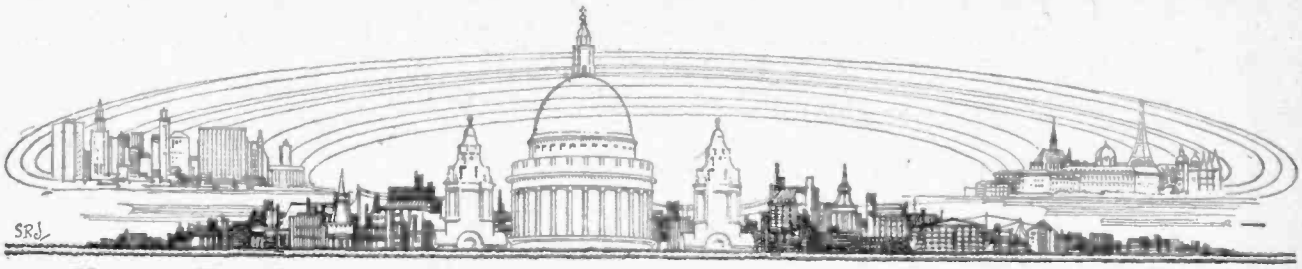
Arabia :—TJ CRJ. Argentine :—R CB8, DB2, DX8, FA3, GA2, HA2. Australia :—A2BK, 2CM, 2LK, 2LM, 3BD, 3EN, 3XO, 5KN, 7CW, 7HL. Brazil :—BZ 1AC, 1AD, 1AF, 1AI, 1AK, 1AL, 1AN, 1AO, 1AQ. 1AR, 1AT, 1AV, 1AW, 1AX, 1BD, 1BG, 1BH, 1BI, 1IB, 1QA, 2AA, 2AB, 2AF, 2AJ, 5AB, 9QA, SQ1X, SQ2, SNI, PT5. Canada :—C 3FC, 8AR. Chile :—CH 2LD. Egypt :—NOT (at Alexandria). French Indo China :—FI 8QQ. Hong Kong :—BXY. Malta :—BYY. Mexico :—M 1J, 1N, 5C. 9A, 1AA, JH. New Zealand :—Z 1AO, 1AX, 2AC, 2AE, 2GC, 2XA, 3AI, 3AK, 4AA, 4AC, 4AK, 4AM, 4AV. Palestine : — PE 6ZK. Panama :—CZ FR5. Phillipine Islands :—PI 1DR, 3AA. Poland :—T PAI, PAU, PAV, PAW, PAX. Porto Rico :—PR 4JA, 4UR. Russia :—R 1FL, 2ND. South Africa :—O A3B, A4Z, A6N. Tripoli :—DA 1CW. Uruguay :—Y 1CD, 1CG, 2AK, JCP. U.S.A. :—U 3ADE, 3AFA, 3ANY, 3AWA, 3AY, 3BGS, 3BVA. 3BWT, 3CDN, 3CDV, 3CJN, 3MV. 3NR, 3PK, 3UT, 3UV, 3ZO, 4BY, 4CJ, 4DD, 4HA, 4HX, 4IZ, 4JK, 4JN, 4JR, 4JS, 4KJ, 4LK, 4OC, 4RM. 4WF. 5ADZ, 5ASW, 5FZ, 5KC. 5WI. 6NI. 8AHC, 8AZT, 8BGI, 8BN, 8BRC, 8BRD, 8BUY, 8BYN, 8CGV, 8CVO, 8CW. 8DAQ, 8DJG, 8DME, 8DMM. 8DRL, 8EQ, 8EX, 8FL, 8KF, 8PL, 8QB. 8RT, 8SV, 8ZN, 9BPB, 9CTR, 9CYE, 9DRS, 9LN, 9MN. Various :—AND, CYY, GEFT, KEGK, KGBB, MMC, NIDK, NTT, RDMW, VOQ.
(0-v-1, Reinartz) On 30-50 metres.

K. B. Davis.

Hammersmith.

(August 1st to 22nd.)
Argentine :—R GA2, DB2, DH5. Brazil :—BZ 1AG. 1BI, 1AR, 5AB, 5AA, 6QA. SNI, 2AB, 2AF. Australia :—A 5KN, 3BQ. Tasmania :—A 7CW. South Africa :—O A6L, A5X. Porto Rico :—PR 4UR, 4JA. U.S.A. :—U 1YZB, 3CDV, 4QK, 4RS, 6CW, 8EBF. WGY, WNP, NAJ.
(0-v-2) On 30 to 48 metres.

H. A. Whatley.



CURRENT TOPICS

News of the Week in Brief Review.

CENTENARY OF WIRELESS PIONEER.

Italy will next year celebrate the centenary of the death of Alessandro Volta. At an international exhibition to be held at Como, Volta's birthplace, between May and October, 1927, it is expected that wireless will be generously represented.

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SENATORE MARCONI INSTALLS HOSPITAL SET.

A three-valve set has been installed in the Dartmouth Cottage Hospital under the personal supervision of Senatore Marconi, whose yacht "Elettra" is lying in Dartmouth Harbour.

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PROGRESS IN CZECHO-SLOVAKIA.

Czecho-Slovakia has just held its Fourth Radio Fair at Prague. At the end of June 108,844 wireless receiving licences had been issued in Czecho-Slovakia, including 74,008 at Prague, 23,522 at Brno, 5,218 at Pardubice, and 3,017 at Bratislava.

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COMMUNAL BROADCASTING.

The new eleven-storey building of the National Press Club Building in Washington, D.C., will probably be equipped with a central wireless receiver with connections to each room. Plans are also prepared for a special studio on the ground floor from which entertainments will be distributed throughout the building.

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REGULAR RECEPTION ON AUSTRIAN TRAINS.

Travellers on the Austrian Railway Company's express trains to and from Vienna can now avail themselves of broadcast programmes from the principal European stations. The scheme was put into operation on September 1st.

Listeners are charged a fee of 1 Austrian shilling per hour.

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A FORTUNE FOR WIRELESS RESEARCH.

News that he had inherited a fortune of 24,000,000 francs came to Roger Matter, a French wireless operator, while he sat at his instruments last week. Matter, who is twenty years of age, is employed in the wireless branch of the Naval Air Department at Rochefort. He has still a year to serve, and declares that, at the end of the period, he will devote himself and his fortune to wireless research.

NEW CANADIAN BROADCASTING STATION.

Plans are being made for the installation of a broadcasting station at Halifax, Nova Scotia, local associations having agreed to subscribe towards the cost.

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PRIZES AT MANCHESTER EXHIBITION.

A sum of £500 is offered in cash prizes for the best amateur-built crystal and valve sets displayed at the Manchester *Evening Chronicle* Wireless Exhibition, to be held from October 26th to November 6th.

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MORE LICENCES IN AUSTRALIA.

The number of broadcasting receiving licences held in Australia at the end of June was 125,047. Victoria held 63,494; New South Wales, 36,292; Queensland, 8,100; South Australia, 12,105; Western Australia, 3,836; Tasmania, 1,170. The percentage of people in Australia holding licences is 2.1.

WHERE ARE THEY?

In view of the reports that American amateurs rely on non-radiating sets, it is interesting to hear the result of a $500 competition (organised by *Radio Broadcast*, New York) for a non-radiating short-wave receiver. Of all the sets submitted for the judge's approval not one was found which failed to radiate. A consolation prize of $100 was awarded to Frank C. Jones (6 ACF), of Berkeley, California.

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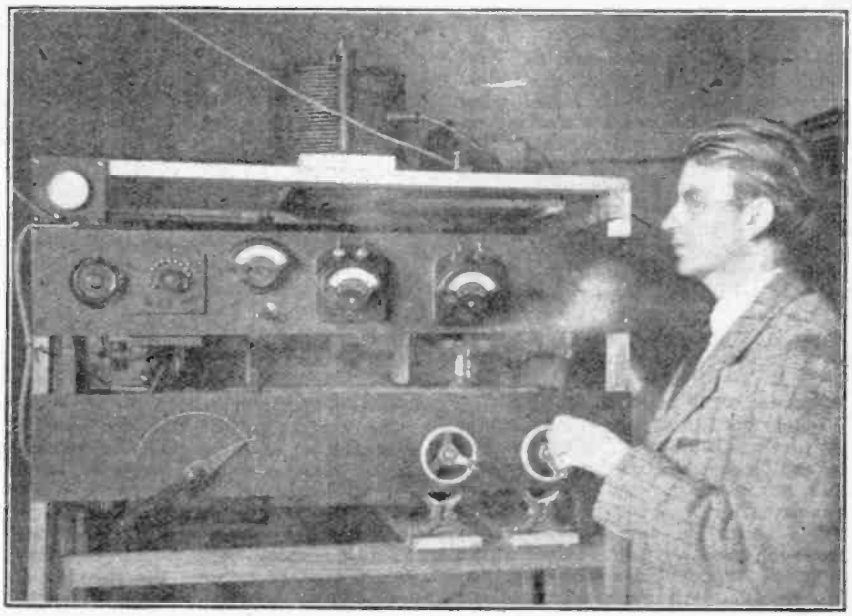
LONELY LIGHTHOUSES.

As a means of breaking down the isolation of some of the more distant lighthouses, the Australian Commonwealth Lighthouse Service proposes to carry out experiments in conjunction with Amalgamated Wireless (Australasia), Ltd., with the object of forming wireless telephony links with the mainland. Owing to the high cost of land and submarine cables, many lighthouses are at present



THE BAIRD TELEVISOR. Our photograph shows Mr. John Baird with the 500-watt television transmitter installed in London. A loose-coupled aerial circuit is employed with the choke system of modulation. The varying currents from the television apparatus modulate the transmitter in the same way as in telephony and broadcasting. The station is designed to work on a wavelength of 200 metres, and uses the call sign 2 TV.

without any means of communication with civilisation.

A land station will be established at Wilson's Promontory to carry out tests with the lighthouses at Cliffy Island and Deal Island, in Bass Strait.

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RADIO AND THE AMERICAN WOMAN.

"Radio has 'revolutionised' the women of America," state the organisers of the Radio World's Fair, New York, which is being held in New Madison Square Garden from September 13th to 18th. The statement is based on the competition essays on "What Radio is Doing for Women," hundreds of which have been received from all over the United States. The following extracts from selected essays are illuminating:—

"Radio, thy better name is Opportunity!"

"Radio is that indescribable touch that makes a home—a home."

"The radio is a blessing in hygienic matters. How many fat women have been able to thank the wonderful exercises broadcasted!"

"Some of us have practically lived with and by radio for the last few years."

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SHORT-WAVE BROADCASTING IN INDIA.

Enthusiasm has been created among wireless amateurs in India by experiments conducted by the Royal Air Force at Simla in broadcasting music from the band of the Royal Scots Fusiliers. The transmissions are carried out on 100 metres, and on the occasion of the first attempt, made on August 14th, the music was heard in Bombay and Indore, a distance of more than 750 miles.

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AMATEUR RADIO FOR AMERICAN RAILWAY.

The Chicago, Milwaukee and St. Paul Railway is about to install a wireless organisation throughout its 11,000 miles of line. Short-wave stations working on 20, 40 and 80 metres, will be installed at various points on the routes for the purpose of providing reliable communication during storms and floods.

It is interesting to note that the accepted design for transmitters and receivers was evolved by Lieut.-Commander F. H. Schnell, the famous American amateur, and that the railway authorities will include many amateur stations in their chain of communication.

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WIRELESS FOR LONELY SETTLERS.

Wireless apparatus is part of the equipment of a small group of British settlers who are leaving the country early this month to open up vast and hitherto unpopulated tracts of country in Bolivia, South America, in accordance with an agreement recently made between the Bolivian Government and Bolivian Concessions, Ltd. It is the intention of the Syndicate to settle 4,000 or 5,000 European families in Bolivia during the next two or three years.

Meanwhile the first little company of settlers numbers about a dozen. They are to take with them the Marconi 500-watt telephone and telegraph transmitter that is to provide the important link between their new country and the outside world. Instead of packing it away in a hold, however, they are with characteristic enterprise fitting it up to work on the vessel in which they are to sail, the 600-ton steamship "President Seevedra." So compact is the apparatus, however, that within a few hours of reaching Gaiba, the colonists' destination and future headquarters in Bolivia, it should be in operation as a land station. This station will be used for communication with the town of Corumba, at present the nearest railway head, about 100 miles distant from Gaiba.

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U.S. WIRELESS STATION FOR CHINA.

Peking will shortly possess a 50-kilowatt station for communication across the Pacific. The new station, which will have six towers each 1,000ft. high, is being erected by the Federal Telegraph Co. of Delaware, controlled by the Radio Corporation of America.

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CONTROLLING THE WORLD'S CLOCKS.

In an address before the French Academy of Sciences in Paris on August 31st, M. Bigourdan explained a method by which wireless telegraphy could be utilised to regulate all the observatory clocks of the world to the thousandth part of a second. It would thus be possible to verify the regularity of the rotation of the earth and the diurnal movement which in every part of the world determines the hour.

NEWS FROM THE CLUBS.

Exhibition at Southport.

Preparations are being made for holding a Southport Wireless Exhibition, to be organised by the Southport Wireless Society. The exhibition will be held in the Temperance Institute, London Street, on Thursday, Friday and Saturday, October 28th, 29th and 30th.

Hon. Secretary: Mr. T. G. Storry, 67, Virginia Street, Southport.

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A Field Day in Essex.

The Essex group of affiliated societies took part in an interesting transmission test on August 15th. Thirty-two members were present, the majority representing the Ilford and Southend societies, and the venue was Childerditch Common, which is situated on high ground midway between the two towns. Transmission was carried out with the portable station 2OU operating on a wavelength of 150 metres. The aerials—single wire for both transmission and reception—were approximately 20ft. high and quite unscreened.

Using an ordinary galvanised earth pin, 2OU was reported at R2 to R3 by 2KT of Wanstead, but radiation was considerably increased when a single-wire counterpoise was later substituted by Mr. Vizard. Two-way communication was effected with 2LZ (Mr. Mayer, of Wickford) at a distance of about 6 miles, and with 2KT (Mr. Nickless, of Wanstead) 20 miles distant. Among the stations heard but not worked were 5DT and 2PX.

The call signs of the Ilford Society are 2OT and 2OU (portable). Hon. Secretary: Mr. D. S. Richards, 50, Empress Avenue, Ilford.

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TRADE NOTES.

Quartz Oscillators.

Readers who wish to obtain quartz will be interested in the list issued by Mr. A. Hinderlich, 1, Lechmere Road, N.W.2, who is now grinding quartz on a large scale and can supply it at any stage of workmanship. For experimenters who are prepared to carry out their own grinding an outfit can be purchased with full instructions.

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The Brown Budget.

The current number of this bright little publication, which is issued by Messrs. S. G. Brown, Ltd., N. Acton, contains details of the new Brown disc loud-speaker, an account of a trial yacht trip with the Brown gyro compass, and a thoughtful article in loud-speaker demonstrations.

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Catalogues Received.

Igranic Electric Co. (149, Queen Victoria Street, E.C.). Publication 6224 dealing with the Igranic supersonic heterodyne receiver outfit.

Sifam Electrical Instrument Co. (95, Queen Victoria Street, E.C.4.). Pamphlets relating to Sifam radio measuring instruments, with hints on better reception.

Ashley Wireless Telephone Co. (1925), Ltd. (Finch Place, Falkland Street, London Road, Liverpool). Booklet No. 71, containing descriptions and price lists of Claritone loud-speakers and headphones.

Oxford Wireless Telephony Co., Ltd. (22 and 29, Queen Street, Oxford). Catalogue of the Oxford wireless apparatus.

Certax, Ltd. (51, Lamb's Conduit Street, London, W.C.1.). Folder dealing with Certax radio accumulators.

Tungstone Accumulator Co., Ltd. (3, St. Bride's House, Salisbury Square, Fleet Street, E.C.4.). 64-page illustrated catalogue of Tungstone accumulators, spare parts, crates, etc., etc.

Houghton-Butcher (Great Britain), Ltd. (High Holborn, London, W.C.1.). Supplement (August, 1926) to Houghton's Radio News, giving revised prices of standard valves, loud-speakers, etc., etc.

Jaybesea Agencies, Ltd. (125, High Holborn, London, W.C.1.). Pamphlet describing the "Hedgeland" pictorial (invisible) loud-speaker.

Ferranti, Ltd. (Hollinwood, Lancashire). Pamphlet Wa401, relating to the Ferranti intervalve transformer, type AF3.

PIONEERS of WIRELESS

BY ELLISON HAWKS F.R.A.S

28.—Edouard Branly Invents the Coherer.

THE discoveries of Hertz soon became the subject of experiment in many laboratories in different parts of the world, and before long there were several workers eagerly endeavouring to turn the Hertzian waves to practical use in wireless communication. It was evident, however, that before wireless telegraphy could become possible, some more delicate apparatus than the somewhat crude resonator spark gap was necessary for the detection of the waves in space. Such an apparatus was speedily forthcoming, and in its final form was given to the world by Professor Branly of France.

Edouard Branly was born at Amiens on October 22nd, 1844, and was educated at the Lycée de St. Quentin, and later at the Lycée Normale Supérieure, Paris. In 1873 he took his degree of Doctor of Science and became Professor of Physics at the Catholic University, Paris, a position that he holds to-day. In spite of his arduous lecturing duties, Professor Branly has never ceased to devote himself with the greatest enthusiasm to scientific research, and even to-day, at over 80 years of age, he is to be found at work in his beloved laboratory in Paris. "I am not yet too old to work," he said in a recent interview, "and very soon I hope to finish my present research. In the meantime, I cannot say anything about it."

Professor Edouard Branly.

Early Discoveries of the Coherer Effect.

To trace the sequence of events that led Branly to his ultimate discovery, it must be mentioned that in 1850 Guitard had noticed that when dusty air was electrified from a point, the dust particles tended to cohere into strings or flakes.

This long-forgotten observation seems to have been rediscovered in 1866, by S. A. Varley. He made the first practical application of this principle of cohesion by embodying it in the construction of his lightning protector for telegraphic apparatus. In a paper read before the British Association (Liverpool, 1870) he tells how he had observed the very great resistance afforded to electric currents of moderate tension by a loose mass of dust. "With a tension of, say, fifty Daniel cells, no appreciable quantity [of current] will pass across the dust of blacklead or fine charcoal powder loosely arranged, even when the battery poles are approached very near to one another." He found that metallic dust interposed between two conductors decreased in resistance as the electrical pressure increased.

The principle was again noticed in 1884, being dealt with in the little-known researches of an Italian professor, Calzecchi-Onesti. He discovered that copper filings, heaped between two brass plates, were ordinarily non-conductors of electricity, but that they became conductive when subjected to the discharge from an induction coil, when their resistance fell from millions to hundreds of ohms. Calzecchi-Onesti published his discoveries in *Il Nuovo Cimento* in 1884, but, as has been the case with other wonderful wireless discoveries, his work attracted no attention until after the publication, six years later, of Branly's researches. Then the earlier discoveries of Varley and Onesti were remembered, and it was seen that they had a considerable value.

Application to Wireless Telegraphy.

Branly, probably having had his attention drawn to the subject by reading the work of Calzecchi-Onesti, commenced a series of investigations into the variations of conductivity of a large number of conductors under various electrical influences, a subject that he (erroneously, as we have seen) claimed had not previously been investigated. The results of his researches were given in a paper, published in 1891. He showed that fine copper dust, porphyrised copper, or other such substance, though a very bad conductor under ordinary conditions, fell in resistance enormously when an electric spark occurred in its neighbourhood. He measured the reduction in resistance caused in a number of different substances, including a quantity of metallic filings and conglomerates, or pastes made of filings, in various viscous liquids and in dry powders. He found that the resistance of these filings was reduced even when the spark from an induction coil was several yards distant.

Not only did Branly confirm and extend the researches of Varley and Calzecchi-Onesti, but he made the further

Pioneers of Wireless.—

and most important discovery that the conductivity imparted to metallic filings by an electrical discharge in the vicinity is immediately destroyed by tapping the tube in which they are contained. In this he had discovered the vital operation that soon after was to form the foundation of Marconi's system.

Very modestly does Branly speak of his work to-day. "As for my coherer," he told the writer recently, "I suppose I did help the progress of radiotelegraphy. For years I studied the conductibility of isolated bodies, and at last, in this very building, I made my first discovery. I hardly imagined at the time that similar results could be obtained at greater distances.

"In making my experiments I placed in the corner of the yard opposite my laboratory a spark coil, and in my laboratory a tube filled with soft iron filings, closed at both ends by two conductor stoppers communicating by means of a cell and a bell. Although the circuit was closed the bell did not ring, but as soon as the current entered the spark coil the bell rang continuously. The principle of wireless telegraphy was thus found, for it was possible to collect the waves transmitted by the spark coil without using a metallic conductor. I noticed that this conductibility, once started, continued, and in order to make it cease I had to tap the tube slightly.

"Marconi profited by these experiments, and on achieving tangible results he sent me a testimonial of his admiration and thanks by a Marconigram sent from St. Margaret's, England, reading 'Marconi sends Mr. Branly his respectful compliments across the Channel, this fine achievement being partly due to the remarkable researches of Mr. Branly.'

"My difficulties have always been tremendous. I have never been well off and so have always lacked appliances. That forced me to study medicine and earn a living as a doctor. Of course, it has helped me, and by making others well I know how to look after myself. I am never ill, and although I know monkey glands are good for some people I do not think I will bother!"

The value of Professor Branly's scientific work has been recognised and many honours have been awarded him. He was a prizeman of the Academy of Sciences in 1898, and at the Universal Exhibition of 1900 he was awarded a Grand Prix. Later he became a Chevalier of the Legion of Honour, with the following mention in the official Gazette: "Has discovered the principle of wireless telegraphy." In 1910 the Society for the Encouragement of National Industry awarded him their "Argenteuil" prize, and since that year he has been an Associate Member of the Belgian Royal Academy. A further honour was bestowed upon him last year when he received the order of Commander of the Legion of Honour.

NEXT INSTALMENT.

Popoff, the Russian Pioneer.

General Notes.

Mr. Manuel A. Tapia (CH 3AT), Casilla 51D, Santiago, Chile, wishes to get into touch with British amateurs who can call him between 19.00 and 01.00 Chilian mid time (23.42 and 05.42 G.M.T.).

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Mr. F. R. Neill (GI 5NJ), Whitehead, Co. Antrim, states that the Australian station A 2LK, operated by Mr. D. B. Knock, reports having clearly received his telephony during July, speech being quite clear on three valves. Mr. Neill was working with an input of 82 watts to a DET1 valve, modulation being effected by grid control. This is believed to be the first time speech has been transmitted direct from Ireland to Australia.

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Mr. D. Woods (G 5WV), Station House, Braintree, established two-way communication at 0015 B.S.T. on August 26th with BZ 1BI, Mr. L. Ayres, of Rio de Janeiro, for threequarters of an hour. Mr. Woods was working with an input of 10 watts to an L85 valve at 400 volts RAC of 350 cycles, and the Brazilian station reported his signals at R6. BZ 1B1 was using an input of 50 watts, and his signal strength was R7, on a 2-valve receiver.

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Low-Power Transmission.

Apropos the suggested low-power transmission tests, Mr. J. Clarricoats (G 6CL) informs us that his station at Friern Barnet has been received on telephony in Paris at a strength of R5 when transmitting on only 1 watt, and he has successfully worked Königsberg and the Faroe Islands using about 2,5 watts. Reports of any of his transmissions will be welcomed from distances of over 200 miles.

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TRANSMITTERS' NOTES AND QUERIES.

Regulations in Egypt.

The Egyptian Ministerial Decree No. 11 of 1926 dated 6th June, 1926, specifies the new regulations for the use of broadcast and experimental receivers.

Applications for licences must be made to the Ministry of Communications on the prescribed form, stating the nationality and profession of the applicant and two certificates of character, with a description of the receiver it is intended to instal and, if this is of home-construction, a diagram of the valve circuits and sketch of the proposed aerial.

The annual licence fee is £T.80 (about 16s.) for a broadcast receiver, plus £T.5 (1s.) per valve, and for an experimental receiver the annual fee is £2 (English), plus 1s. per valve up to the maximum number desired. The number of valves used must not exceed the maximum stated in the terms of the licence without the written consent of the Inspector-General of Telegraphs and Telephones. A refund of 1s. per valve may be claimed if the number of valves is reduced after a licence has been issued.

It is not stated whether any proportion of the fees collected will be set aside for the upkeep of broadcasting programmes, and we understand that Egyptian broadcast listeners consider they are called upon to pay rather high fees and get very little in return, as the small broadcasting station at Cairo and the European stations are liable to be jammed by Morse transmissions from Ras el Tin.

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New Call-Signs Allotted and Stations Identified.

G 2UV	W. E. F. Corsham, "Woodlands," Rugby Avenue, Sudbury, Middlesex. (Change of address.)
G 2BOR	T. S. Wilkin, 102, Lisle Rd., Colchester.
G 2MF	J. Fife Mortimer, Beech Drive, Hoylake Rd., Moreton, Birkenhead, transmits on 150 to 200 metres.
G 2ADI	(Art. A.) H. G. Blanden, 10, Woodfield Rd., Braintree, Essex.
G 2AGF	E. Goodenough, 17, Crabtree Ave., Waterfoot, Rossendale, Lancs.
G 5IV	L. F. Irvin, Middlemore Cottages, Braunston, near Rugby, transmits on 8, 23, 45 and 90 metres.
G 6HI	W. C. Haddick, 48, Woodvale Ave., Belfast, is at present testing on 45 metres with low power.
G 6WF	J. B. Whitehouse, 32, Bourne St., Dudley, Worcs.
G 6WS	S. F. G. Weston, 110, Chesterfield Rd., Copnor, Portsmouth, transmits on 45 metres. (This call sign formerly belonged to Mr. L. E. Neaverson, Peterborough.)
EAC 2	J. Balta Elias, Calle Cortes 564, 2° Barcelona.
A 3EN	A. B. Leonard, Drouin, Victoria.
U 2XG	De Forest Radio Co., New York City.

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QRA's Wanted.

U JB (38.5 metres), CZ FR5 (37 metres), VIS (35 metres), KGBB (39.5 metres), Z 3AG, Z 2TU, G 2BK, R DX8, R NA6, K AYY, BZ CB, BZ F2, J 3XP.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

Wavelength Changes Deferred.

It is understood that the European wavelength changes will not take place, as originally arranged, in mid-September, but will be deferred for a few weeks. When they do come about it will be found that listeners experiencing difficulty with their local station will have the Daventry transmissions as a standby, as these are to be considerably stronger than in the past.

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A Holiday at Savoy Hill.

The studios and control room at Savoy Hill are enjoying a well-earned rest at present, the bulk of the transmissions now passing through the control room at the Olympia Radio Exhibition.

To-morrow (Thursday) the Braemar Games will be broadcast through the Olympia control.

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Rumour Rampant.

Suggestions are still floating about to the effect that this or that prominent person has been appointed (or disappointed) in connection with the formation of the Broadcasting Corporation Board.

Our prescient *intelligentsia* have lately been telling us who will *not* be appointed. This is a very much safer course; you have all humanity to draw upon with the exception of the chosen half-dozen.

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Mr. Reith.

With regard to the rumoured staff changes at Savoy Hill, I venture to predict that the New Year will see very little, if any, difference. We may be fairly certain that the Postmaster-General will be too wise to allow Mr. Reith to sever his connection with a concern which he has helped to build up from the beginning, and about the administration of which he obviously knows more than anyone else in this country.

FUTURE FEATURES.

Sunday, September 12th.

LONDON. — The Royal Artillery String Band.
BIRMINGHAM.—Symphony Concert.
BOURNEMOUTH. — Concert relayed from Royal Bath Hotel.
GLASGOW.—Symphony Concert.

Monday, September 13th.

LONDON.—Popular Classics.
NEWCASTLE.—The Roosters' Concert Party.

Tuesday, September 14th.

LONDON.—The Kneller Hall Band.
ABERDEEN.—The Roosters' Concert Party.
CARDIFF.—Pre-War Reminiscences.
MANCHESTER.—"The Sweep," a Farce by A. W. Bird.

Wednesday, September 15th.

LONDON.—"The Bohemian Girl," an Opera in three Acts, relayed from the New Chenil Galleries, Chelsea.

Thursday, September 16th.

LONDON.—The Band of H.M. Royal Air Force.
ABERDEEN.—"An Elder of the Kirk," a Play by Alan Macbeth.
BELFAST.—"Catherine Parr," or "Alexander's Horse," a Play by Maurice Baring.
NOTTINGHAM. — Birthday Programme.

Friday, September 17th.

ABERDEEN.—Old Favourites.
BIRMINGHAM.—The Roosters' Concert Party.
GLASGOW.—"Grey Ash." a One-act Play by Leonora Thornber.

Saturday, September 18th.

LONDON.—Excerpts from "No No Nanette." relayed from the Palace Theatre.

Some Time Table!

The B.B.C. is fairly scrupulous in the matter of programme timing, but for real downright precision I like WGY, Schenectady, U.S.A. A typical schedule:—

12.01 p.m. Weather Report.
12.03 p.m. Produce Market Report.
12.05 p.m. Lettuce Report.
12.06 p.m. Weather Report.

Incidentally it seems rather unfair that the American lettuce eater should be doomed to wait 1,439 minutes every day before he can have one all to himself. And to have to listen to two weather reports inside five minutes sounds rather like insult added to injury.

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Impersonations.

Listeners to certain of the American broadcasting stations have recently been treated to a glut of impersonations. There is more in this than meets the eye or ear. The sober truth is that American stage and concert stars can "git around" a contract like a wood alcohol kid "gits around" Prohibition.

The "impersonations" are uncannily true to life.

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Tightening the Belt?

Is the B.B.C. "feeling the pinch"? A close scrutiny of recent programmes suggests an unwonted aim towards economy. This may be due to the fact that the Post Office is still holding up a considerable part of the revenue from licences to which the B.B.C. is entitled. "Outrageous!" says Mr. McHaggis, of Aberdeen.

Before passing judgment, however, it is better to investigate the facts. The B.B.C. receives its income, not in weekly or monthly sums varying with the number of licences issued, but twice yearly. Basing the amount on the licence figures

for the last half year, the Postmaster-General hands over a definite sum in March and also in October. We are now in September. We can therefore make the obvious deduction that the B.B.C. is eagerly waiting to tear off another page from the monthly calendar.

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No Debts.

From inquiry at Savoy Hill I learn that the B.B.C. has never yet encroached on the sum due in the succeeding half year. When the affairs of the Company are handed over to the Corporation there will be no debts.

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State News for Denmark.

Prior to August 1st the news bulletins from the Copenhagen station were provided by three well-known Danish papers. This department has now been taken over by the State. There appear to be no complaints

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No Broadcast Censorship in U.S.A.

There is nothing in the radio Bills now pending in America to give the Government any authority to censor matter intended for broadcasting. If the Bills are passed the position of the American broadcasting stations will be much the same as that of the Press, though the proviso is made that a station allowing the dissemination of political matter must grant equal facilities for all parties.

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G.B.S. the "Enemy of Radio."

Mr. George Bernard Shaw has thought fit, I see, to prohibit the broadcasting of his plays in Germany. In a letter to his publisher, the famous dramatist describes himself as "a declared enemy of radio," but he adds a gem of paradox by stating that he has no objection to the broadcasting of his essays and introductions.

A very graceful "enemy"!

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A Doubtful Copyright.

Some mystification was caused on Tuesday of last week by the announcement from Dover that the five minutes' talk by the Channel swimmer, Mrs. Corson, was to be regarded as "copyright."

The explanation appears to be that the talk cost the B.B.C. a considerable sum —rather more than fifty pounds—and the embargo was placed upon it in order that the material could be used in another direction. The incident raises the interesting question of whether copyright *can* be claimed in the broadcast world. If any newspaper had decided to take a shorthand note and had published a summary of Mrs. Corson's talk, it seems to me that the B.B.C.'s chance of justifying its claim to copyright in a court of law would have been very slender.

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Jolly Times at Zagreb.

For all I know you may have heard Zagreb last night. Radio Stanice Zagreb is situated in Yugo-Slavia and broadcasts nightly on 350 metres. It is one of those tantalising stations, I imagine, which we pick up just before closing down for the night. Our fingers are already wandering over to the filament switch when we give a haphazard turn to the condenser, and lo! our ears respond to something like this: "Cetiristogodisnjica bitke na Mohackom polju." That was the title of a talk given from Zagreb by Prof. Dr. R. Horvat on Wednesday, August 25th. I have it on the programme kindly forwarded by the station director.

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The Unknown.

How few of the European stations can actually be identified! A vague notion

A LISTENER IN EGYPT. The new regulations for broadcast reception in Egypt are anything but favourable to the listener. The licence fee is 16/- plus 1/- per valve for broadcast sets and £2 plus 1/- per valve for experimental sets. Special State permission must be obtained before an extra valve can be added!

of the wavelength is often our only guide, and when an announcer does happen to give the station call it generally sounds like the title of Dr. Horvat's talk, and the music is resumed immediately.

When Geneva has determined the European wavelengths with some degree of finality, some scheme might be embarked upon which would simplify the task of identification. Have *Wireless World* readers any suggestions for a workable scheme?

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Transatlantic Relays.

However alluring may be the prospect of the regular re-transmission of music from across the Atlantic, the possibility of such an arrangement this winter is rather remote.

During his visit to London, Mr. David Sarnoff, Vice-President of the Radio Corporation of America, was reported to have said that he had effected plans for the regular relaying of dance music from Daventry for the benefit of American listeners, and that the relays would be carried out three times a week. I am inclined to think that Mr. Sarnoff was misreported; even he would disclaim such optimism. I do know, however, that he took back with him for publication in America a special message from Mr. Reith in which the Managing Director of the B.B.C. cautioned wireless enthusiasts against expecting great things at present in the way of international exchanges.

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A Popular Play.

On September 14th listeners to 2LO will hear Cameron Taylor's play, "The Grandfather Clock," which has already been broadcast from provincial stations, meeting with a favourable reception. The cast includes Phyllis Panting, Miriam Ferris, Margaret Watson and Henry Oscar, all well known to the broadcasting public.

On the same evening listeners should hear Miss Mabel Constanduros, who will give some of her favourite character-studies, and Geoffrey Gwyther, who will sing several songs at the piano. Mr. Gwyther was responsible, in association with Mr. Max Darewski, for the musical numbers in "The Saturday Night Revue," broadcast from 2LO and 5XX a fortnight ago.

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Vicissitudes in South America.

Should you be tempted to make a journey to the sunny shores of South America, be careful what kind of broadcast receiver you take with you. The atmosphere of South America is decidedly damp, a fact which slipped the memory of the U.S. manufacturers who first shipped apparatus to that Continent. The manufacturers have since profited by experience.

Mr. Linsig, of the Friede Eisemann Radio Corporation, N.Y., estimates that there are now 250,000 sets in the Argentine, 40,000 to 50,000 in Chile and 60,000 in Brazil. Progress is being made in Peru, Uruguay and Ecuador, but official restrictions have put the brake on broadcasting enterprise in Paraguay, Bolivia and Venezuela.

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Publicity for the Museums.

Radio Belgique is carrying on a very active campaign on behalf of the museums in Brussels, and the idea seems to be meeting with success Special talks have been given by the majority of the museum conservators, with the result that the turnstiles have been kept busy at the "Porte de Hal," the "Cabinet des Médailles," and the "Musée de l'Armée."

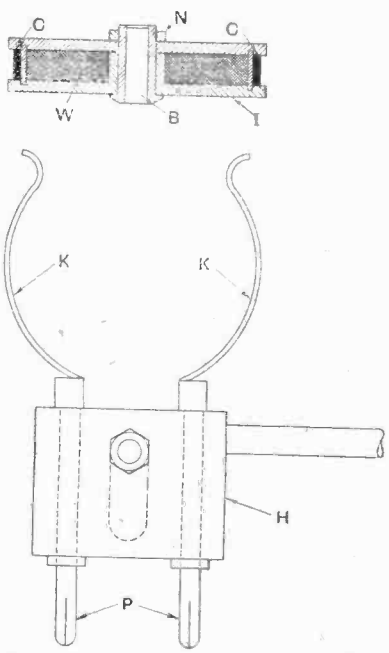
Mention of "museum" seems to frighten a good many worthy people, but surely the London museums would provide material for quite thrilling talks if these were handled in the right manner.

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 1/- each.

System of Coil Mounting.
No. 253,767.

Conv. Date (Denmark), July 16th, 1925.

Another method of mounting a coil is described by A. C. V. Hansen in the above British Patent No. 253,767. The windings W of the coil are contained in an insulating casing I, the casing being held together by a hollow bush B, provided with a nut N. The ends of the



Plug-in coil mounting. (No. 253,767.)

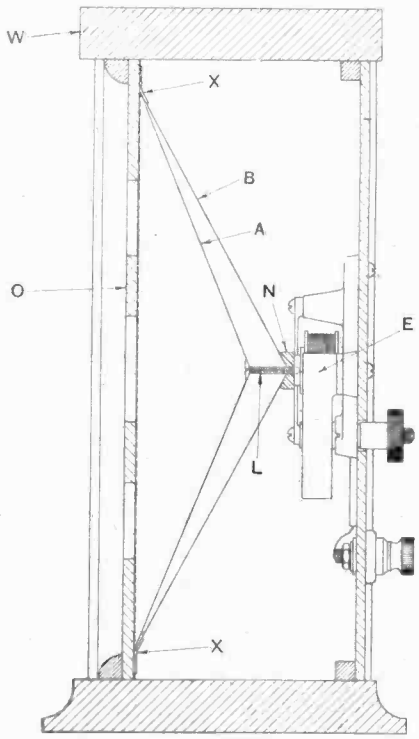
winding are connected respectively to two contact members C in the form of metallic strips fixed round the periphery of the casing. The holder for the coil consists of an insulating block H provided with two contact pins P, which are electrically connected to two springy contact members K, the distance between them being somewhat less than the diameter of the coil. Thus it will be seen that on pressing the coil between the two members K they will make contact respectively with the two contact strips C, and the resiliency of the members K will retain the coil firmly in position. In another modification of the invention the block H is provided with means for attaching another movable block, so that two coils can be coupled together.

○○○○

Double Cone Diaphragm.
No. 253,687.

Application Date, May 14th, 1925.

The construction of another cone type diaphragm loud-speaker is described by P. J. Mullaly in the above British Patent Specification. The accompanying illustration should make the invention quite clear. The loud-speaker is contained



Double cone loud-speaker diaphragm. (No. 253,687.)

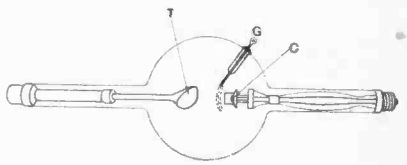
within a wooden or other cabinet W, with an openwork front O. The diaphragm consists of two cones A and B, fixed at their peripheries to the front of the cabinet at X. The inner cone A has a more obtuse angle than the outer cone B, and the two pieces are joined together by a link L such as a screw which terminates in a wood plug N. This is connected to an ordinary electromagnetic system E. The specification states that the cones constituting the diaphragm may be made of paper, parchment, metallic foil, or thin wood.

○○○○

A Television Scheme.
(No. 252,799).

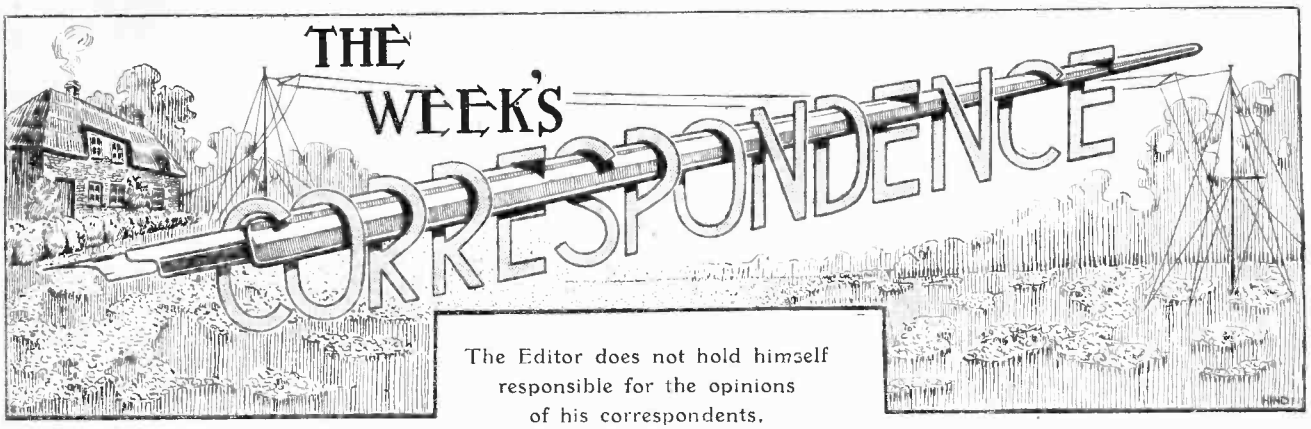
Application date March 6th, 1925.

Certain television schemes have been devised in which an X-ray tube plays an important part. An application of this principle is described by G. M. Wright and R. N. Vyvyan in the above British patent. The accompanying illustration shows an X-ray tube provided with a heated cathode, the tube, of course, being of the Coolidge type. The X-ray stream



X-ray tube for television apparatus. (No. 252,799.)

is reflected from the target T in the normal manner. This stream is allowed to impinge upon a fluorescent screen or some photographic device. Between the cathode and the target a control electrode or grid G is placed, and the electric potentials representative of change in intensity of light, such as those obtained from a photoelectric cell, are applied between the grid and the cathode, thereby modulating or varying the intensity of the X-rays reflected on the target. This, of course, gives rise to corresponding change in intensity of the illumination of the fluorescent screen.



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.

FREQUENCY AND WAVELENGTH.

Sir,—I read with interest the letter under the above heading in the Aug. 18th issue of *The Wireless World*, sent by Mr. Kingsbury, but two points in his communication call for comment. First, regarding the question of the space occupied by present-day condensers, as against the old semi-circular type. Surely Mr. Kingsbury has not forgotten one important advantage the present-day type has over the old, namely, the low minimum? Personally, I regard this as amply compensating for any additional space that may be occupied, as, after all, what is two inches extra space compared with an extra 15 per cent. of tuning range on the lower wavelengths.

The second point is regarding the question of amplification, when Mr. Kingsbury suggests some manufacturer should turn out a special transformer, suitably arranged to amplify the higher-frequency components of the modulation. Why? It is well known that H.F. amplification alone, but more so with reaction, gives greater prominence to the lower frequencies, but surely, from the point of view of quality, this is an advantage? I would suggest a three-stage resistance coupled amplifier, suitably controlled, for purity as well as signal strength, as my own experience with transformer coupled amplifiers is that synthetic "Xs" drown a weak signal, while a really well-made (and properly screened) resistance amplifier, used in conjunction with H.T. accumulator batteries, is not at all guilty of *adding* crackles, which are generally put down as "atmospherics," but are not.

Galashiels BRYAN GROOM.

THE LOW-POWER TESTS.

Sir,—Mr. Hartley's letter in the August 25th issue of *The Wireless World*, with regard to the probable interference of Continental transmitting stations with the proposed low-power tests, interests me greatly, as I had also foreseen this difficulty.

However, would it not be possible to arrange for the tests to be universal, at least as far as the Continental stations are concerned? This would ensure an absence of serious QRM and a more useful series of tests would result.

It is important to note, however, that adequate notice *must* be given, and to ensure it reaching every European transmitter due notice should be given to the R.E.F., the Réseau Belge, etc.

Also the information should be passed to the *Journal des* 8, which has a very large circulation throughout France and Central Europe.

I think that the previous tests in 1920 failed partially because sufficient publicity was not given to them abroad, and it is to be hoped that this will not be allowed to occur in the case of the present proposed tests. E. A. DEDMAN, (G 2NH).

New Malden.

LICENCE FEES.

Sir,—At a council meeting of this Association held on the 25th instant, the following resolution was passed :—

"That having regard to the high educational and recreative value of broadcasting and the urgent need of funds for more fully developing the service, the Council of this Association is of the opinion that licence fees should not be subject to any deduction other than the actual cost of collection, and that the amounts already retained by the Post Office in excess of such cost should be paid to the British Broadcasting Company, Limited."

CLIFFORD and CLIFFORD,
Hon. Secretaries, The Wireless Retailers' Association of Great Britain.

London, E.C.2.

A NEW RADIO SOCIETY.

Sir,—It is proposed to form a Radio Society in this neighbourhood, covering the Southgate, Finchley and Barnet districts. In order to ascertain the degree of response to this project I shall be pleased if interested readers of your journal will communicate with me at the above address.

J. CLARRICOATS
(G6CL Member, T. and R. Section, R.S.G.B.).

London, N.11.

THE NEW BROADCASTING CHAIRMAN.

Sir,—I have just seen a note in *The Daily Mail* announcing the probability of the appointment of Lord Eustace Percy to the chairmanship of the Commissioners of Broadcasting.

Whilst having every respect for the ability of the chosen chairman, I cannot but feel that the popularity of broadcasting is likely to suffer seriously if the proportion of educational matter and talks is allowed to extend any further than at present. The name of Lord Eustace Percy as President of the Board of Education naturally suggests that the trend of future programmes will be in the direction of more "high-brow" material.

Surely in matter of such vital interest to all listeners, the appointment of the chairman should be made openly, with the opportunity given to the public of expressing their views, rather than ignoring them and making the appointment in secret.

London, N.W.6. C. STEWART.

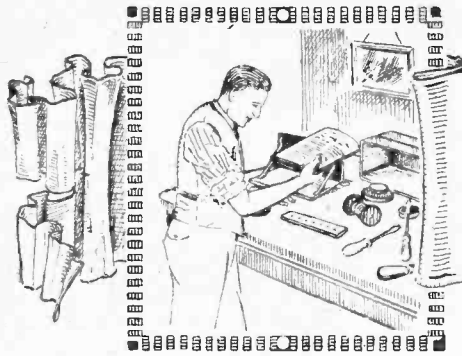
APPREHENSION.

Sir,—In your Sept. 1st issue I see that, under the heading "Apprehension," you very wisely draw attention to the scandalous use to which broadcasting is being put by certain privately-owned stations in the United States.

I expect you know that on the Continent as well, quite extensive use is made of broadcasting in the service of advertisers as a means of realising revenue. Broadcasting is a weapon of such amazing power that its control should never get into the hands of any owner who might make unsuitable use of its possibilities.

To my mind, to employ broadcasting for advertising purposes degrades broadcasting as a whole, and it behoves everyone interested in seeing that broadcasting in our own country is kept clean, to watch very carefully for any sign of interference with the hitherto clear record of the British microphone.

Manchester. ANXIOUS.



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.

The Klotz Circuit.

I have been reading in a foreign periodical a description of what is called the "Klotz" circuit, but owing to my limited knowledge of the language in which the journal is written I cannot quite fathom the modus operandi *of the circuit, and shall be glad if you can assist me.*

J.H.

The circuit to which you refer is a member of the large family of regenerative circuits employing a capacity reaction control which had their origin in the Reinartz and Hartley circuits. It is attributable to Heinrich von der Klotz, and enjoys considerable popularity in the Fatherland. We reproduce in Fig. 1 the circuit in question with a stage of L.F. added.

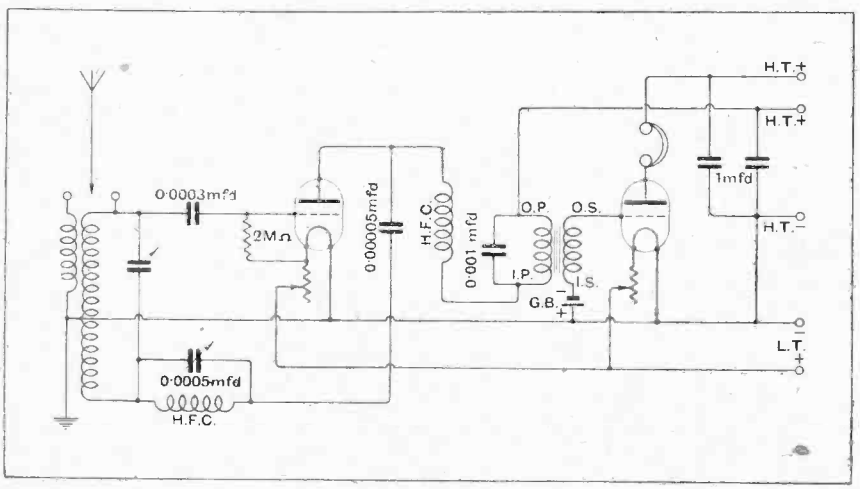


Fig. 1.—The Klotz circuit.

The action of the circuit is not hard to understand. The presence of the H.F. choke in the plate circuit of the valve *tends* to deflect a large amount of H.F. energy through the circuit represented by the 0.00005 mfd. fixed condenser, the second H.F. choke and its shunting variable condenser and the bottom end of the tuned circuit. Now, when the variable 0.0005 mfd. condenser shunting the bottom H.F. choke is set to its maximum this H.F. choke will to all intents and purposes be short circuited so far as H.F. energy is concerned. The impedance of the plate circuit choke is much higher than the impedance of the 0.0005 mfd. fixed condenser, and, therefore, most of the H.F. energy will travel round to the bottom end of the tuned circuit, and oscillation will occur. When the condenser shunting the bottom choke is, however, turned to its minimum position we then have the impedance of this choke in series with the small fixed condenser, and even if the two chokes are of equal impedance, it is obvious that the impedance of the circuit through the small fixed condenser and bottom choke will be higher than the impedance through the plate circuit choke and less H.F. energy will get through the former circuit than through the latter. Oscillation would still probably occur, however, as it requires very little feed back to produce oscillation in a circuit of this type, and the bottom choke should consist of two commercial chokes in series, the plate circuit choke consisting of one choke only. An exceedingly smooth reaction control will then be obtainable by manipulating the variable condenser shunting the bottom choke, its action being, of course, to vary the impedance of the choke.

It is important that the small fixed condenser be not greater than 0.00005 mfd. unless the bottom choke be made to possess a very high degree of efficiency in respect of high inductance and small self-capacity as compared with the plate circuit choke. The condenser may consist of two 0.0001 mfd. fixed condensers in series, although 0.00005 mfd. fixed condensers are now marketed, one being used in the "Universal Three-valve Receiver" described in the August 25th issue of this journal.

○○○○

Capacity, Inductance and Impedance.

I frequently see it stated that in certain choke-coupled L.F. amplifier circuits a high impedance is required in the anode circuit, and, therefore, a choke of high inductance is required, or that a condenser must be used in a certain position to provide a low-impedance by-pass. Can you explain the relationship between impedance, inductance, and capacity, and how to calculate one from the other?

W.H.N.

The impedance which any inductive choke offers to the passage of an alternating oscillatory or pulsating D.C. current is expressed by the formula Impedance $= 2\pi fL$ where impedance is expressed in ohms, f is the frequency in cycles per second, and L the inductance of the choke expressed in henries. It is obvious from the above that the higher the frequency the greater the impedance offered to its passage by a choke of given inductance, or the greater the inductance the greater the impedance offered by the choke to the passage of a given frequency. For instance, it is obvious from the above that if we are dealing with a frequency of 1,000 cycles per second a choke of 80 henries will offer an impedance of about half a million ohms to its passage.

The impedance which any condenser offers to the passage of any alternating or oscillatory current is expressed by the formula: $\text{Impedance} = \frac{1}{2\pi fC}$ where C equals the capacity in farads, the other symbols being as before. It is plain from the above that, unlike the case of the choke, the higher the frequency the

lower is the impedance offered to its passage by a condenser of given capacity, or the greater the capacity the less the impedance offered by the condenser to the passage of a given frequency. From the given formula, for instance, we know that if the frequency with which we are dealing is 1,000 cycles, a condenser of 0.001 mfd. capacity will offer about 160,000 ohms impedance to its passage. Do not forget that C in the formula quoted represents capacity in farads, and as, therefore, we are dealing in microfarads, it will be necessary to divide by one million if we are to use the formula as it stands, or we can more easily set to work by taking one million instead of unity as the numeral of the fraction.

°°°°

Throttle-controlled Reinartz Receiver.

I have constructed the receiver, employing throttle control of reaction described by you on page 433 of your March 17th issue, under the title of "Sensitive Two-valve Receiver," and have obtained most excellent results. I understand, however, that it is possible to design a throttle-controlled receiver using a parallel H.T. feed instead of series feed as in this receiver, and shall be glad if you can let me have particulars of same. *T.O.T.*

The receiver which you have in mind is the well-known throttle-controlled Reinartz receiver, which is a combination of the Reinartz receiver with the ordinary type of receiver employing throttle control of reaction. We give the circuit in Fig. 2. Its chief point of difference from the March 17th circuit is that the steady H.T. current does not flow through the reaction coil which, of course, it does in the case of the more conventional type of throttle control circuit.

The action of the circuit is as follows: The H.F. energy in the plate circuit of the valve has two paths of escape open to it, one through the 0.0003 mfd. fixed condenser and reaction coil, and one through the H.F. choke and H.T. battery. It naturally divides itself in the same ratio as the impedance of the two paths. The effect of the reaction condenser is to vary the impedance of the H.F. choke and H.T. battery path, and so cause more or less energy to flow through the reaction coil. In the Reinartz circuit proper it is the impedance of the other path which is varied by means of a series variable condenser. The difference, then, lies in the circuit which has its impedance variable by means of a suitably connected variable condenser, but the result is the same in each case.

°°°°

The Original Schnell Short-wave Receiver.

Was there not a draughtsman's error in the Schnell short-wave circuit which you published in your August 25th issue, in response to my query? Also what is the inner diameter of the basket coils, and why is it imperative that the transformer primary should have no fixed condenser shunted across it? *T. E. R.*

There was, unfortunately, an error, as you rightly surmise, in Fig. 1, page 281, of the August 25th issue, which, among other things, causes the grid of the detector valve to be completely isolated. The error is that the 0.00025 mfd. reaction condenser is inserted in the wrong lead. It is shown connected between the bottom of the tuned grid circuit (L_1) and the positive side of the filament. Actually, a wire should connect direct from the bottom of the coil L_1 and its 0.0001 mfd. tuning condenser, and the 0.00025 mfd. reaction condenser should be inserted in the lead at present joining the positive side of the filament to the I.P. connection of the transformer.

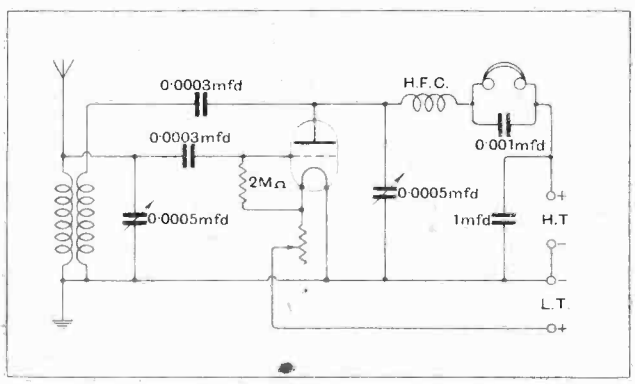


Fig. 2.—A Reinartz modification

The reason why a fixed condenser must not be connected across the transformer primary is that we are using the primary of the transformer to act as a rough H.F. choke for the purpose of offering sufficient impedance to the H.F. component of the current to render operative the particular system of reaction used. If it is desired to use a transformer with a condenser fixed across its primary, this can easily be done by inserting an H.F. choke in the lead connecting between the I.P. terminal of the transformer and the plate coil L_2. If this is done, the 0.00025 mfd. reaction condenser must not be connected between the positive side of the filament and the I.P. terminal of the transformer, but from the filament positive to the other side of the H.F. choke, that is, to the junction between the H.F. choke and the reaction coil L_2. In any case, of course, it must be distinctly understood that the present wire joining filament positive directly to I.P. must be removed.

The inner diameter of the basket coils is 1½in. It may be necessary to experiment a little with the exact spacing between L_1 and L_2. It will be in the neighbourhood of 1in., but a little adjustment may be necessary according to the exact characteristics of the detector valve. Their position should be adjusted until a smooth control over oscillation is given by the 0.00025 mfd. reaction condenser.

°°°°

Using Power Valves on the Push-pull System.

I am situated very close to a broadcasting station, and for a certain purpose I require very great volume indeed, and for this purpose am using four stages of L.F. amplification, each stage having its separate batteries. Volume is so great, however, that I find that the output valve is overloaded, even when using an L.S.5A valve with 400 volts H.T., and 100 volts G.B. I propose, therefore, to use two of these valves in the output stage operating on the push-pull system as described in your issue dated September 23rd, 1925. Can you tell me if this plan is feasible and if there are any special precautions to be taken? *O. B. Y.*

Failing the use of a special valve having an even greater straight portion of grid-volts anode-current curve than this valve, you can, of course, lengthen the working portion of your curve by making use of the push-pull system. You must not, however, make use of the ordinary type of push-pull transformers, since in the case of your output transformer the iron core would become magnetically saturated under the influence of the exceptionally heavy plate current of 150 milliamperes with which it had to deal, and it will be necessary, therefore, to have suitable transformers specially constructed for your purpose.

The Wireless World AND RADIO REVIEW

(14th Year of Publication)

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ALTERNATIVE BROADCASTING SYSTEMS.

THE word "broadcasting" has come to be used in connection only with standard systems of communication by wireless where the intention is that reception should be general as distinct from transmissions intended for one or more particular receiving stations, so that we are apt to forget that the term "broadcasting" is equally applicable to other systems of communication. Perhaps one of the earliest systems of broadcasting a message was the ancient expedient of lighting beacon fires across the country as a warning of a pending invasion by some foreign foe.

Broadcasting by electrical means can be subdivided, because it can be conducted in different ways, making use of the ether or metallic conductors. Some little stir has recently been created in this country by an announcement suggesting that in the near future it will be possible to listen-in without wireless sets by utilising as the medium of transmission existing cables in place of the ether. The proposal is, briefly, that central electrical power stations should employ methods for distributing broadcasting over their transmission lines so that every house supplied from a central station would have broadcasting "on tap" from the wires serving for house lighting and heating purposes. These ideas are not new in theory, nor, indeed, in practice, since for at least a year or two past certain towns in Germany have employed such methods with considerable success.

The two alternatives exist of transmitting at radio frequency or of distributing actual speech currents along the lines. In the latter case the speech currents could be utilised to operate telephones or loud-speakers directly, whilst in the former it would be necessary to have the equivalent of a simple wireless receiver to make reception possible. We see that it is suggested that the utilisation of such a system would mean that wireless receivers as we know them to-day would be superseded, but we very much doubt whether anything of the kind would be likely to take effect. In the first place the distribution would be limited to those buildings supplied from a power station adopting the broadcasting system, and this would debar a very large section of the community from participation. Secondly, the listener would be deprived of the ability to change from one programme to another, and there seems little prospect that the programmes put out in this way could compare favourably with those of the B.B.C., unless the B.B.C. programmes themselves were utilised, which would hardly be possible unless this alternative broadcasting came under the same control.

The subject is naturally one of some interest, but as things stand at present we think the practical possibilities are limited; particularly if the system is intended to compete with our national broadcasting service. The direction in which some measure of success might be anticipated would be if, in the larger towns, the system were adopted in conjunction with broadcasting primarily as a means of overcoming oscillation interference where receivers are operating in close proximity.

CONTENTS.

The Motorist's Four

A Loud-speaker Receiver for Home or Car Use.

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

MANY people, who are the fortunate owners of cars, do not bother much with wireless in the summer months, because, as they say, in the fine evenings and week ends they are out in the car, so they do not use it. Others, however, have bought portable sets, and obtain much enjoyment from their intermittent use out in the open, but when they try to use them for continuous home use in the periods when they are not out in the car, they usually find that they have to have the batteries charged or recharged very frequently, which is rather annoying, besides being expensive. The reason for this is because in most portable sets weight is cut down to the minimum, so that the smallest possible batteries are used, both for high tension and low tension. The writer has elsewhere pointed out[1] that it is a great mistake both from an expense and from a quality point of view to use small capacity high-tension batteries for loud-speaker work, and that high-tension accumulators, or failing these, the very largest size of dry batteries are really necessary if good results are to be obtained.

In view of these arguments, the set described below has been designed to be equally suitable for the drawing-room or the car, as will be seen on referring to the photographs; moreover, it is more powerful than the usual portable receiver, and will last for about a month on one charge of the accumulator with an average use of two hours per night. Further, and this is an advantage that no other set yet has, as far as the writer is aware, the L.T. accumulator can be charged from the car batteries without removing it from the set, and on many cars, without disturbing the lighting wiring at all. All that is necessary to do is to insert a plug into the set and the accumulator is automatically put on charge.

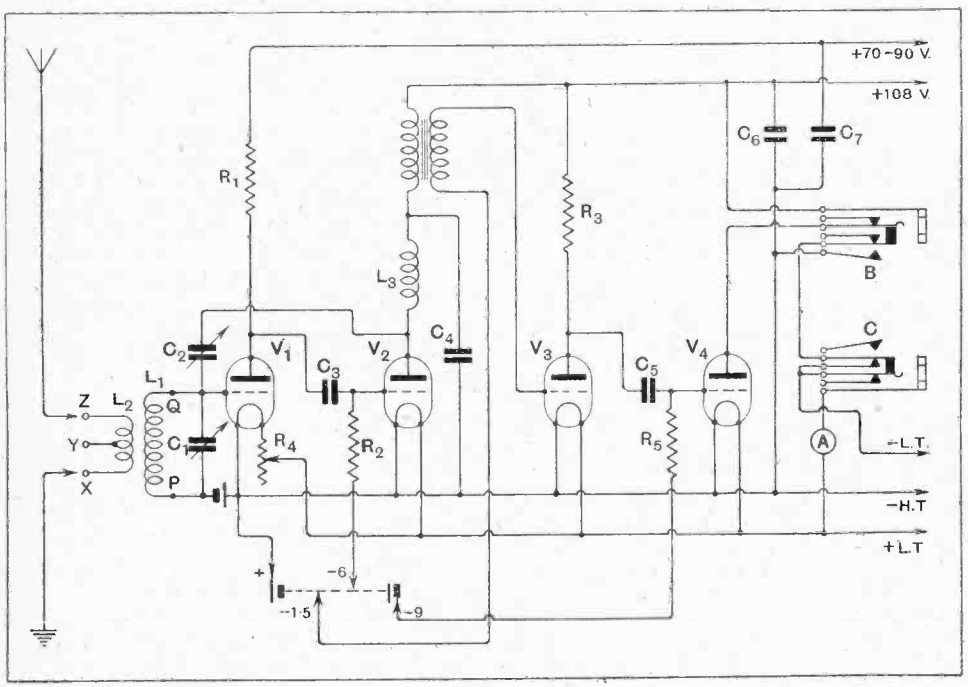


Fig. 1.—THE COMPLETE CIRCUIT OF THE RECEIVER. L_1=50 turns 27/44 Litz wire on 3 in. Paxolin former. L_2=7 turns No. 28 S.W.G. wire on spacers. L_3=Cosmos radio choke. C_1=Gecophone 0.0005 mfd. variable condenser. C_2=Gambrell Neutrovernier. C_3=0.0005 or 0.001 mfd. C_4=0.0003 mfd. and C_5=0.005 mfd. C_6, C_7=1 mfd. R_1=1 megohm. R_2=5 megohms. R_3=Two ½ megohm leaks in parallel. R_4=15 ohm filament resistance. R_5=2 megohms. A=0-6 ammeter. B=Loud speaker jack. C=Charging jack. V_1 and V_3=Mullard P M.I., H.F. V_2=Mullard P.M.I., L.F. V_4=Mullard P.M.2.

The Circuit.

The complete circuit of the receiver is given in

[1] *The Wireless World*, September 9th, 1925.

The Motorist's Four.—

Fig. 1, but for the purposes of discussion the essential features have been redrawn in the skeleton diagram Fig. 2, in which jacks,, etc., are omitted. This particular circuit is rather curious — it might be thought to be a perfectly straightforward 1-v-2 arrangement with

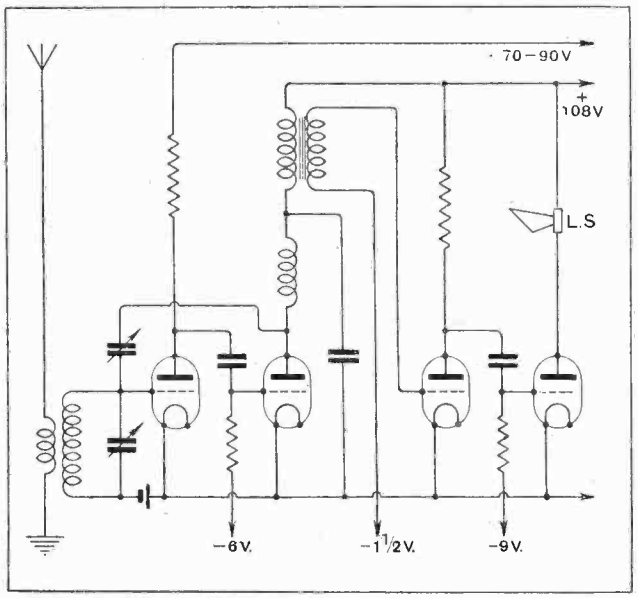


Fig. 2.—Simplified diagram showing essentials of the circuit.

a resistance-coupled high-frequency amplifier, and so it is for long wavelengths (over about 1,000 metres) provided R_1-R_2, R_3-R_4 are suitably chosen, but simply by interchanging R_1-R_2 and R_3-R_4 it is possible to transform the circuit into an 0-v-3 arrangement.

The question of resistance high-frequency amplification at broadcast wavelengths (300-600 metres) will not be discussed here, as it will be dealt with in a separate article, but it may be said that it does not work on these short wavelengths unless very special precautions are taken to eliminate stray capacities, which practically involves mounting the complete H.F. and detector stages inside the same valve bulb.

Reaction Control.

Since the set described in this article is designed to work on these wavelengths, it will be seen that it must be an 0-v-3 arrangement with reaction from the first *L.F. amplifier* valve. This arrangement was found to work very well indeed when experimenting with grid leak resistances for H.F. amplification on the broadcast band—in other words, when attempting to use the arrangement of Fig. 2 as a 1-v-2 set. Results obtained were extremely good: with three valves only and a 100ft. aerial 20ft. high 25 miles from London, a good many stations were tuned in *on the loud-speaker* after dark, so that it seemed as though effective resistance H.F. amplification was being obtained, and it was only after attempting to measure the H.F. amplification of the first valve with a valve voltmeter that the true state of affairs was fully realised—*i.e.*, that the H.F. amplification of the first valve V_1 was practically nil, but that, owing to the high value of resistance used in its plate circuit, it was rectifying on the bottom bend of its characteristic, and that V_2 was amplifying at low frequency. Adjustments of H.T. supply to V_1 and V_2 were made, with improved results, as soon as these facts were realised. Since reaction effects and with very smooth control, too, are obtained from the second valve, it follows that some of the high-frequency energy is reaching this valve, probably partly *via* R_1 and C_3 (Fig. 2) and partly *via* the grid-plate capacity of V_1.

Choke-capacity reaction is used, as it gives a smooth control and does not upset the tuning; and, as a small balancing condenser of the many-revolution type is used, it is almost impossible to oscillate *accidentally*, although, of course, it may be done deliberately. For normal reception, this condenser is left in a mean position (not oscillating), and the required station tuned in on the aerial condenser, the reaction condenser being used only for weak signals. In case the station is too loud, a volume control is provided, consisting of a variable resistance in the filament circuit of V_2.

On examination of the complete circuit of the set (Fig. 1), two jacks B and C will be noticed, one for the loud-speaker, and one for charging the accumulator, and it will be seen that the set is switched off until the loud-speaker plug is inserted, and also that when the accumulator is being charged it is disconnected from the valves, thus obviating any accidental burn-outs on the filaments. The voltage of the two-volt accumulator rises to about 2.7 volts maximum value on charge, and falls to 2.2

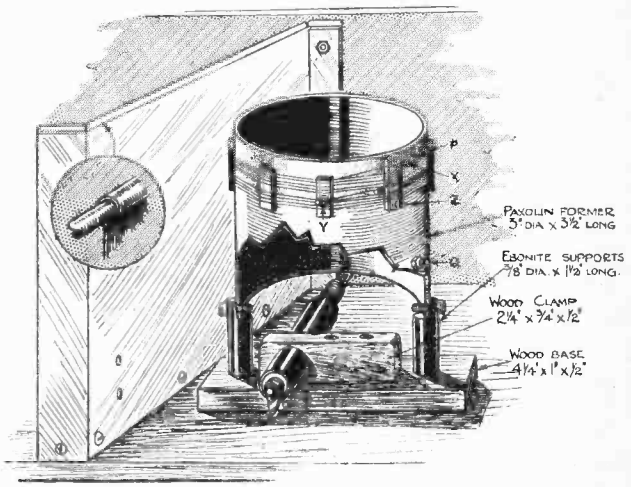


Fig. 3.—Constructional details of the tuner, copper screen and reaction condenser.

when fully charged but disconnected from the charging supply—and 2.7 volts is rather too much for two-volt valves. For safety purposes a bright emitter type valve fuse blowing at about 0.8 ampere may be inserted in the filament circuit if it is desired.

Construction.

The construction of the set may conveniently be divided into the following parts: (a) panel and baseboard; (b) battery arrangements; (c) cabinet.

The panel and baseboard are mounted together so that the control arrangements only appear on the panel, and

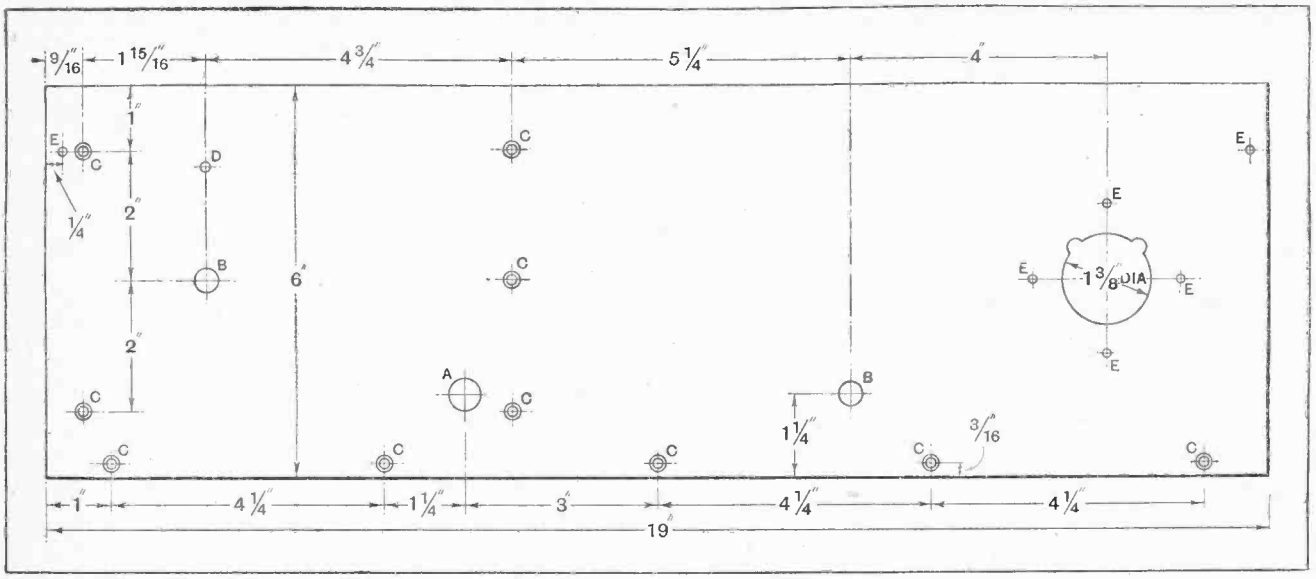
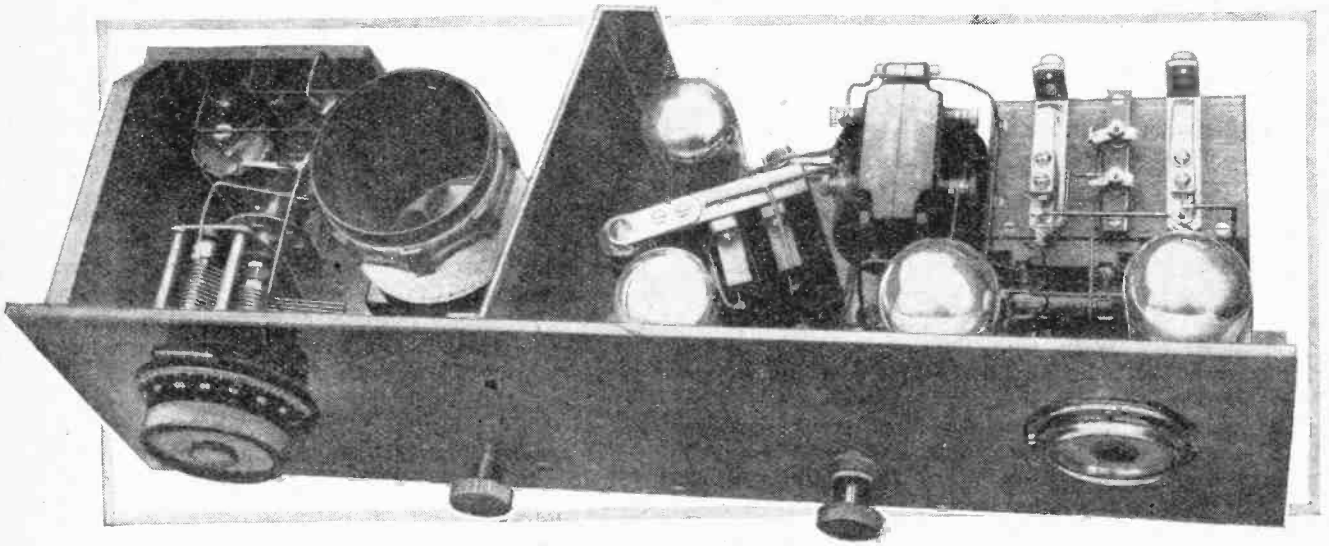


Fig. 4.—Drilling details for the aluminium panel. Sizes of holes are as follow: A, 7/16 in. dia.; B, 3/8 in. dia.; C, 5/32 in. dia., countersunk for No. 6 wood screws; D, 5/32 in. dia.; E, 1/8 in. dia

the rest of the components are mounted on the baseboard. Points of interest in the construction are the provision of a copper screen to shut off the tuning arrangements from the rest of the set, the complete boxing up of the L.T. accumulator, and the way in which the components are mounted in order to economise space without unnecessarily increasing stray capacities where they are harmful.

Starting from the input side of the set, the first component to be constructed is the combined aerial and grid coil, represented in Fig. 1 by L_1 and L_2. The Paxolin former on which the coils are wound is obtained in 4-inch lengths, which is most convenient for our purpose. This former should first be drilled in accordance with the sketch in Fig. 3 and No. 7 B.A. screws inserted where shown. two soldering tags being threaded on each bolt and the whole tightened up with No. 7 B.A. nuts. After the coil has been wound, retighten these nuts, which are sure to have worked loose owing to the effect of heat when the wire is attached, and then screw another nut on to each bolt and tighten well up to serve as a lock nut. As a final precaution, the part of the bolt projecting above the nuts is cut off with a pair of cutting pliers, and the edges lightly burred over with a file. The grid coil consists of fifty turns (14 yards) of 27/44 silk-covered Litz wire wound with the turns touching. To wind the coil, first unwind about half an inch of the outer silk covering of the wire, and carefully bare *each* of the little strands of No. 44 gauge wire, which may be done either with a blunt knife or with an edge of a piece of hard wood, such as oak. It is well to spend a little time in baring the wire, as, if strands are broken, or missed, the advantage of using Litz wire will be lost. When the fifty turns have been wound, it will be easy to see where the wire has to be bared again to solder in place. On



The receiver unit removed from the cabinet.

The Motorist's Four.—

referring to the photograph showing the inside of the set, it will be seen that the coil is rather smaller than is usual for a single layer coil used for broadcast reception —the dimensions being approximately 2in. long by 3in. diameter, and the value of the parallel condenser (0.0005 mfd. maximum) rather higher than usual; this has been done deliberately to increase the selectivity of the set, the aerial coupling still further if required—*i.e.*, when quite close to a broadcast station.

It should be remembered that the selectivity of a set as a whole depends on the selectivity and number of its tuned circuits, and as here we have only one tuned circuit, it follows that we must make and keep it as selective (*i.e.*, of as low resistance) as possible. For this reason a small grid bias voltage of $1\frac{1}{2}$ volts, supplied by

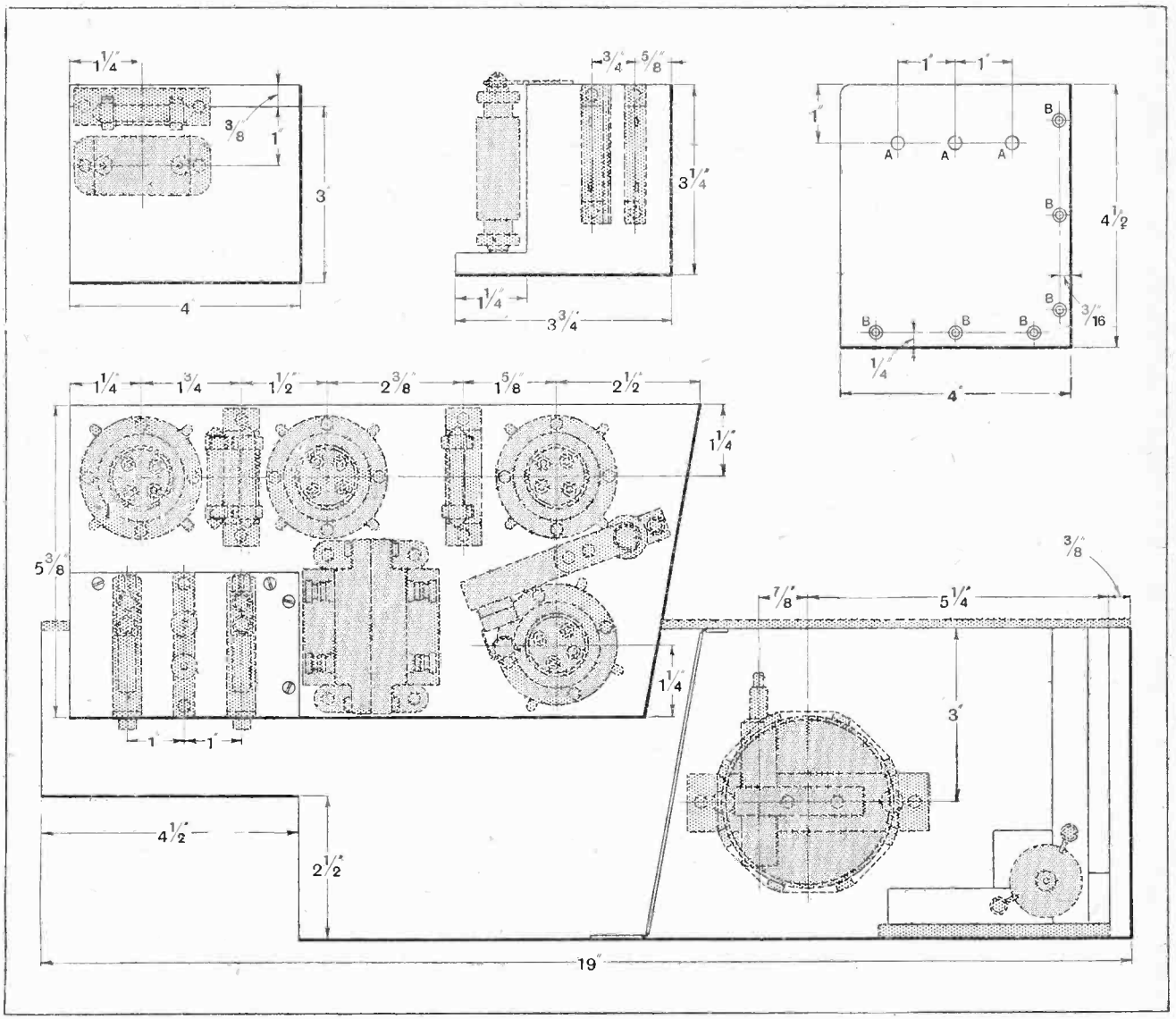


Fig. 5.—Dimensioned layout of components on the baseboard and sub-panels. In the terminal panel A=7/32 in. dia.; B=1/8 in. dia., countersunk for No. 4 wood screws.

since a circuit containing a small coil and large condenser is of lower resistance (therefore more selective) than a circuit of similarly designed components with a small condenser and large coil both being tuned to the same wavelength. The aerial is loosely coupled by means of the seven-turn coil (L_1 in Fig. 1) for the same reason, as by this means nearly all of the damping due to the aerial is removed from the grid circuit and provision is made, by tapping this coil at the third turn, to decrease a single dry cell, is used on the first valve in order to obviate any chance of damping of the grid circuit due to grid current from this valve.

When the grid coil is wound, three of the aerial coil spacers, which are conveniently cut from a 3in. diameter ebonite tube on which a thread of 16 threads per inch has been turned, should be drilled for No. 8 B.A. countersunk screws, and these fitted with nuts as shown in Fig. 3, and the projecting part of the bolts tinned, after

LIST OF PARTS.

1 Fixed condenser, 0·0003 mfd., No. 600a (Dubilier).
1 Fixed condenser, 0·0005 mfd., No. 600a (Dubilier).
1 Fixed condenser, 0·005 mfd., No. 600a (Dubilier).
1 Grid leak, 0·5 meg., Dumetohm (Dubilier).
2 Grid leaks, 2 meg., Dumetohm (Dubilier).
1 Grid leak, 5 meg., Dumetohm (Dubilier).
4 Grid leak holders (Dubilier).
1 Cosmos choke (Metro-Vick Supplies, Ltd.).
1 Gecophone variable condenser, 0·0005 mfd. (G.E.C.).
4 Lotus valve holders (Garnett, Whiteley & Co., Ltd., Lotus Works, Broadgreen Road, Liverpool).
2 Edison Bell D.F. No. 5 jacks and plugs (Edison Bell Ltd., Edison Bell Works, Glengall Road, S.E.15).
1 Transformer ratio 3½ to 1 (Ferranti AF3).
1 Neutrovernia (Gambrell Bros., Ltd., 76 Victoria Street, S.W.1).
1 Lissenstat minor filament control, 0-15 ohms. (Lissen, Ltd.).
1 Flush mounting ammeter, 0-6 (Economic Electric Co., Ltd., 10, Fitzroy Square, W.1).
1 Dial indicator (Belling & Lee).
2 Tapa plugs (W. J. Charlesworth, 88-89, Aston Street, Birmingham).
3 Tapa sockets and indicators (W. J. Charlesworth, 88-89, Aston Street, Birmingham).
4 packets glazite (London Electric Wire Co. and Smiths, Ltd., Playhouse Yard, Golden Lane, E.C.1).
1 Aluminium panel, 19in. × 6in. (Smith & Sons, Ltd., St. John's Square, E.C.1).
Baseboard, 18¼in. × 5¾in.
1 Paxolin tube. 3in. diameter by 3½in. long (Micanite & Insulators, Ltd., Empire Works, Blackhorse Lane, Walthamstow, E.17).
20 yds. Litzen wire (P. Ormiston & Sons, Ltd., 79, Clerkenwell Road, E.C.1).
7 Wander plugs.
1 Cabinet "Camco" (Carrington Man. Co., Ltd., 18-20, Norman's Buildings, Mitchell St., Central St., E.C.1.)
1 1½ volt grid battery, Ever-ready (Portable Electric Light Co., Ltd., 120, Shaftesbury Avenue, W.C.1).
1 9 volt grid battery, Ever-ready (Portable Electric Light Co., Ltd., 120, Shaftesbury Avenue, W.C.1).
1 108 volt H.T. battery, Ever-ready W24S (Portable Electric Light Co., Ltd., 120, Shaftesbury Avenue, W.C.1).
1 Exide accumulator, 2 volt, 1 CZ3 (Chloride Electrical Storage Co., Ltd., 219, Shaftesbury Avenue, W.C.1).

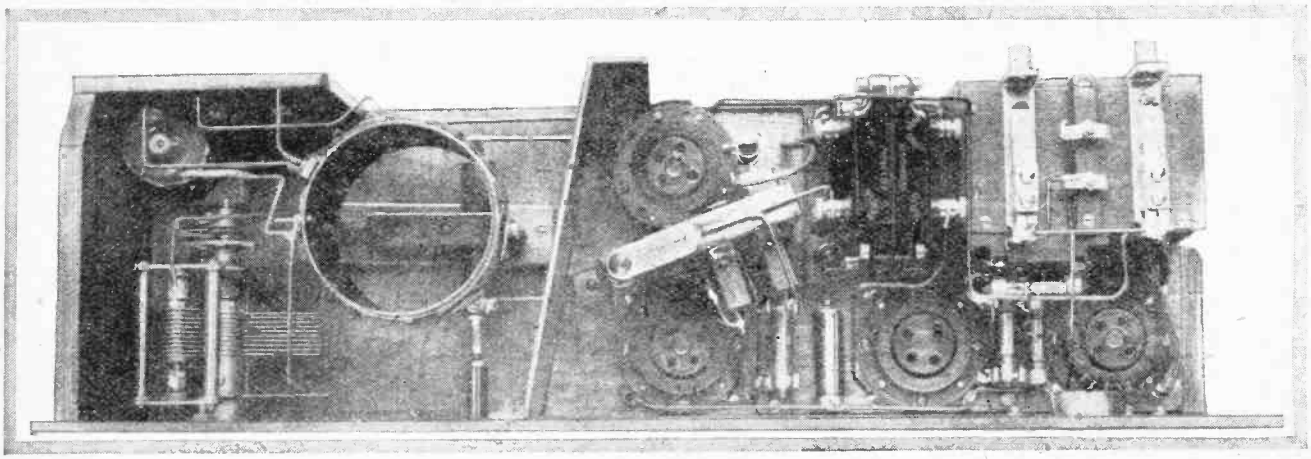
Approximate cost - - £12 0 0

which the eight spacers are evenly distributed round the periphery of the coil and held in position by means of two rubber bands. When the spacers are in place, the aerial coil may be wound with No. 28 S.W.G. enamelled wire. Care should be taken that the spacers carrying bolts are arranged in the correct position (as shown in Fig. 3) on the coil to ensure short connecting wires.

The remaining component in the tuning compartment is the reaction condenser, which is clamped down on to the wood block holding the grid coil supports. Fig. 3 will perhaps make this part of the construction clearer.

The screen is made from No. 24 or 26 gauge copper sheet, cut to the dimensions shown in Fig. 3, which shows also how the edge of the screen is turned down over a wire edge to strengthen the top and free side and prevent it rattling. The screen is mounted on the diagonal side of a half-inch slab of wood which serves to carry the valve-holders and transformer and also as a support for the panel.

The set is constructed on extremely solid lines, although it is of very small size for a four-valver, in order that it may stand up to hard wear, and much bumping about on the car, since, apart from the valves, it may be dropped from a table to the floor without the likelihood of breaking anything—not that this treatment is recommended, of course, but the writer has had considerable experience of the effect of bumping sets on a small car driven fast on bad roads, and can safely recommend a car set to be strongly made, and all components to be well anchored down.



Plan view of the receiver with valves removed.

The Panel.

This is made of aluminium ⅛in. thick. Aluminium was chosen in preference to ebonite for two reasons; it is stronger than ebonite, and will not warp or deteriorate in sunlight. Incidentally, it is both lighter and cheaper than an ebonite panel, since the latter would need to be at least ¼ inch in thickness. Aluminium is a very easy

The Motorist's Four.—

metal to work, and the black control knobs look very well against it. The panel dimensions and the positions and sizes of the various holes are given in Fig. 4, which also gives the baseboard dimensions. When the panel has been cut to size and the holes drilled, it should be smoothed carefully with a little pumice and water, and finally polished with rouge or one of the various compounds used for cleaning silver, after which it should be lacquered on both sides and all the edges with colourless lacquer.

The coupling resistances and condensers for the first two valves are mounted on a small vertical wooden bracket which also serves to hold the Cosmos H.F. choke. The bracket (see Fig. 4) is held on to the baseboard by three screws fixed from below, and the two grid leaks are mounted on the baseboard itself, one on each side of the volume control, which consists of a Lissenstat or other small filament resistance.

The jacks are mounted on top of the wooden case made to cover the top of the accumulator, and are held in position by two wood screws. In order to drill the jacks for the wood screws, the two bolts holding the contacts are removed with the contact assembly complete and the jacks drilled and fixed in position, after which the contacts are replaced. The front of the jack carries a bush to position the plug (and also to give one connection to the latter) which is normally used to fix the jack to a panel, but in

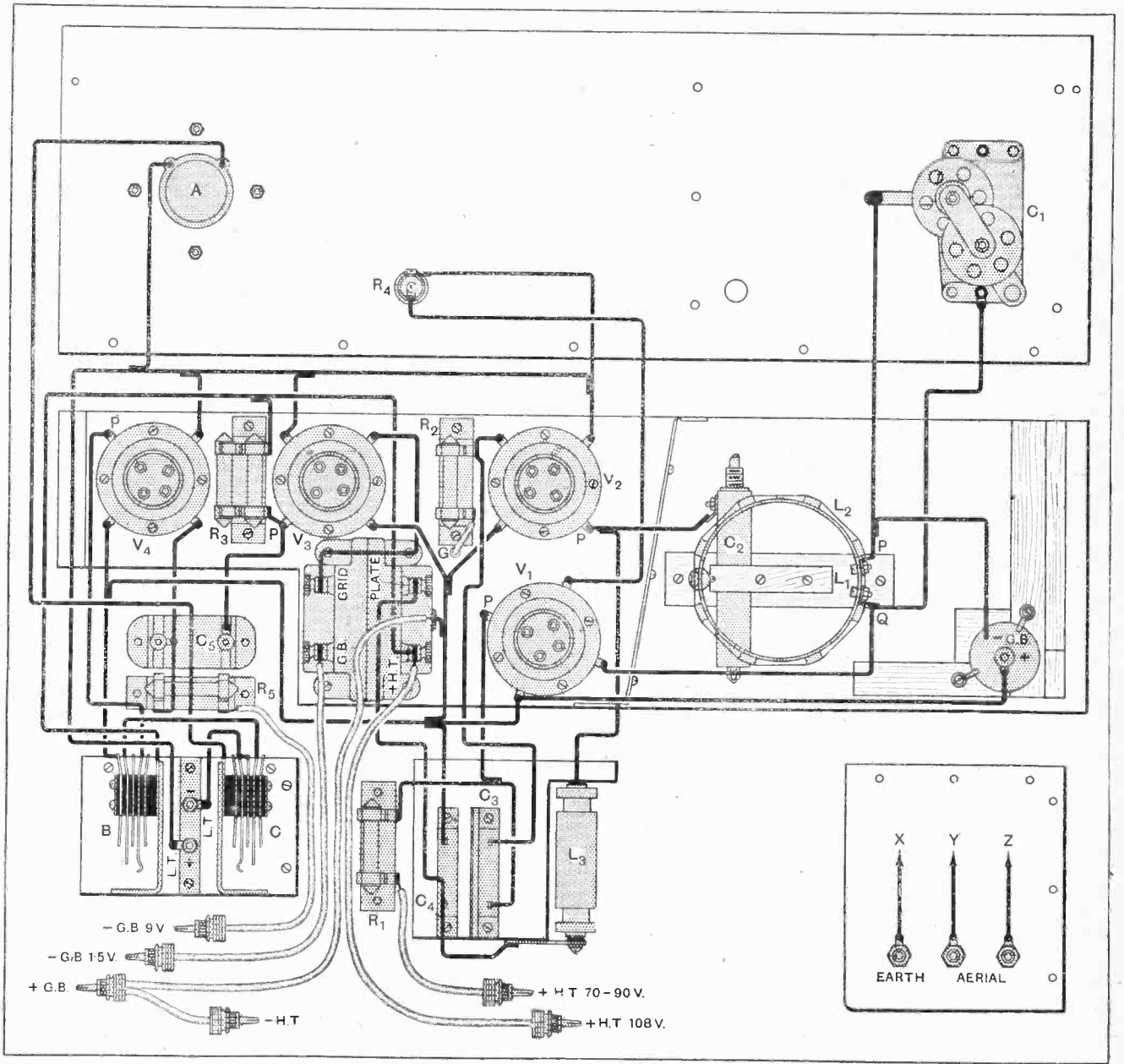


Fig. 6.—Complete wiring diagram. The lead passing through the base at G is provided with a wander plug for connection to the 6-volt tapping of the grid battery (see Fig. 1).

The Motorist's Four.—

our case the jacks are mounted facing away from the panel at the back of the baseboard so as to be available from the outside of the case when the front is shut up. The hexagon face of these bushes is therefore cut away to make a plain bush which may be pushed through the back of the case when the set is slid into position, and since these bushes bear in holes in the case, they help to hold the baseboard firmly in position.

The Wiring.

All the tags on the condensers, leak holders valve holders, etc., should be tinned before these various components are finally screwed down. Owing to the small space between the components, the wiring may have to be done in various stages unless an electric soldering iron is available. The components in the coil compartment may be wired without difficulty, but this piece of wiring should be left to the last. The first thing to wire is the filament supply to the valves when the panel and screen have been removed, after which the components on the bracket should be dealt with, followed by the wires to the transformer and jacks. The remainder of the wiring is completed when the panel and screen have been replaced. If an electric soldering iron is available, the whole assembly may be wired up in position fairly easily, but the reader is not advised to do this with an ordinary iron. In order to strengthen the wiring, it is first soldered in position in the usual way, and then the joint bound with about No. 36 gauge tinned copper wire and the whole re-soldered. This method ensures that the joint will hold under conditions of considerable vibration, but, of course, it is not used for the very short connecting wires.

The complete connections are given in the wiring diagram (Fig. 6).

The H.T. and grid bias batteries are carried in a compartment below the panel and a large size 108 volt H.T. battery is used for reasons already stated. Leads to the batteries are brought down from behind the baseboard to which they are clamped, and a fair amount of slack is left so that plugs may be inserted when the batteries are pulled forward out of the case.

The L.T. accumulator is a 2 volt 30 ampere-hour (actual) type and in order to prevent acid spray from reaching the set the arrangements described below should be carefully followed.

First of all, in order to prevent loss of water from the accumulator by evaporation and thus to eliminate frequent "topping up" with distilled water, a layer about ¼in. to ½in. thick of Price's accumulator oil is poured on top of the acid when the latter is first put in. Secondly the celluloid disc which forms the top of the stopper in the filler hole of the accumulator is removed and a short length of stout rubber tubing pushed into the stopper, vaseline being used in liberal quantities to make a gastight seal. The other end of the tube is bent round and cut to fit flush in a hole bored in the back of the case and glued in position, and vaseline again used. Vaseline should also be used on the brass parts of the accumulator terminals and the tags on the leads which are attached to them, and, as a final precaution, the part of the case round the accumulator and the whole of the battery compartment (including the bottom of the baseboard) painted with anti-sulphuric paint. The idea of using vaseline may seem rather crude and messy, but vaseline certainly forms a very fine seal for acid fumes, and, moreover, it is flexible and so ideal for the purpose; also, in any case the accumulator should not require to be removed from the set for at least a year in the ordinary course of events.

The accumulator is held firmly in position against the case at the bottom by means of a clamp, as shown in Fig. 7.

The dimensions of the case are given in Fig. 7, and it is strongly recommended that it be made up by some firm

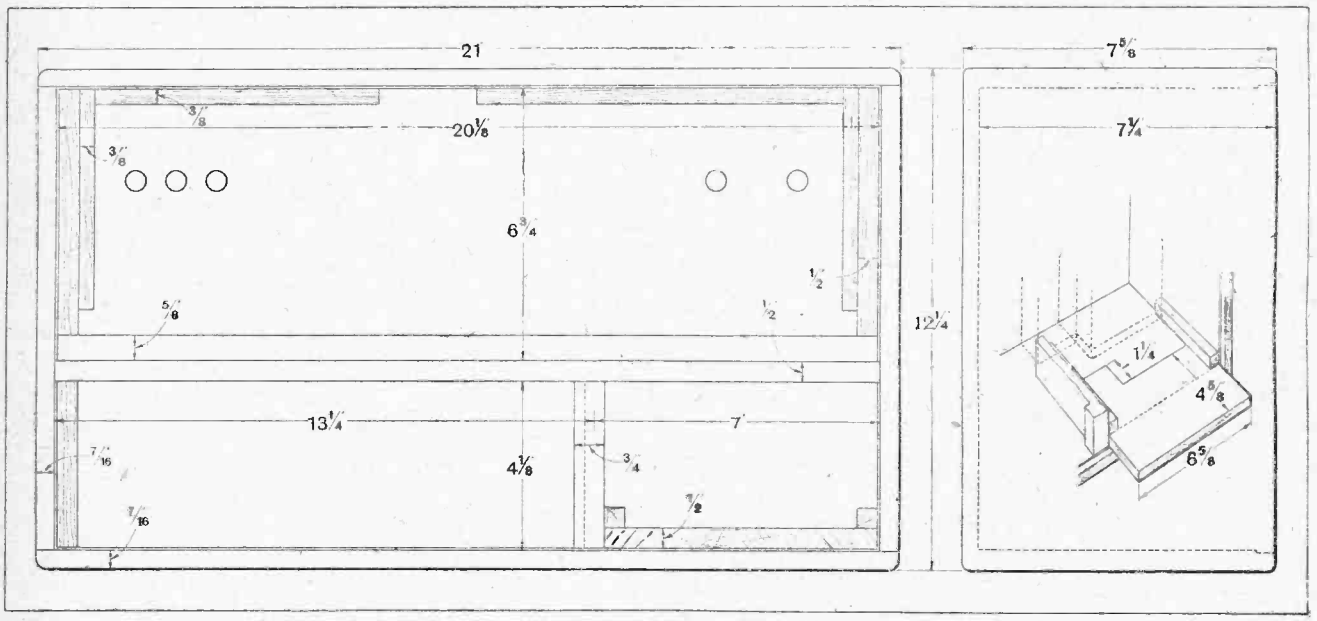
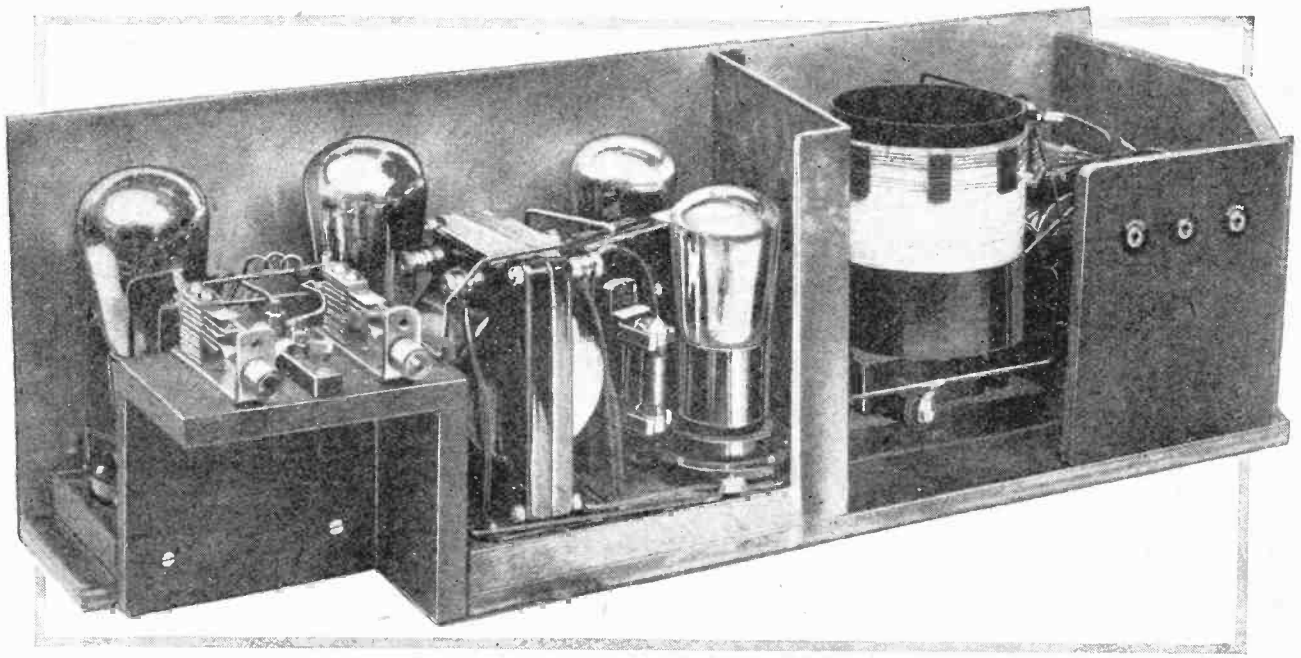


Fig. 7.—Details of the cabinet, showing the method of fixing the L.T. and grid batteries.



The receiver unit viewed from the rear.

used to cabinet work as it *must* be strongly made and weatherproof. The actual case illustrated was made by Carrington of ½in. mahogany and finished with two coats of black cellulose, which is quite weatherproof and improves with time if given a rub over occasionally.

The writer recommends carrying a 6oft. length of rubber-covered wire with a tag on the end in the space between the panel and the drop front of the case, to serve as an aerial, and another short piece of wire with another tag connected to the chassis of the car at some convenient part to serve as an earth. It may be remarked that a short aerial from the bonnet, over the windscreen to the back of the car, is all that is required to receive the nearest station when the car is travelling in the day time, and, of course, in the evening results are very much better.

Cars equipped with Lucas lighting sets need no alteration to the wiring for the charging, as a small plug may be inserted in the test holes in the dashboard. In case of doubt, any competent mechanic will wire the charging plug, with or without a switch as required, for a small sum.

In conclusion, the reader who constructs this set will be making something to provide enjoyment on the road, on the river, or at home, and need not be afraid of using the set as much as he wants to without fear of the bogey of "no juice" just when it is most annoying.

TRANSMITTERS' NOTES AND QUERIES.

General Notes

Mr. G. L. Brownson (G 2BOW), Bryning, Hale, Cheshire, asks us to state that U 8DDL, of Rochester, N.Y., intends to carry out a series of tests every Sunday, beginning on October 3rd, and will welcome full reports from British amateurs stating QRK, QSS, QSB, weather, etc., which may be sent *via* G 2BOW. The transmissions will begin at 0300 G.M.T. with "FNB FNB FNB GU 8DDL 8DDL 8DDL," which will be sent for several minutes, followed by news concerning the tests and an announcement at 0330 of the next test, which will begin at 0400 and continue until 0430 in the same manner. The wavelength will be 37.5 to 40 metres, QSB probably RAC.

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The German station K 4HA, in the Ruhr district, is anxious to get into touch with British amateurs. He transmits regularly between 2100 and 0000 G.M.T. on Saturdays, and at various other times during the week, with an input of about 12 watts RAC and on a wavelength of about 47 metres. QSL cards and other communications may be sent *via* Mr. L. A. C. Lawler, 67, Lucien Road, S.W.17.

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Low Power Tests.

With reference to the generally expressed desire on the part of amateur transmitters to hold a series of tests on low power, we understand that the Committee of the T. and R. Section of the R.S.G.B. is arranging to hold a series of such tests on 44/46 metres during the week beginning November 1st from 2300 to 0800 G.M.T. Those wishing to participate should send their names to the Hon. Sec., T. and R. Section, 53, Victoria Street, S.W.1, not later than October 15th.

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New Call Signs Allotted and Stations Identified.

G 2TW	Television, Ltd., Motograph House, Upper St. Martin's Lane, W.C.
G 2TV	Television, Ltd., Harrow (receiving station only).
G 5TD	T. A. Studley, 12, Whitmore Road, Harrow (change of address).
G 6AP	(Ex 2BOC.) A. C. Porter, 1a, Manor Rd., Brockley, S.E.4, wishes to arrange telephony tests on 90 metres.
G 6BN	A. E. Bond, 3, Havelock Terrace, Welshpool, transmits on 23, 44–46 and 90–200 metres.
G 6OT	H. A. Clark, 50, Rosebery Gardens, Harringay, N.4 (change of address).
G 6WK	W. Wicks, 11, Rigby Cottages, Dawley, Hayes, Middlesex. (Transmits on 45, 90 and 150 metres).

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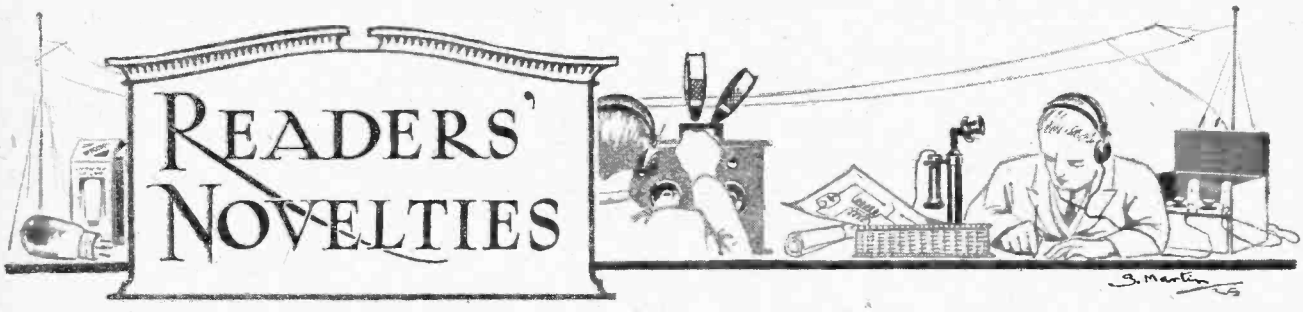
QRA's Wanted.

G 5SW, FC 8FLO, J 5ME, G 2BZW, G 5CI, F CIT, FM 8RA, 8MA, 8ST, J 3XP, P 1AY, R DX8, Z 3XB.

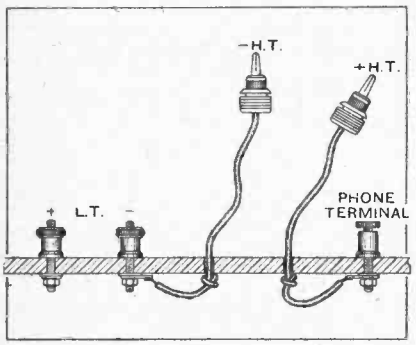


A Section Devoted to New Ideas and Practical Devices.

BATTERY CONNECTIONS.

With terminals for H.T., L.T., and grid bias all arranged on a strip at the back of the receiver cabinet there is always the possibility that sooner or later the H.T. battery will be inadvertently connected across the L.T. terminals to the detriment of the valve filaments.

To prevent such a mistake, flexible leads and wander plugs may be provided instead of terminals for the connections to the H.T. battery. The diagram shows a convenient method of putting this idea into



Flexible H.T. leads to prevent mistakes in connecting batteries.

practice. The H.T. battery terminals are removed and the flexible leads passed through the holes in the terminal panel, knots being tied in each lead to relieve the soldered joints of any strain. The negative H.T. lead may be joined to the —L.T. terminal and the positive H.T. lead to the positive phone or loud-speaker terminal.—S. McC.

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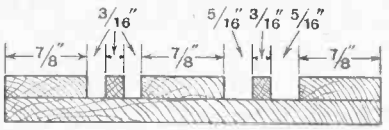
"WIRELESS WITHOUT WEIGHT."

In building the portable receiver described under the above title in the July 21st issue of *The Wireless World*, it is necessary to cut four grooves round the outside of the containing case for the frame windings. Without a special rabbeting plane this may prove a difficult operation, but a simple method of construction is shown in the diagram. This indicates that the walls of the containing



Built-up former for frame coil windings of portable receiver.

case may be built up in two thicknesses, the outer layer being laid on in the form of strips of suitable width and spacing, which, when assembled will provide grooves for the frame windings in the exact positions given in the original specification.—K. E. W.

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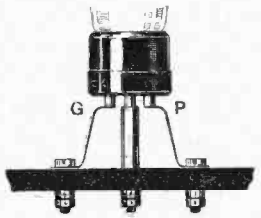
REDUCING VALVE CAPACITY.

For reception on very short wavelengths, where inter-electrode capacity is highly detrimental, the valve



Low-capacity valve mounting.

mounting illustrated in the diagram will be found very useful in reducing the effective inter-electrode capacity.

The filament pins are inserted in valve sockets in the ordinary way, but the grid and plate pins of the valve are cut down to within $\frac{1}{8}$in. of the valve base. Contact to these pins is made through the medium of the two flat phosphor-bronze contact springs secured to the ebonite panel of the receiver by No. 4 B.A. cheese-head screws well separated from one another.—D. J. L.

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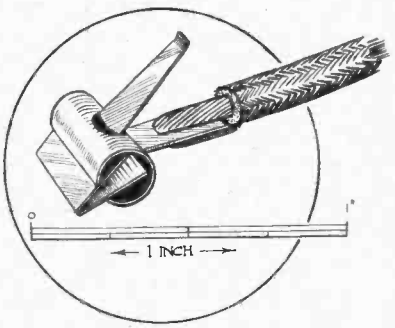
CLIP CONNECTOR.

In experimental work, both with receivers and transmitters, one is constantly in need of some sort of clip



Clip connector obtainable from any stationer.

connector of small dimensions for making connection to individual turns in a cylindrical inductance coil.

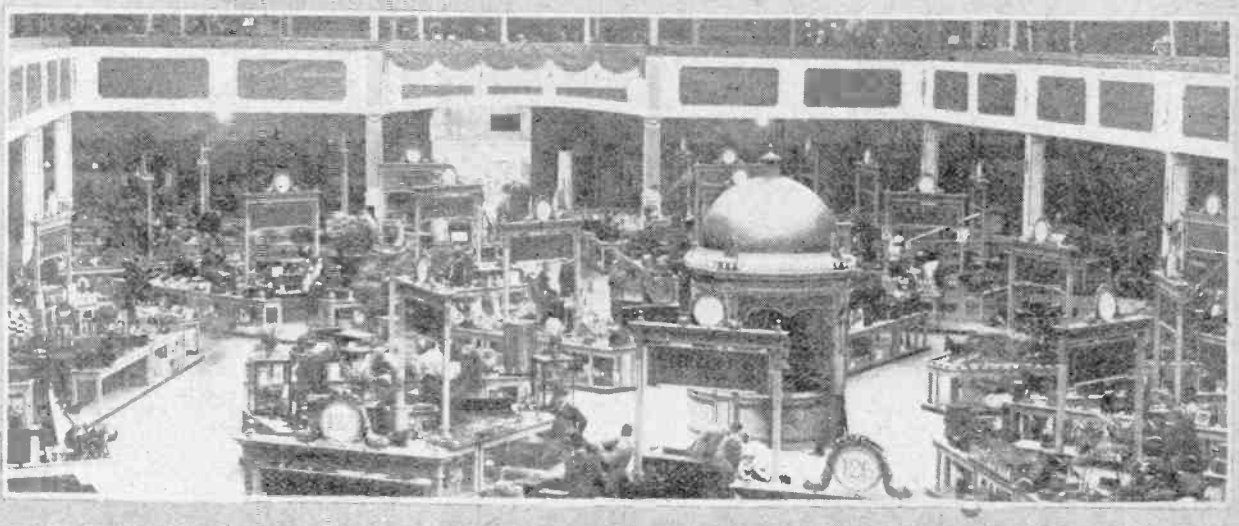
A small clip of the type and size indicated in the sketch exactly meets this requirement, and can be obtained from stationers at a cost of about fourpence per dozen. The clips were originally intended for affixing price cards, etc., to articles displayed in shop windows.—C. H. B.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A dull emitter receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," Dorset House, Tudor St., London, E.C.4, and marked "Ideas."

SHOW REVIEW



Details of New Sets at the Olympia Exhibition.

CURTIS PORTABLE SUPERHETERODYNE.

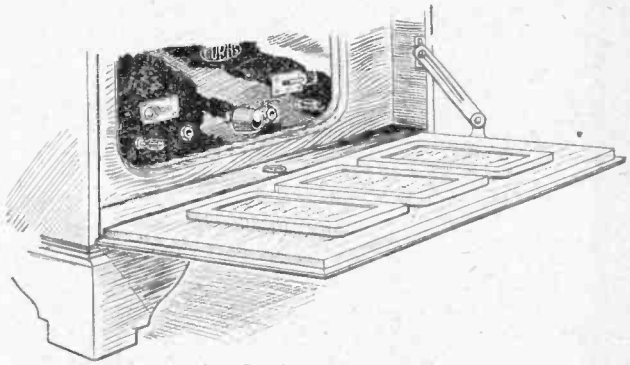
An 8-valve receiver, with separate oscillator, 3 stages of intermediate-frequency amplification and 2 L.F. amplifiers, one of which may be eliminated by means of a switch. Batteries and loud-speaker are contained in the case, which is of hardwood, attractively finished.

The frame aerial is tapped at the centre, and provision is made for loading it on each side of the tapping for reception of the long waves. The oscillator, which, incidentally, is sold as a separate unit, has a self-contained switching arrangement for changing the inductance of the windings.

The Curtis self-contained Superheterodyne

A particularly useful feature is the provision of an arrangement for eliminating the oscillator and intermediate-frequency amplifier, enabling the receiver to be used as a simple detector-L.F. combination for reception of the local station. An external loud-speaker may be substituted for that contained in the case, and sockets are fitted for the attachment of a larger frame or an open aerial.

Stand No. 159.—Peter Curtis, Ltd., 11, Red Lion Square, W.C.1.



The control panel of a Curtis superheterodyne, showing tablets for recording adjustments.

A "REINARTZ" RECEIVER.

The Bowyer-Lowe Co. are showing a 3-valve receiver comprising a regenerative detector valve, and two stages of L.F. amplification. The circuit is a modification of the well-known Reinartz arrangement, with capacity-controlled reaction. It should be sensitive, and, taking into consideration the fact that there is only one tuned circuit, a good degree of selectivity should be obtainable.

A change-over switch is provided for connecting up long-wave coils for the reception of Daventry. The insertion of a 'phone or loud-speaker plug automatically lights the filaments.

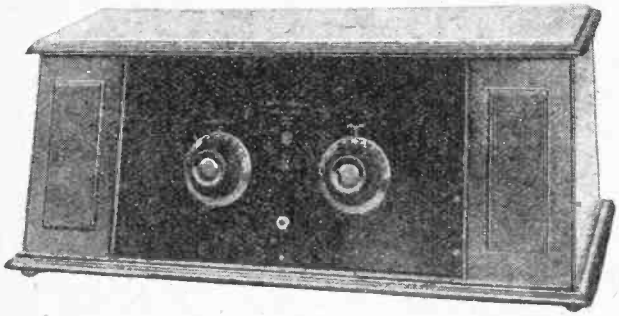
Batteries are contained inside the cabinet, which is of polished walnut, well finished, and designed on pleasing lines, with a sloping panel.

Stand No. 126.—The Bowyer-Lowe Co., Ltd., Radio Works, Letchworth, Herts.

Show Review.—

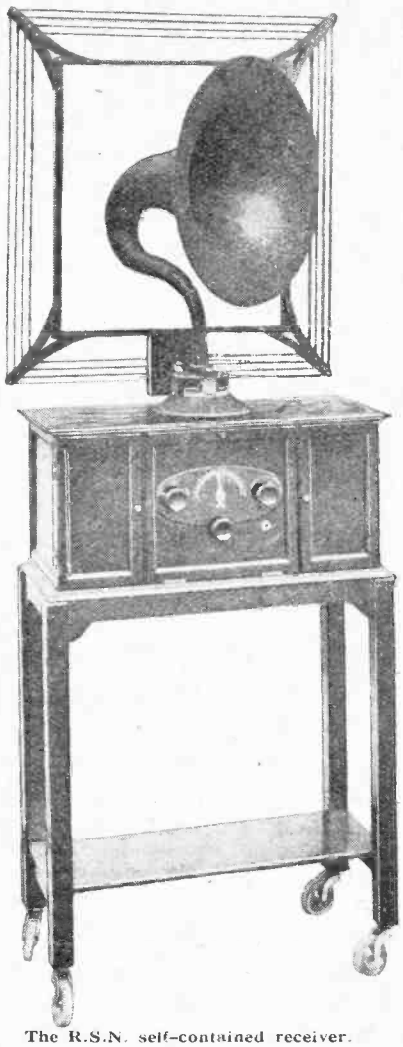
THE R.S.N. 5-VALVE RECEIVER.

A set with resistance-coupled low-frequency amplification, contained in a handsome raised cabinet with rubber-tyred wheels. It is thus easily moved from room to room, and is entirely self-



The Bowyer-Lowe "Vox-Populi" receiver, with capacity-controlled reaction

contained, with frame aerial and loud-speaker mounted on the top. The instrument panel swings out for inspection, spring connections being fitted for this purpose.

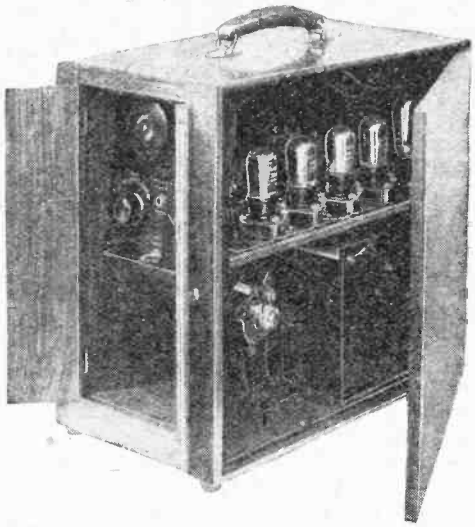


The R.S.N. self-contained receiver.

Stand No. 133.—Auto Sundries, Ltd., 10a, Lower Grosvenor Place, S.W.1.

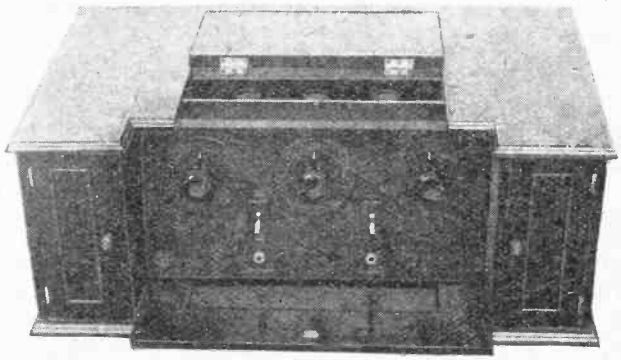
THE "PELICAN" PORTABLE.

A 5-valve self-contained receiver, with several ingenious features, and stated to have a range of 25-30 miles on the local station, and to be capable of receiving Daventry anywhere in Great Britain. The two H.F. stages are coupled by chokes, which are designed to resonate at about 1,600 metres, with a flat-topped amplification curve on these longer wavelengths. This arrangement is interesting; and it is noticed that the H.F. chokes are wound to have a restricted external field. The amplification per stage must be low on the short wavelengths, but the sensitivity resulting from the form of reaction control included should be sufficient.



The "Pelican" Portable set.

Reaction is arranged on the so-called "Hartley" principle, and the design of the centre-tapped frame aerial is worthy of note. It is wound in three sections, which are connected in series and parallel, for the long and short wavelengths respectively, by the operation of a switch. An Amplion loud-speaker



The R.I. receiver, with two stages of tuned H.F. amplification.

movement is fitted with a rubber goose-neck joint, to minimise the effects of mechanical vibration. The closing of the doors covering the control panel automatically switches off the valves. A safety fuse is inserted in the H.T. battery circuit.

The filaments of the 2-volt valves are supplied from an unspillable accumulator cell, while the 81-volt H.T. battery is composed of large-size cells—a commendable point.

Stand No. 85.—Cahill & Co., Ltd., 64, Newman Street, London, W.1.

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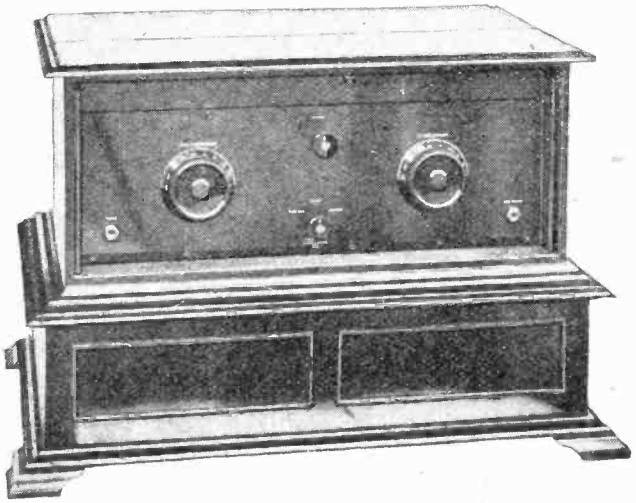
THE NEW R.I. 5-VALVE RECEIVER.

Radio Instruments, Ltd., have just produced a receiver with two H.F. stages, operating on the "tuned grid" principle. Chokes are inserted in the anode circuit of each H.F. valve.

Show Review.—

Slow-motion condensers of good design and excellent workmanship are fitted.

The aerial is direct-coupled, and the operation of the long-wave switch inserts loading coils in series with each of the three tuned circuits.



The new McMichael 4-valve set, with balanced high-frequency amplification.

All battery terminals are mounted on a strip at the back of the cabinet, which has a sloping front. The L.F. stages are coupled by R.I. multi-ratio transformers.

Stands Nos. 145 and 147.—Radio Instruments, Ltd., 12, Hyde Street, New Oxford Street, London, W.C.

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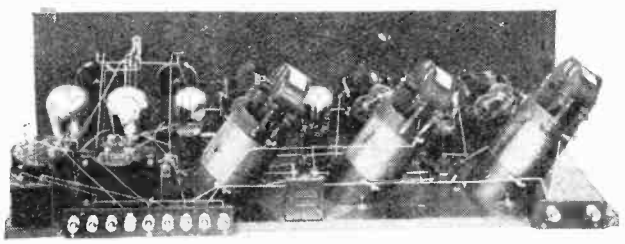
THE "DIMIC FOUR."

L. McMichael, Ltd., are showing a new four-valve receiver, comprising one high-frequency valve, a detector, and two stages of L.F. amplification. The set may be considered as representing modern practice, as the H.F. stage operates on the balanced tuned anode principle, with a centre-tapped "Dimic" coil. Inductances of the same type are used for tuning the aerial-grid circuit, and are, of course, interchangeable for the longer wavelengths. A large base, which houses the high-tension and grid bias batteries, is supplied with the set, which has a very good appearance. Terminals for the L.T. battery, which is intended to be connected up externally, are mounted behind the cabinet.

McMICHAEL SUPERHETERODYNE.

It was at the exhibition last year that the McMichael supersonic heterodyne made its first appearance, and it was one of the very few receivers of the superheterodyne type then available. L. McMichael, Ltd., have specialised in the pro-



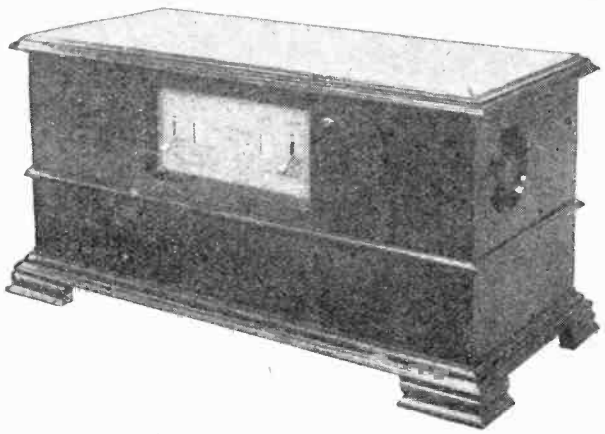
The B.R C. set of parts for home construction of a 5-valve receiver. A completely wired set of similar construction is also supplied.

duction of H.F. intervalve couplings, and it is the design of the intermediate transformers that governs the performance of this type of set.

An autodyne circuit is employed, in which a single valve serves as oscillator as well as first detector, followed by three intermediate stages operating on 3,000 metres, valve detector and two L.F. stages, one of which is resistance-coupled. The circuit is entirely orthodox, the intermediate amplifier being stabilised by a potentiometer. Unlike many superheterodynes, its reception is not confined to one waveband only. Tuning to Daventry and Radio Paris is accomplished by substituting a long-wave autodyne unit, while the frame aerial is loaded by means of a "Dimic" plug-in coil, for which clips are provided on the front part of the panel.

A twenty-four-page booklet describes in detail the fundamental principles, and how to assemble, wire, and operate the set. The construction is reasonably easy, owing to symmetrical disposition of the components, which greatly simplifies the wiring.

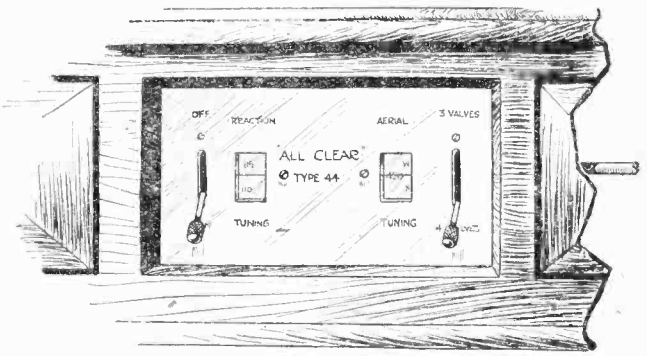
Stand No. 142.—L. McMichael, Ltd., Wrexham Road, Slough.



The "All-clear" 4-valve receiver, with wavelength indicator.

TWO NEUTRALISED H.F. STAGES.

The receiver manufactured by the British Radio Corporation, Ltd., follows American standard practice to a limited extent. It has two neutralised H.F. amplifiers, with a valve detector and two low-frequency stages. An interesting and ingenious device is adopted to permit of the addition of inductance for reception of the long wavelength. A large ebonite bobbin carries loading coils for both primary and secondary windings, and is fitted with contacts mounted so that these are placed in circuit when it is rotated through a few degrees. Each of the three H.F. transformers are fitted with the device, which is mounted on top of the former carrying the short-wave coil. It is stated that a wavelength range of 200-2,000 metres is covered.



Details of the "All-clear" indicating and switching panel

Switches for eliminating the last L.F. valve and for controlling the filaments are included.

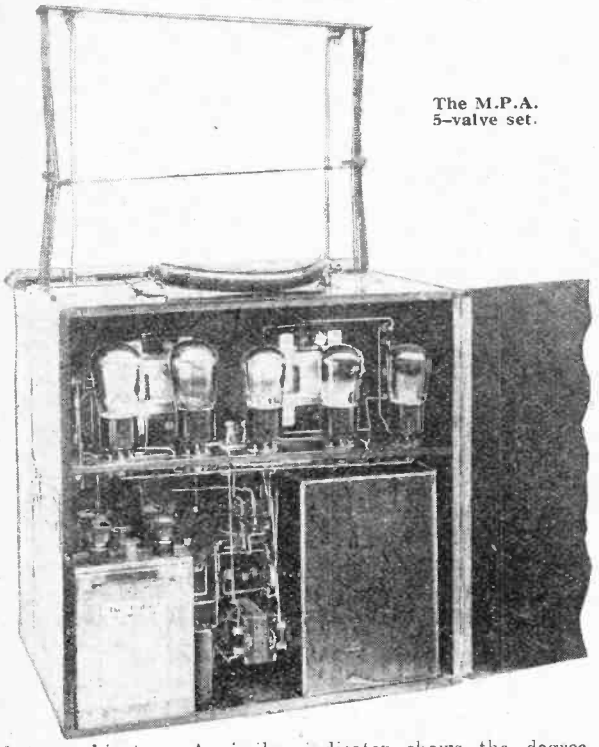
This firm also supply a set of parts for the home construction of this receiver. The intervalve H.F. couplings are also sold separately. They are well-made, and are clearly an instrument-maker's job rather than a mass-production one.

Stand No. 17.—The British Radio Corporation, Ltd., Weybridge, Surrey.

Show Review.—

THE "ALL CLEAR" 4-VALVE SET.

A receiver with capacity-controlled regenerative detector and three resistance-coupled L.F. amplifiers. The aerial circuit is untuned. The wavelength is indicated on a rotary scale, a small segment of which is visible through an observation window fitted in a small metal control panel let into the wooden front



The M.P.A. 5-valve set.

of the cabinet. A similar indicator shows the degree of reaction coupling; both condensers are driven from knobs mounted inconspicuously at each side of the cabinet.

Two switches are mounted on the panel; one of these controls the filaments of all the valves, and the other eliminates one of the L.F. amplifiers when required. Interchangeable coils, with aerial, grid, and reaction windings are used for reception of the longer wavelengths.

Stand No. 79.—William Dibden & Sons, St. Mary's Road, Southampton.

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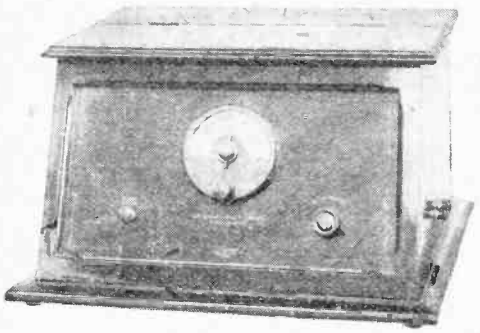
THE M.P.A. "SUPER FIVE."

This receiver comprises two stages of H.F. amplification with tuned and untuned transformers in the order stated, followed by a valve detector and two L.F. amplifiers, which are coupled together by transformers.

All the apparatus is enclosed within the cabinet, which measures $14 \times 14 \times 9\frac{1}{4}$ inches. The extending frame aerial is



The 3-valve Cleartron Set, incorporating the Lodge "N" circuit for which is claimed the full use of regeneration without oscillation interference

of distinctly novel design, and is a good feature; the increased sensitivity derived from a loop of reasonable size is obtained without the necessity of increasing the size of the set. Provision is made for loading this frame by inserting a plug-in coil for reception of the long wavelengths. A switch is also mounted on the panel, and makes the appropriate changes to the high-frequency coupling.

The loud-speaker, which is on the cone principle, is built into the frame compartment, and is operated by a "Brown" unit specially constructed for this purpose. The valve filaments are controlled by a switch, fixed resistances being inserted to reduce the voltage of the battery to a suitable value. A 4-volt accumulator and 90-volt high-tension battery are supplied as standard.

Stands Nos. 65 and 67.—M.P.A. Wireless, Ltd., 62, Conduit Street, Regent Street, W.1.

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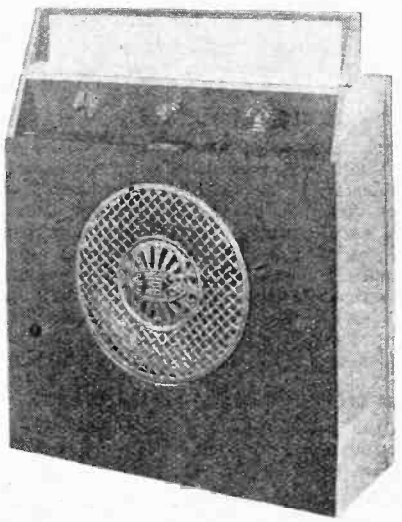
LODGE "N" CIRCUIT.

Precise technical details are not available of the receiving set embodying the new circuit system developed by Sir Oliver Lodge which is being manufactured in quantities by Cleartron Radio, Ltd.

Two popular models are shown: a two-valve and a three-valve set. The external appearance is the same in both cases, each being fitted with a single tuning dial, on-and-off switch, and a third knob for volume control. It is stated that the circuit arrangement makes full use of reaction to the extent that the set is capable of bringing in distant stations, yet the particular claim made is that the aerial circuit is not energised. Provision is made for tuning to the 200-500 metre waveband as well as Daventry.

Stand No. 102.—Cleartron Radio, Limited, 1, Charing Cross, London, S.W.



Pye 5-valve portable for the reception of Daventry. Two stabilised H.F. stages are fitted having fixed tuning. The only tuning adjustment is a vernier control across the frame condenser.

DAVENTRY PORTABLE.

The five-valve portable of W. G. Pye & Co. is entirely novel as regards layout and operating controls. There are no calibrated dials, and the one tuning knob that is provided is only a vernier, the set being closely tuned to the Daventry wavelength. The fine tuning knob is necessary to correct for small differences in tuning brought about by earth and other stray capacities. Two efficient H.F. stages are used, critically tuned and stabilised, followed by a valve detector and two L.F. stages. Volume is controlled by a variable shunt resistance across the input to the L.F. amplifier, giving perfect graduation from soft to loud, in addition to which a switch provides for throwing one of the L.F. amplifying stages out of circuit. An Amplion Radiolux loud-speaker is built into the cabinet. The set is exceedingly sensitive, compact, entirely self-contained, and easy to operate, and although styled as a portable it is a convenient set for general use. The valves used in the detector and H.F.

Show Review.—
circuits are Mullard P.M.1 type, and for the L.F. stages P.M.2, deriving filament current from an unspillable Exide accumulator. The overall size is 18 by 16¾ by 7 inches, and the approximate weight is 32 lbs.

Stand No. 91.—W. G. Pye & Co., Granta Works, Montague Road, Cambridge.

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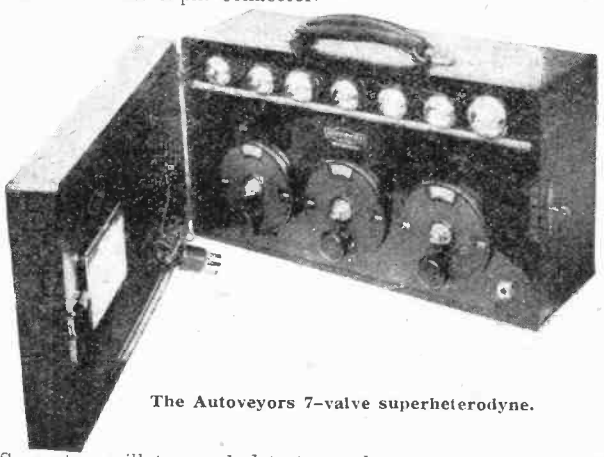
AUTOVEYORS SUPERHETERODYNE.

This is the smallest superheterodyne receiver seen at the exhibition, measuring about 15 by 9 by 6 inches and weighing 23 lb., though in making a comparison it must be remembered that many of the other sets include the necessary batteries. In this instance the batteries as well as the loud-speaker are contained in a separate case of the same dimensions as the set and weighing 25 lb. The two units are linked across with a cable fitted with a multi-pin connector.

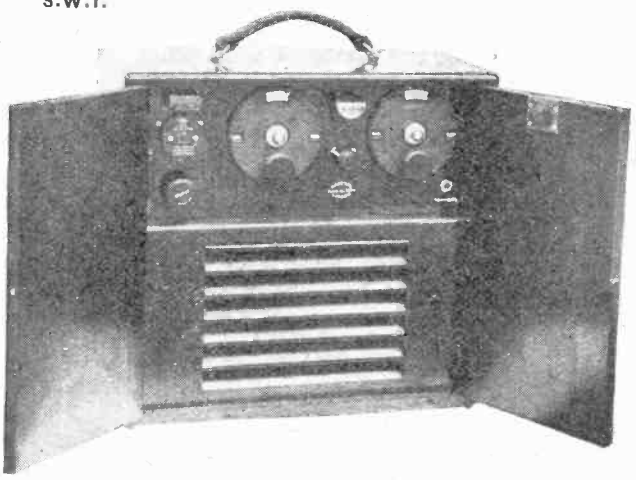


The Autoveyors 7-valve superheterodyne.

Separate oscillator and detector valves are employed with three intermediate H.F. and one L.F. stage, using seven valves in all. On the front of the set are three large-diameter dials having reliable reduction action, clear scales and attractive moulded covers. The aerial tuning is on the left, with oscillator tuning in the centre and potentiometer dial on the right.

The battery unit, in addition to the H.T. battery and 4-volt unspillable accumulator, is fitted with a Celestion loud-speaker.

Stand No. 20.—Autoveyors, Ltd., 84, Victoria Street, London, S.W.1.

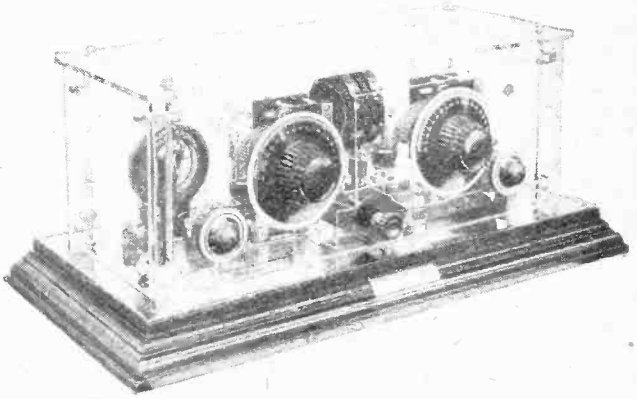


The Halcyon portable set. A small electric lamp is fitted on the panel, to illuminate the tuning dials.

THE HALCYON 5-VALVE PORTABLE SET.

This receiver represents another example of the popular combination of the two H.F. valves, detector, and two L.F. amplifiers. The H.F. side is coupled by one tuned and one untuned transformer; there are thus only two tuning controls—those for the frame and H.F. coupling.

The loud-speaker is mounted in the lower section of the cabinet; behind it is space for the L.T., H.T., and grid bias batteries. A switch is arranged to short-circuit part of the frame aerial when it is desired to receive the long-wave stations, and provision is made for changing the H.F. transformer.

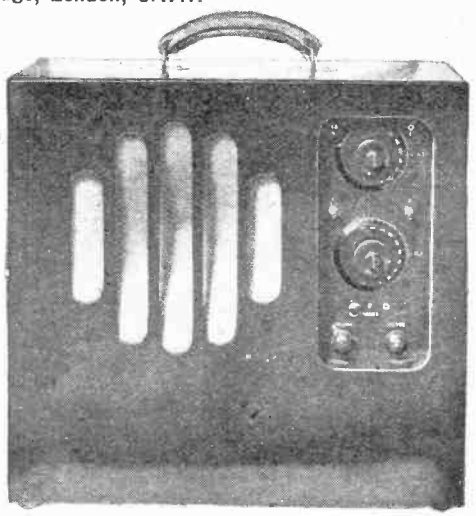


The Langham 3-valve model, with panel and containing case.

The filaments of the 1.8-volt D.E.2 valves are controlled entirely by a switch on the main panel; no resistor of any kind is required, as the necessary voltage drop is present in the incidental resistance of the leads, etc.

Capacity-controlled reaction is included, a few extra turns being wound on to one end of the frame aerial for this purpose. A 100-volt battery is fitted, together with L.F. transformers of excellent design, so it is evident that the makers have endeavoured to assure reproduction of good quality. The slow-motion dials, so necessary for a frame aerial set, seem to operate satisfactorily, and have a good appearance. They are fitted with slots backed by a disc of xylonite or similar material, on which station settings may be marked in pencil. An external aerial and loud-speaker may be used.

Stand No. 59.—Halcyon Wireless Supply Co., Ltd., 110, Knightsbridge, London, S.W.1.



The Rees-Mace 4-valve portable set

THE LANGHAM RECEIVER.

With panel, sides, back, and top of plate glass, with ground edges, this set has an extremely pleasing but unconventional appearance. The glass parts are held together by well-finished plated screws and fittings, the whole being mounted on a heavy polished wooden base. The circuit is straightforward, and in the case of the three-valve set consists of H.F., detector, and one low-frequency valve. The top is easily removable, to allow access to the valves and coils.

Show Review.—

The two-, four-, and five-valve sets made by the same firm are of similar construction.

Stand No. 257.—Langham Radio, 9, 10, 11, Albion House, New Oxford Street, London, W.C.1.

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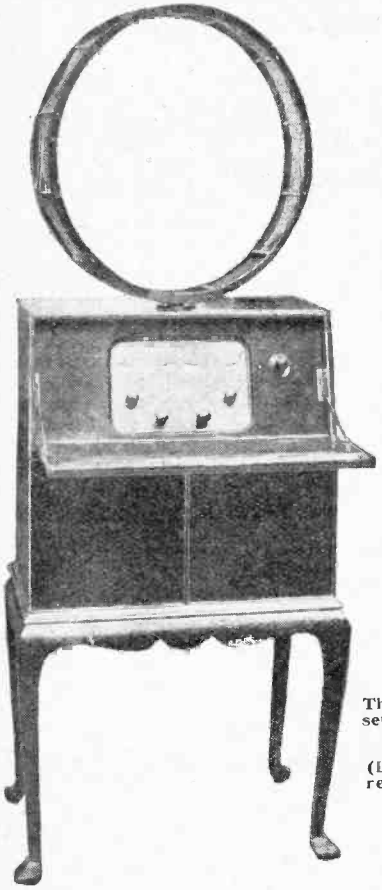
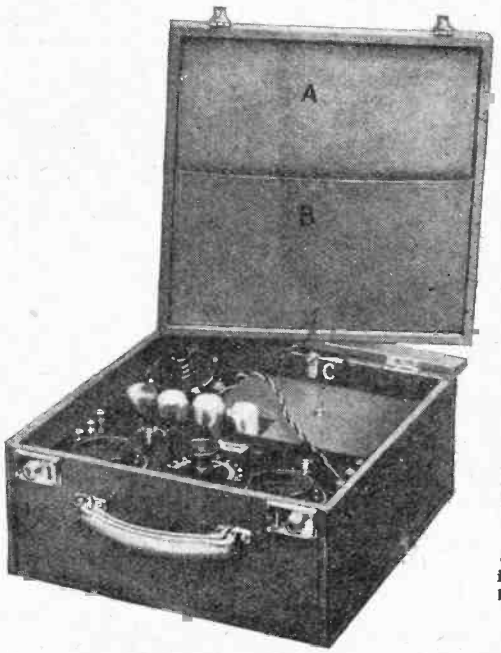
A FOUR-VALVE PORTABLE.

The Rees-Mace Co., who were early in the field as manufacturers of self-contained broadcast receivers, now produce a range of four models, having 2, 3, 4 and 7 valves respectively.

The four-valve set has the conventional combination of one H.F. amplifier, with detector and two L.F. stages. It is stated to be automatically stable, due probably to a reversed reaction effect between the frame and H.F. coil, or to some incidental damping. A tuned anode coupling is employed, with capacity reaction from the plate of the detector valve.





The "Rayol" self-contained set, with pivoted frame and folding loud-speaker.

(Left) The A.J.S. 7-valve receiver with hoop-shaped frame aerial.

A double-cone loud-speaker of special design, together with a 108-volt high-tension and a grid bias battery are enclosed in the case. For the reception of Daventry, a very large fixed condenser, of 0.002 or 0.003 mfd., is connected across the frame by a switch, the movement of which makes the appropriate changes to the H.F. inter-valve coupling coil. An unspillable accumulator is fitted, and a fuse is inserted in the H.T. lead to protect the valves and the battery itself.

An open aerial and an external loud-speaker may be used with this set when desired.

Stand No. 248.—Rees-Mace Manufacturing Co., Ltd., 39a, Welbeck Street, London, W.1.

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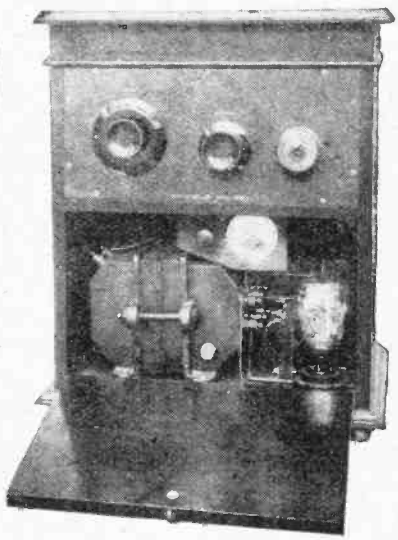
THE A.J.S. SUPERHETERODYNE.

A. J. Stevens and Co., Ltd., are showing a range of receivers, including 2-, 3-, 5-, and 7-valve models, of novel construction and excellent appearance. The apparatus is enclosed in a dark-finished mahogany cabinet of praiseworthy workmanship and pleasing design, without any exposed insulating panel. Instead, a small metal panel is let into the woodwork, and in it slots are cut to expose a small segment of a rotary scale attached to the tuning devices, which are actuated by small knobs at the bottom of the panel. A second segment on the blank half of each scale is exposed by another slot, and on it can be marked in pencil the settings for various stations. This feature is common to all the different types of receivers. The 5- and 7-valve sets are also supplied in bureau cabinets, with space under the instrument for accommodation of the batteries.

The seven-valve model is a superheterodyne having two detectors, a separate oscillator, and two stages each of intermediate and low-frequency amplification. For the long waves, a separate frame aerial is needed, the necessary changes to the oscillator coils being effected by a switch.

Amplification is increased by the application of reaction (capacity-controlled) on to the frame, and the sensitiveness of the I.F. amplifier is controlled by decreasing through a potentiometer the positive bias impressed on the grids.



Gambrell 2-valve A.C. mains set. This is probably the first receiving set to be produced in which filament heating current is derived directly from the mains.

The frame aerial supplied with the set is of good construction and novel design. This component, hitherto, has not been a thing of beauty, but no fault can be found with the A.J.S. loop on this score.

Stand No. 116.—A. J. Stevens & Co. (1914), Ltd., 122-124, Charing Cross Road, London, W.C.2.

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THE "RAYOL" ALL-PURPOSE RECEIVER.

This instrument, which possesses several novel features, has a total of four valves—H.F., detector and 2 L.F., with reflex feed-back to the first valve. The frame aerial, which is enclosed in what is normally the lid of the case, is pivoted when opened, and can be swung in any direction without moving the receiver itself. This is a distinct advantage, as it is inconvenient, as a rule, to rotate the set bodily, as is necessary, of course, when the frame is built into its containing case. An automatic switch is controlled by the lid and breaks the low-tension circuit when it is closed.

The horn of the loud-speaker is collapsible and is constructed of rubberised material. When not in use it folds up, and is stowed in a pocket fitted to the lid. An Amplion unit is mounted in the case, behind the valves and beside the battery compartment.

A form of balanced high-frequency amplification is used, reaction effects being obtained by partial unbalancing of the circuit—a very practical method. There are two frame aerials in the lid; these are placed in circuit by a selector switch which simultaneously changes over the high-frequency coupling coils. On the L.F. side there is one transformer-coupled and one resistance-coupled stage, in the order named.

Show Review.—

Provision is made for cutting out one L.F. stage by means of a switch.

Stand No. 12.—Engineering Works (General and Electrical), Ltd., 7, and 8, Great Winchester Street, London, E.C.2.

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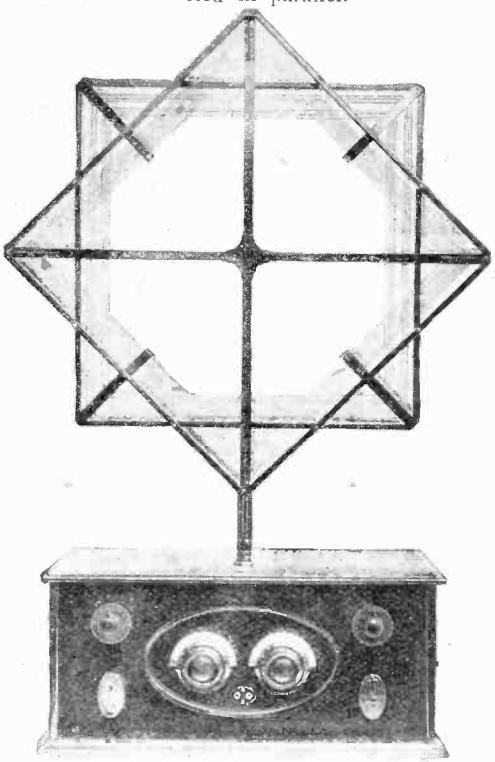
A HOSPITAL SET.

The Oxford Wireless Co., Ltd., specialise in the equipment of hospitals with wireless apparatus, and have carried out over 100 installations of this description during the past year. They are exhibiting one of their standard sets, which comprises a direct-coupled aerial circuit with a series fixed condenser to reduce damping, a tuned anode-coupled H.F. amplifier with a "bottom band" detector, and transformer and choke-coupled L.F. valves. The output from this latter valve, which is a DE5A, feeds a bank of 50 phones, for which a resistance-operated volume control is fitted.

There are further resistance and choke-coupled L.F. stages for feeding loud-speakers or other banks of phones.

A rather unusual form of reaction control is fitted, and is interesting because it can be assumed that experience has shown it to be the most suitable for this type of set, where extreme reliability and simplicity are essential. The reaction coil is fixed both as regards inductance and its position relative to the coil with which it is coupled, sufficient damping to prevent oscillation being obtained by adjustment of a Marconiphone variable resistance connected in parallel.



The Ethodyne 7-valve superheterodyne receiver. Several modifications have recently been introduced including the use of a double winding on the frame aerials for eliminating long wave Morse interference.

The same firm have recently placed on the market an inter-valve L.F. transformer of their own manufacture, of large size and apparently robust construction. It is enclosed in a shielding cover of solid nickel.

Stand No. 112.—The Oxford Wireless Telephony Co., Ltd., 22-29, Queen Street, Oxford.

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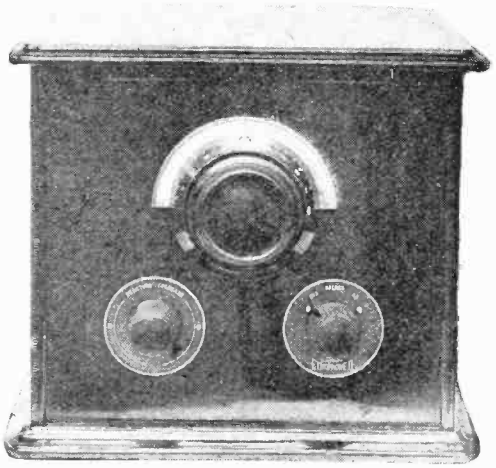
THE "UTILITY" RECEIVER.

Wilkins and Wright, Ltd., the manufacturers of the "Utility" switches and other components, have now commenced the manufacture of complete sets and are producing three- and four-valve models of interesting design. The former instrument, which is intended purely for reception of the local station and Daventry, is unusual inasmuch as it has an "untuned" coupled aerial circuit without any form of reaction.



The new Ethodyne-Two has a single tuning control, and a wide wavelength range is obtained by means of plug-in coils. It is fitted with the new Burndept geared dial

The utmost possible simplicity is evidently aimed at, and this object is well achieved, together with a very attractive appearance. The front of the cabinet is of wood, with a small circular panel on which are mounted a tuning condenser and a three-position switch giving "Off," "Local Station," and "Daventry." This switch, of course, inserts extra inductance in both aerial and closed circuits when on the long-wave position. In spite of its simplicity and the fact that there is no reaction to sharpen up the tuning, the makers state that the set is sufficiently selective to eliminate Birmingham and receive Daventry at a distance of a quarter of a mile from the former station.

Stand No. 74.—Wilkins & Wright, Ltd., Kenyon Street, Birmingham.

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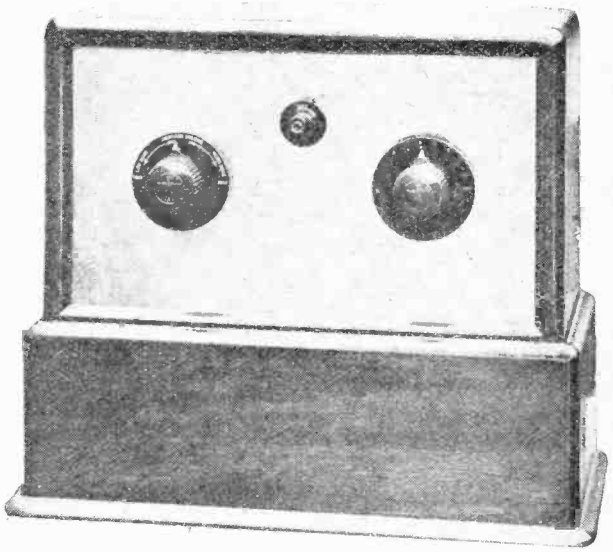
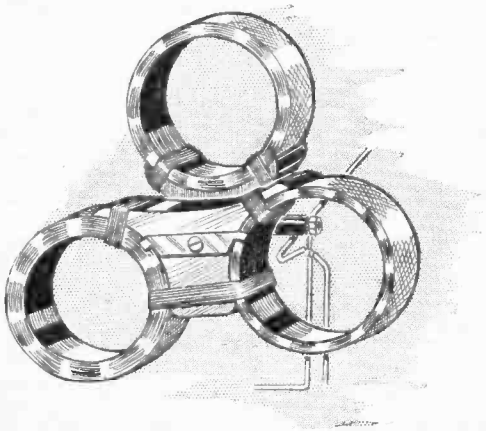


A new departure in receiver construction is the use of a brass front panel In addition, a wave change switch is combined in the reaction coupling adjustment of the B.S.A. 2-valve set.

Show Review.—

A.C. MAINS RECEIVER.

The first set to be produced in this country in which filament heating as well as anode current supply is derived from alternating current mains is shown by Gambrell Bros., Ltd. Battery eliminators have been devised for filament heating, but in such cases it has been the practice to float an accumulator across the leads carrying the rectified filament supply or make use of two filament heating batteries arranged so that when one is being "trickle" charged the other is connected through to the set.

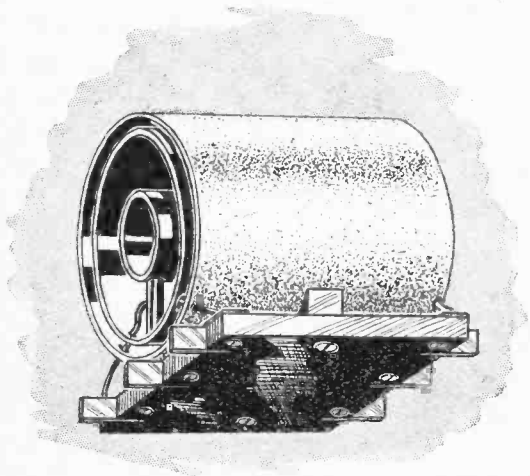


Details of the tuning unit incorporated in the B.S.A. two-valve set.

In the Gambrell sets all filaments are series connected and heated directly with rectified current. Full wave rectification is employed, and the valve, a U5, furnishes also the plate current as well as the grid biasing potential. The filament heating current required is 60 mA., the detector valve being a B5 with a 3-volt filament, and the amplifiers are B7 type with 6-volt filaments. As to H.T., two voltage outputs are produced, 40 volts for the detector and up to 130 volts for the amplifiers. Two-, three- and four-valve sets are constructed on this principle, the rectifying equipment being the same in each case and accommodated in the lower half of a two-section cabinet.

Tuning is carried out by interchangeable Gambrell coils. The three-valve model includes an H.F. stage, and stabilising is carried out in the usual way by means of centre tapped coil. Self-oscillation is controlled by adjusting the stabilising condenser.

Stand No. 90.—Gambrell Bros., Ltd., Merton Road, Southfields, London, S.W.18.



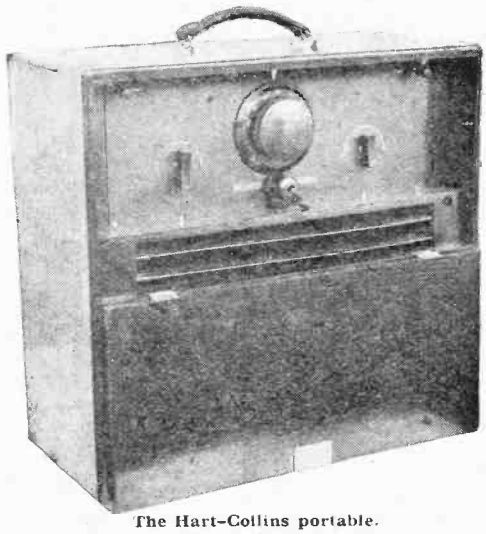
The construction of the oscillator unit included in the B.S.A. superheterodyne receiver.

THE ETHODYNE.

The superheterodyne receiver of Burndept Wireless, Ltd., has undergone several minor modifications since last year's Exhibition. It is now rather more compact, the length of the front having been reduced by a few inches, the vernier dials are of new design, whilst in the frame aerial an additional inductance is arranged to eliminate the long-wave pick-up effect on the wave band of the intermediate amplifier. Separate frames are employed for the 200-500 and for the longer-wave high-power stations such as Daventry and Radio Paris.

The train of valves comprises oscillator, detector, two intermediate, second detector, and two low-frequency stages. The intermediate transformers are of the iron core type and are wound with a primary-to-secondary turns ratio of about 1 to 4. They are used in conjunction with Burndept type valves HL.512. By adjusting the core they are carefully regulated to wavelength, and are completely screened by means of cylindrical brass cases. These transformers are now included in the range of Burndept components. The intermediate wavelength is about 6,000 metres. The detector valves are both anode rectifiers. In the L.F. amplifier the first stage is resistance coupled, and a switch is provided for throwing this out of circuit. In addition to this switch, other controls are arranged for regulating reaction, and a potentiometer governs the intermediate amplifier.

The set is unique in its appearance, being fitted with polished mahogany front panel and attractive chemically engraved scales. The cabinet-making is superb, and the instrument is capable of the very best performance, giving good-quality loud-speaker reproduction on the most distant stations.



The Hart-Collins portable.

The new Burndept set for the home constructor is the "All wave" superheterodyne, designed to be tunable from 50 to 3,000 metres, and can be used either with a frame or elevated aerial. It is not offered as a complete set of components, but a detailed booklet is supplied giving full constructional information so that the reader can introduce modifications to suit his requirements. The circuit system is similar to the Ethodyne, though interchangeable coils are used for tuning.

"ETHODYNE-TWO."

This is a standard receiving set of high-class construction, consisting of detector valve and note magnifier and a tuning range of 200 to 650 metres, though additional tuning coils are easily substituted to cover the wave band 900 to 3,000 metres. It has a single tuning dial which is the new Burndept "Ethovernier," having an 18 to 1 gear ratio. This dial is new and is fitted with absolutely noiseless friction drive, completely free from backlash. The moving parts are "floating," and consequently self-compensating for wear. The large-diameter milled knob for quick adjustment is undoubtedly better than the small knobs so often seen for obtaining a speedy adjustment with accuracy. The engraved scale is stationary, and the pointer is of original design.

Show Review.—

Two other controls consist of a small knob to vary the position of the reaction coil, and a master switch which in the "off" position disconnects all batteries. A Marconi "Ideal" inter-valve transformer is used to couple the two valves. All terminals are mounted on the back of the instrument.

Stand No. 140.—Burndept Wireless, Ltd., Eastnor House, Blackheath, London, S.E.3.

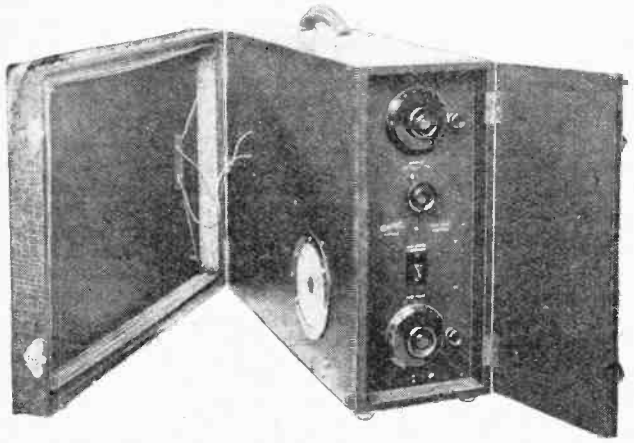
The Alphian station tuner. A heterodyne wavemeter for use in broadcast reception.

B.S.A. TWO-VALVE SET.

New features include the use of a brass front panel finished with a purple tinted lacquer, a novel system of wave change combined with reaction control and the obtaining of grid bias by the potential drop across a resistance connected between the H.T. and L.T. batteries. In the process of swinging the tuning coils to adjust the reaction coupling an automatic change-over switch is brought into operation so as to switch from the broadcast band of 275 to 500 metres to a higher band which includes 1,600 metres. In addition to this control on the front of the instrument there is a tuning condenser knob and an "on" and "off" switch. The front of the instrument presents a particularly "clean" appearance, and to the non-technical user the set is easy to operate and devoid of bewildering controls.

There is also a B.S.A. three-valve set incorporating two L.F. stages, while a four-valve set includes a high-frequency stage. Of particular interest, however, is the B.S.A. Universal seven-valve set, which is a superheterodyne. In addition to its metal front the interior is divided up by aluminium plates into a number of completely screened sections. It is apparent that the design has been developed by Standard Telephones (until recently known as the Western Electric Co.), and is a modification of the well-known Western Electric superheterodyne.

Stand No. 163.—B.S.A. Radio, Ltd., Small Heath, Birmingham.



The Chakophone eight-valve portable superheterodyne, which is completely self-contained and gives 20 hours' service for each charge of the accumulator.

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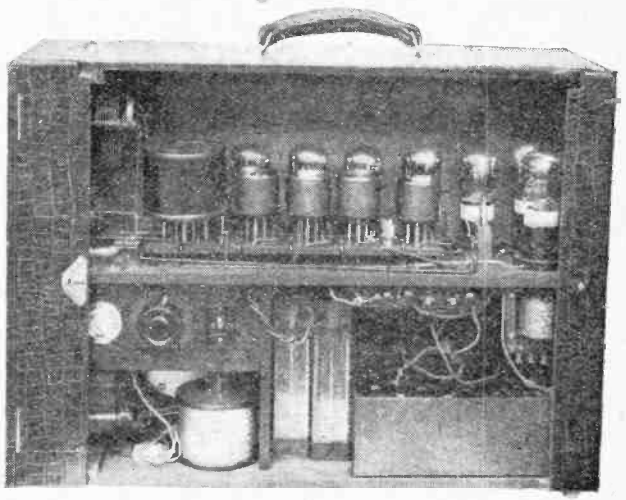
ALPHIAN WAVEMETER.

The usefulness of a heterodyne wavemeter as an aid to tuning is not generally appreciated by the listening public, and with the increasing use of multi-valve sets—evidenced at the Exhibition—a good deal of dial swinging interference would be avoided if sets were tuned not by search but by adjusting to a local wavemeter oscillator. Alphian Wireless, Ltd., although producing essentially a series of 3-, 4 and 5-valve portables, manufacture also a heterodyne wavemeter. It is enclosed in a cabinet which houses the H.T. and L.T. batteries, and a simple form of voltmeter is fitted to indicate filament potential.



Interior view of Chakophone superheterodyne.

Another interesting set is the Alphian Public Address unit. It is an entirely portable outfit, including all necessary batteries, and makes use of two amplifying stages with P.M.4 type valves. Two controls are provided, one a filament rheostat, the filament potential being indicated on a small voltmeter, the other, styled a "tone control," regulates the output. The purpose of an instrument of this kind is obvious, though the manufacturers introduce the novel application of using it as an adjunct to office or works organisation for the purpose of relaying instructions by means of internal wiring and loud-speakers.

Stand No. 60.—Alphian Wireless, Ltd., 99, Mortimer Street, Regent Street, London, W.1.

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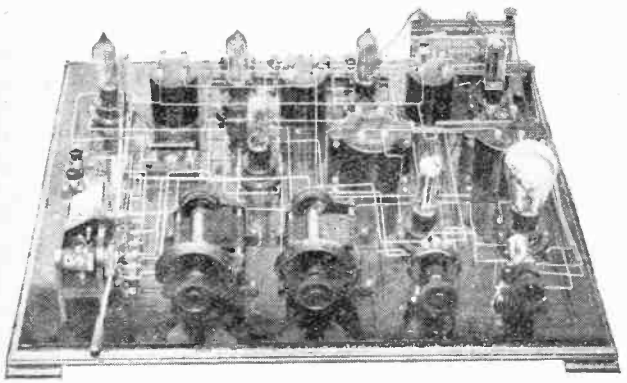
CHAKOPHONE PORTABLE SUPERHETERODYNE.

With separate oscillator and first detector valves, three intermediate amplifiers, and two low-frequency stages, eight valves in all are used. In circuit principle the arrangement follows orthodox practice, though a point of interest is the use of iron-cored H.F. coupling transformers. The wave ranges covered are 280 to 540 metres and 1,400 to 1,800 metres, the longer wave range being obtained by loading the frame and plugging in a long wave oscillator. By removing one of the side panels the apparatus and batteries are exposed and access is gained to a master filament rheostat, a small double-range voltmeter, and voltmeter switch. A narrow recessed panel carries the controls,

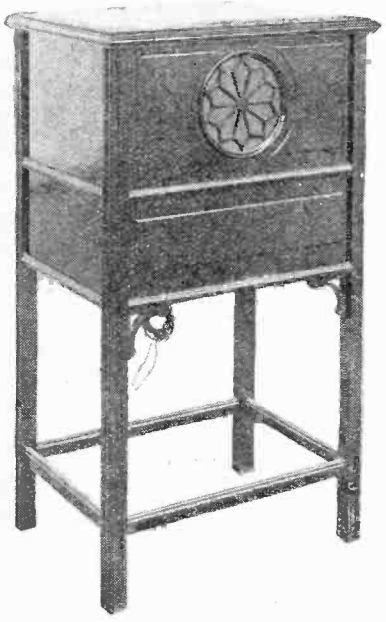
Show Review.—

consisting of the two tuning dials, volume control (potentiometer), and a lever type on-and-off switch. The loud-speaker, a Beco, is recessed in one of the sides, and when the set is closed this is covered by the flap carrying the frame aerial winding. Two leads only are brought from the frame. All



The baseboard layout adopted by the Marconiphone Company in their series of sets for the home constructor. This seven-valve superheterodyne has two intermediate amplifying stages with iron core couplings. An air core filter circuit is not employed.

the intermediate couplings are fitted with plug-in connectors; the precaution is taken of providing a fuse in the H.T. battery leads, for a transformer incorrectly inserted would cross-connect the H.T. and L.T. batteries. In order that the correct H.T. working potentials may be maintained, a second scale on the voltmeter is applied to any part of the battery by means of wander plugs. Anode rectification is used for both valve detectors. The receiver, which is entirely self-contained, measures 22in. × 8¾in. × 16in., and stands on its narrow side and



The new B.T.H. loud-speaker fitted with a moving coil action and an almost free-edge cone diaphragm.

weighs about 40 lbs., all in. It is covered with brown morocco leather. On one charge of the accumulator the set can be run for about 20 hours continuously, whilst it is stated that the H.T. battery should give from two to three months' service.

The oscillator coupler, together with filter and intermediate coupling transformers, are supplied separately, mounted upon an ebonite baseboard fitted with interchangeable pin connectors and operating on a wavelength of approximately 4,000 metres.

Among other sets manufactured by the Eagle Engineering Co. might be mentioned the H.F. amplifier which, as a complete unit, is designed for adding in front of a detector valve set. The aerial circuit of the set then becomes a tuned intervalve coupling, still retaining its position in the grid circuit, the H.T. supply being fed through a choke coil which is fitted in the external H.F. amplifier. The amplifier has a vertical panel and is fitted with a tapped tuning coil as well as a variable condenser. These, of course, tune the aerial circuit. Self-oscillation is controlled by means of a potentiometer. The tuning range is 250 to 2,000 metres.

Stand No. 55.—Eagle Engineering Co., Ltd., Eagle Works, Warwick.

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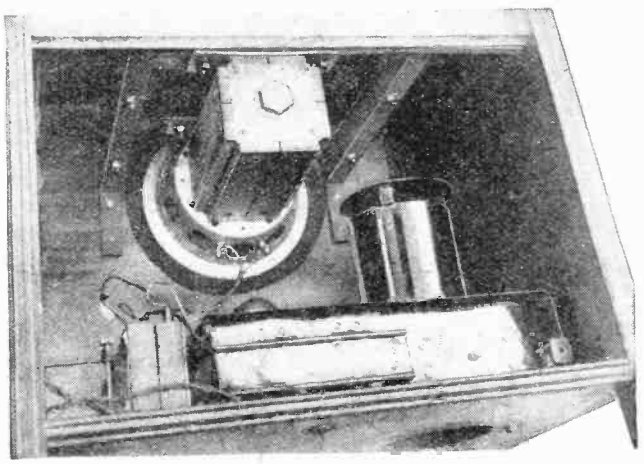
MARCONI SETS FOR HOME CONSTRUCTION.

In catering for the requirements of the home constructor the Marconiphone Co. is not only offering a very comprehensive range of components but is issuing a booklet giving circuit and complete constructional details for building sets making use of the components described. The superheterodyne receiver in this series of home-constructor sets is a seven-valve arrangement with separate oscillator and detector valves, two intermediate amplifiers, and two transformer-coupled L.F. stages. Cumulative grid rectification is employed in the case of the first detector and anode-bend rectification in the second. An interesting point is that the filaments of the first six valves are series-connected in pairs, using 3-volt valves with a 6-volt accumulator. The pick-up coil in the grid circuit of the first



Interior of the B.T.H. loud-speaker. Eight large bar magnets produce the permanent field. The amplifier is incorporated in the loud-speaker and is operated entirely from A.C. or D.C. mains.

detector and the two coils forming the oscillator are plug-in inductances carried in a three-coil holder. The circuit shown in the constructional booklet reveals that it is not considered necessary to use a tapped frame for the purpose of providing reaction, while actually there is no filter circuit, the three intervalve coupling transformers being suitably designed as to selectivity. In regard to the supersonic transformers, these are of the iron core type, the steel stamping being less than 0.003in. in thickness. The frequency is approximately 43,000 cycles (nearly 7,000 metres). This set is shown with all the components assembled flat on the baseboard, though the constructor would be well recommended to slightly adapt the design so as to make use of a vertical front panel for the controls which are, by the way, all in suitable positions for this, so that by means of suitable cabinet work the receiver can be protected from mechanical damage and dust.

In this series, also, there is a very simple two-valve set which can be easily made up and the user has the satisfaction of knowing that his set, which is quite inexpensive, is built with reliable components, while if it is desired to build a set for use with any particular cabinet these outfits are essentially suitable.

Included in the series is an H.T. battery eliminator for working from A.C. mains, and it is interesting to note that

Show Review.—

the rectified output from a U.5 type valve after passing the filter circuit is shunted by two 8-candle power metal filament lamps in order to produce the required two-voltage outputs.

Stand No. 125.—Marconiphone Co., Ltd., 210/212, Tottenham Court Road, London, W.1.

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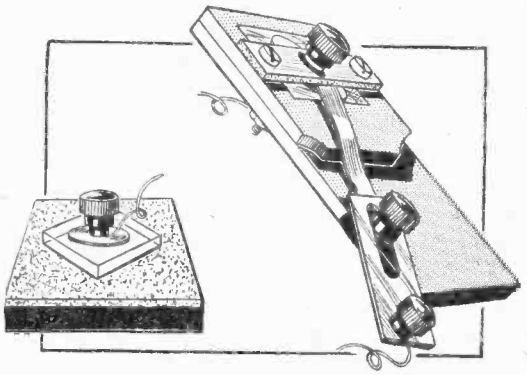
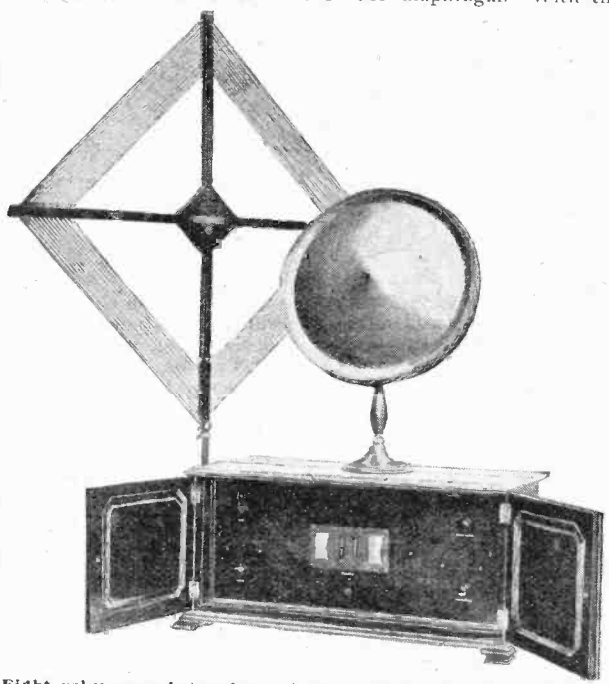
A LOUD-SPEAKER DEVELOPMENT.

The principle of using a moving coil in a magnetic field is not new in loud-speaker construction, but the principal objection to this system has been the need for providing the polarising current for the permanent field and thus creating an extra drain on the current supply from the batteries. It must be remembered that a moving coil free to move in a field can impart a considerable amplitude to a diaphragm to which it is attached when fed with pulsating currents such as are available at the output terminals of an amplifier. The new B.T.H. loud-speaker model R.K. is of the moving coil type; the diaphragm is conical and very lightly supported at the edges. It is understood that an airtight barrier is, however, fitted around the edge to prevent interaction between the sound waves emitted from both sides of the diaphragm. With this same purpose in view the diaphragm is set up in the centre of a large cabinet, the entire front board preventing this form of interaction, which would produce a considerable reduction in the volume of the sound produced. The polarising field is set up by four pairs of bar magnets, roughly 8in. in length by 1¼in. wide and nearly ½in. in thickness and arranged in pairs. An original feature, also, is that of incorporating a power amplifier in the loud-speaker cabinet, and by this means the last valve in its associated circuits can be definitely designed to match the loud-speaker winding. The valves used in the amplifier are the new B.T.H. power amplifiers, type B.11, which are specially designed to handle strong signals without causing distortion.

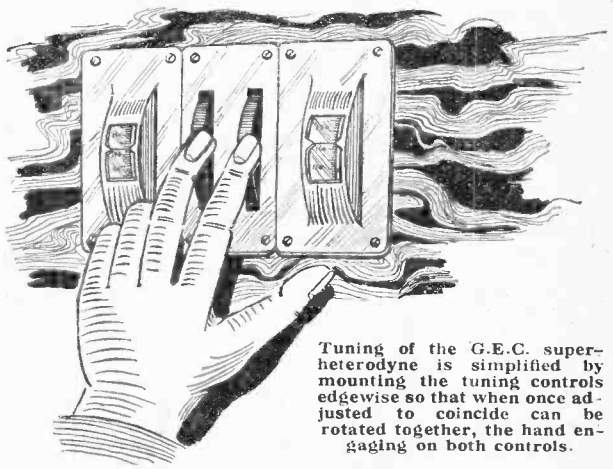


A simple method of mounting a piece of quartz for use in a crystal-controlled oscillator. This is being demonstrated by Mr. Hinderlich on Stand No. 203.



Eight-valve superheterodyne of the General Electric Company. A wave range of 300 to 3,000 metres is covered by the operation of a switch in conjunction with the tuning dials.

Another important feature is that filament and anode current and grid biasing potentials are all obtained from the electric lighting mains, and the equipment is supplied to operate from either alternating or direct current. A two-valve full-wave rectifier is embodied for operation from A.C. mains, but where a D.C. supply is available a smoothing and voltage-controlling circuit is included in the equipment. The cabinet is of polished mahogany and presents a handsome appearance. This loud-speaker should be capable of giving faithful reproduction and at the same time of handling a big output, projecting the sound in a manner that will obviate much of the sound-wave interference effect so often experienced. It has no batteries and only one control.



Tuning of the G.E.C. superheterodyne is simplified by mounting the tuning controls edgewise so that when once adjusted to coincide can be rotated together, the hand engaging on both controls.

Stand No. 127.—The British Thomson-Houston Co., Ltd., Alma Street, Coventry.

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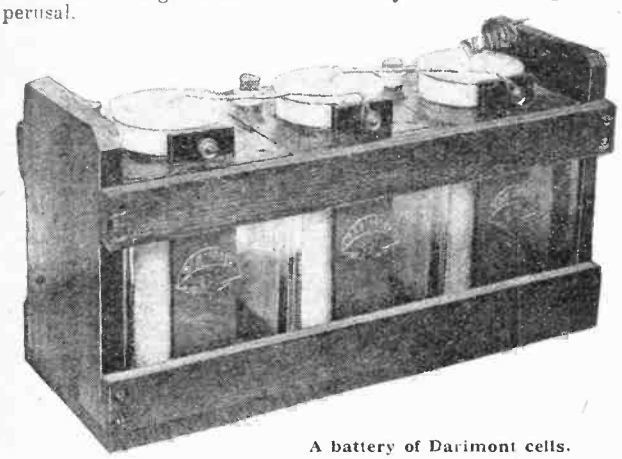
QUARTZ FOR FREQUENCY CONTROL.

To the transmitting amateur probably the most interesting exhibit in the Exhibition is the experimental quartz control oscillator shown by Mr. A. Hinderlich, M.A., who has apparently conducted considerable investigation work on the properties of quartz crystal. It has been generally thought that the specimen of quartz employed for use in an oscillator must be highly polished and free from scratches, damp, or grease, yet with good specimens Mr. Hinderlich shows that considerable liberties can be taken in these directions. It is shown that enough control is available when using a carefully selected specimen to maintain oscillation through the interelectrode capacities of the valve. The specimen, moreover, need not be homogeneous, inasmuch as a bubble or natural internal fracture appears to be the hall-mark of a good oscillator. It is in the method of mounting the crystals that the amateur is probably most interested, and the arrangement shown in the accompanying illustration, although it may appear to be somewhat crude, gives entirely satisfactory results with the demonstration oscillator. A very valuable booklet, of which Mr. Hinderlich is the author, is obtainable at the stand, and under the title "Quartz" he gives a summary of the applications of the piezo-electric effect. This book is written for the amateur, much of the information included never having been published previously. It deals with the properties of quartz, the accuracy of calibration, practical methods of quartz cutting and grind-

Show Review.—

ing, and the construction of mountings, being adapted essentially to the limited facilities of the experimenter. The calibration of oscillators is described in a practical manner, and is followed by a description, together with diagrams, of the various circuit arrangements. The book is concise and full of facts, and in view of the important developments taking place in the use of quartz control wavemeters and transmitting sets, the transmitting amateur can scarcely afford to neglect its perusal.



A battery of Darimont cells.

Specimens of quartz already prepared for use are shown at the stand, as well as samples of all the well-known crystals used for detection.

Stand No. 203.—A. Hinderlich, 1, Letchmere Road, London, N.W.2.

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G.E.C. SUPERHETERODYNE.

Although eight valves are employed, only two intermediate high-frequency stages are used, there being three choke-coupled low-frequency amplifiers. The frame aerial is centre-tapped for reaction purposes, and the wave range, which is continuous from 300 to 3,000 metres, is obtained by interchanging internal inductances by the operation of one of the control knobs, which operates a multi-contact switch of low loss design. In order that a critical control of reaction may be produced, a small degree of capacity coupling is permanently applied, a stop being fitted to the controlling condenser in such a way that its capacity cannot be reduced to an absolute minimum.

Separate oscillator and detector valves are used, the former being a D.E.8 L.F. and the latter a D.E.8 H.F. The two valves of the intermediate amplifier are D.E.8 L.F., whilst the second detector, like the first, is a D.E.8 H.F., both arranged for anode rectification, negative grid biasing being produced by a voltage drop across the resistance. In the L.F. stages, which are choke coupled, DE.5 type valves are used. The L.F. amplifier is of interesting design, the anode coils having inductance values as high as 40 henries, whilst iron core inductances are fitted in the grid circuits in place of the usual grid leak resistances. The input to the L.F. amplifier is, however, a transformer with a 1 to 4 maximum ratio volume control being effected by a number of tappings in the secondary.

It is the general disposition of the controls on the front of the instrument that will appeal to the prospective purchaser. It is well known that the two tuning dials of a superheterodyne set move almost, though not precisely, together. It is not possible, therefore, to permanently link up the two tuning condensers, giving one dial tuning, though by setting up the tuning dials edgewise they can both be rotated simultaneously, which is, perhaps, a better feature than endeavouring to tune on two separate dials using both hands. Two inspection windows reveal the condenser settings, which are shown on the edges of cylindrical scales.

Stand No. 63.—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

DARIMONT BATTERIES.

These cells would seem to have a very real field of usefulness in cases where facilities for accumulator charging do not exist. They show a good discharge curve, even on continuous load, and are easily recharged by renewing the zincs and electrolyte. The cells should be quite capable of supplying current to a three- or four-valve receiver using modern valves.

The No. 10 cell (the most popular size) has a stated maximum discharge rate of 0.7 amp., with an internal resistance of 0.6-0.75 ohm, and an ampere-hour capacity of from 40-44 over the normal working voltage range.

Stand No. 243.—Darimont Electric Batteries, Ltd., Darimont Works, Abbey Road, Park Royal, London, N.W.10.

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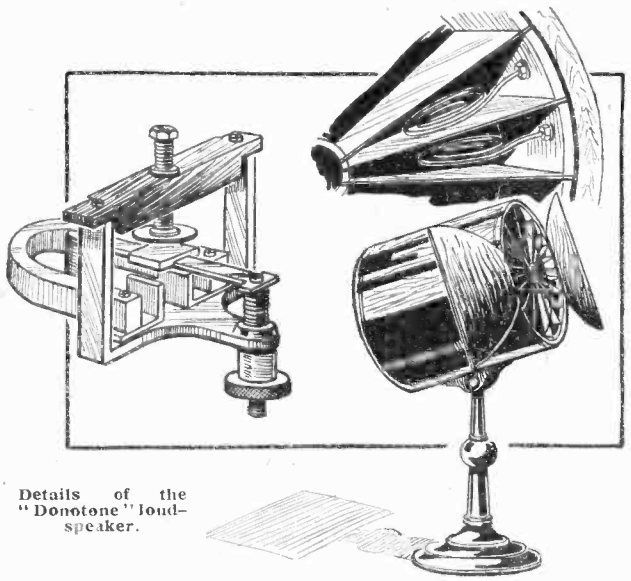
THE "DONOTONE" LOUD-SPEAKER.

This is one of the few loud-speakers at the exhibition which is of really unconventional design. An electromagnetic movement is mounted on the closed back of a cylindrical container, opened at the front. This armature drives a "free-edge" cone, which is constructed of varnished silk reinforced with cane ribs. Behind this, and mounted co-axially, are a series of smaller diaphragms, which are not visible when the large diaphragm (which has a diameter nearly as great as that of the inside of the container) is in position.

A series of radial metal baffles are mounted round the mouth of the sound chamber, and between each pair is fitted a spiral steel spring, free at one end.



Details of the "Donotone" loud-speaker.

The makers state that they have carried out audibility tests with the aid of a constant-voltage oscillator, and have found the loud-speaker to be capable of reproducing notes corresponding to frequencies ranging from 90 to 8,000 cycles.

Stand No. 236.—The Donotone (Regd.) Loud-Speakers, Sentinel House, Southampton Row, London, W.C.1.

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THE AMPLION VALVES.

The makers of the Amplion loud-speakers are now marketing a range of valves constructed on the efficient "short path" principle (that overworked word "efficient" is used here in what would seem to be its correct sense as applied to valves).

Of special interest is the type A.M.S. 6/100, which is stated to have an internal A.C. resistance of the extraordinarily low figure of 1,000 ohms, with a voltage amplification factor of 2.5. Its filament takes 1 amp. at 5.5 volts.

Stands Nos. 131, 132.—Alfred Graham & Co., St. Andrew's Works, Crofton Park, S.E.4.

ABROAD WITH A PORTABLE.

How Customs Duties Affect the Wireless Tourist.

IN the old days an Englishman meditating upon a trip to the "Continong" generally made out a list of essential articles of luggage—he forgot most of them when the day arrived—and, as a final, reckless touch, added his camera. He was then ready to start.

This summer not a few people have found that for a Continental holiday the camera has a rival for supremacy in the portable wireless set. On foreign soil a portable opens up enthralling possibilities. To turn on the knobs in, say, an ancient Swiss chalet and hear the usually faint stations at 2LO strength is an experience which is worth a little trouble to obtain.

Behold, therefore, the usual holiday list of shaving tackle, clothing, camera, etc., etc., surmounted by the words "portable set." So far, so good. On paper the prospects are delightful. But wait! Surely there must be a snag somewhere? There is.

Where Customs Differ.

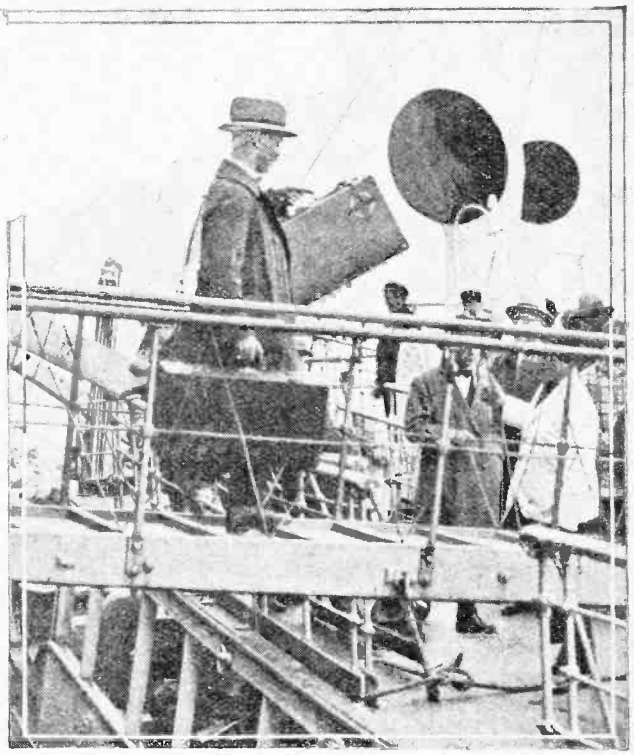
If there were strict uniformity in the Customs arrangements devised by the various European countries, the tourist could express himself in one burst of uncontrolled vocalism and thereafter hold his peace. But unfortunately each country must to some extent appear original; it would never do to exasperate the tourist by exactly the same methods at each landing place. The man who contemplates a trip with his wireless set through Belgium, Switzerland, France and Spain must, therefore, be prepared to have his temper tried on occasion, though on the whole the Customs arrangements with regard to wireless sets are by no means unfair. Perhaps some wringing of hands may be avoided if we make a brief study of the regulations obtaining in different countries.

Belgium and France.

No great inconvenience is encountered in taking a set into Belgium. There are no restrictions upon the use of a portable wireless set if the following conditions are complied with. There is a duty of 900 francs per 100 kilogrammes on wireless apparatus, but the amount of duty paid can be reclaimed from the Customs when the same apparatus is taken out of the country provided (1) when entering the country a special declaration has been made at the Customs Office, and (2) that the Customs officials are satisfied concerning the identity of the declared article removed out of the country.

Having faithfully complied with these conditions our tourist can be left to his own devices while in Belgium; doubtless he will receive Brussels and many of the Dutch and German stations at an unprecedented strength. But what if he wishes to leave Belgium and enter France?

The French regulations are not unlike those of Belgium, i.e., special provision is made for sets temporarily



taken into the country, a deposit being necessary. A special declaration form must be filled up in duplicate at the Customs House, and the owner of the set must undertake to export the set within a year of the date of entry, otherwise he forfeits his deposit.

The ordinary Customs dues must be paid on the set when imported, but these are returnable when the set is taken out of the country. It may be mentioned that the repayment is made at another Customs office than that in which imported apparatus is dealt with.

Switzerland and Spain.

Let us now follow our friend to Switzerland, a country which will afford him an excellent central position for listening to stations all over Europe.

Enquiry at the Swiss Legation in London provides us with the following information. In the first place our traveller will have to place an application with the "Direction Générale des Télégraphes et des Téléphones" at Berne. The application must contain these details:—

Full Name.
Exact Address.
Date of Birth.
Nationality.
Date of arrival in Switzerland.
Date of intended departure.
If possible, route and places of residence in Switzerland.

If permission has not been previously obtained the tourist will be required to deposit a certain sum of money at the Swiss frontier when entering the country.

There is also a small Customs Duty to be paid on sets entering the country, but this amount is refunded if the

Abroad with a Portable.—

set is taken back to England within three months. In order to save unnecessary trouble the tourist, when paying the duty, should ask for a "passavant" which will enable him to get his money back quickly when he leaves Switzerland.

Assuming that he has remembered his "passavant" and secured the safe return of his cash, let us see our friend to Spain, where a score of broadcasting stations are eagerly waiting to pour their song into his receptive ear.

There are no restrictions in Spain on portable receivers. The ordinary duty of two pesetas gold (about 1s. 8d.) per kilogramme net weight is payable and a certificate of origin is required. Whether our friend stands a chance of having his money returned when he leaves the country is not made clear by the Spanish Consul-General in London.

It will be seen that there is really no terrible hardship to be undergone in order to enjoy the delights of Continental touring with a portable. But amid all the excitement of preparation, the filling up of forms, the anticipation of difficulties and the catching of trains, don't forget the set.

A NIGHT AT OLYMPIA.

PERKINS, who sometimes breaks out into allegory, blew a couple of smoke rings and said: "The Radio Exhibition is like a beautiful woman. It fascinates, but all the time you feel it would be better for your peace of mind if you steered clear of it."

"But *you* went, didn't you, Perkins?"

"I did. And I persuaded Smith, who had never done me any harm, to accompany me. If we popped in for half an hour, I said, he would find just the loud-speaker he'd been searching for. Personally, I was in quest of a good L.F. transformer.

"We got there at six o'clock. Everything seemed so bright and happy that we forgot our immediate needs in the hullabaloo of the moment. There were lads of the old brigade brandishing valve curves, lads of the young brigade staggering under the weight of art catalogues, jovial dads casting a wise eye on crystal sets, dignified johnnies pacing about with the air of broadcast announcers—sisters, mothers, cousins, aunts—everybody, in fact, who has ever thrilled, or hoped to thrill, at the sound of a wireless 'sig.' I think I regained mental equilibrium before Smith did.

"'Laddie,' I said, 'we've got to root out that loud-speaker.' To tell you the truth, I wanted to get Smith's business over first so that I could have the run of the show.

"'Loud-speaker? Er—yes, you're right, kid,' said Smith, 'but do look at this valve demonstration.'

"It was fascinating, I admit; when it was over I again suggested the loud-speaker. 'Righto,' said Smith, 'but we mustn't miss this television gear.'

"From the television gear we wandered on to the B.B.C. display. It was certainly a treat to watch the engineer chappy in the control room; and as for the aunties . . . well, Smith said he wished he had a broadcasting station of his own.

"'And now for the loud-speaker!' I said. 'Oh, sure!' said Smith, 'but have you seen how they grind quartz?'

"This, too, was mighty fascinating, and you could say the same of the historical exhibit, the wireless photographs stand, the unbreakable valves, and a regular riot of I don't know how many other things.

"'And now for the loud-speaker!' I exclaimed, brightly, as if the idea were fresh from the Mint. Smith was gazing absently into the roof. 'If I bought a superhet,' he mused, 'I could do without a loud-speaker for a time. Gee! Did you hear that?' I *had* heard it. It was Big Ben striking nine o'clock. 'We'd better get a move on,' I said. 'Er—what about your loud-speaker?'

"'A superhet would only need a frame aerial,' continued Smith, 'but I should be sorry to scrap my outside one. I think I'll build a reflex. By the way, why don't you try resistance-capacity coupling?'

"'H'm, I hadn't thought of that,' I murmured, feeling tired. 'Let's sit down and talk it over.'

"To cut it short, we sat down, and I listened while Smith talked about neutrodynes, superhets, single-knob control, and a hundred other things, until we suddenly found the lights going out. And there was Smith, who five hours previously had been an innocent, unsophisticated creature of retiring habits, babbling away like Tennyson's brook!

"And what about yourself, Perkins?

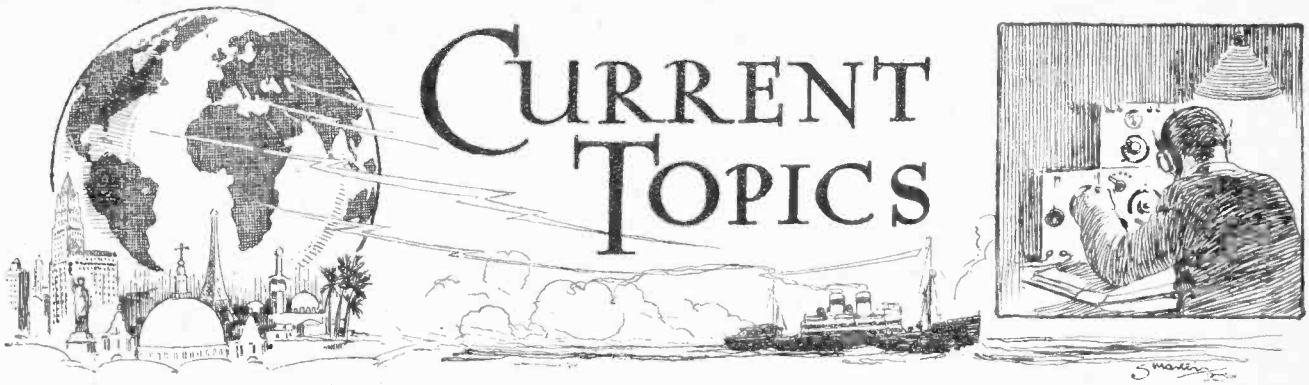
"Me? I'm a nervous wreck. I tell you, the Radio Exhibition is like a beautiful woman. It's fascinating, but . . ."

E. C. T.

AMERICAN BROADCAST RECEPTION.

ALTHOUGH usually the end of October is regarded as the opening of the American broadcast reception season in this country, yet it appears that the season is being put forward this year as the result of the remarkable improvement in receivers. Last week we received a report from a reader in South London who was so optimistic about reception with an "Everyman's 4-Valve" set which he had just built, that he decided to sit up and try his luck with America. He was gratified beyond his anticipations, for he received no less than six different American broadcasting stations on the loud-speaker between 3 and 3.30 a.m.

We wonder if other readers have had equal success, and if so we should like to have their reports. One does not usually expect success in American reception at this time of the year, the reason being generally attributed to the swamping effect of atmospherics during the warm weather.



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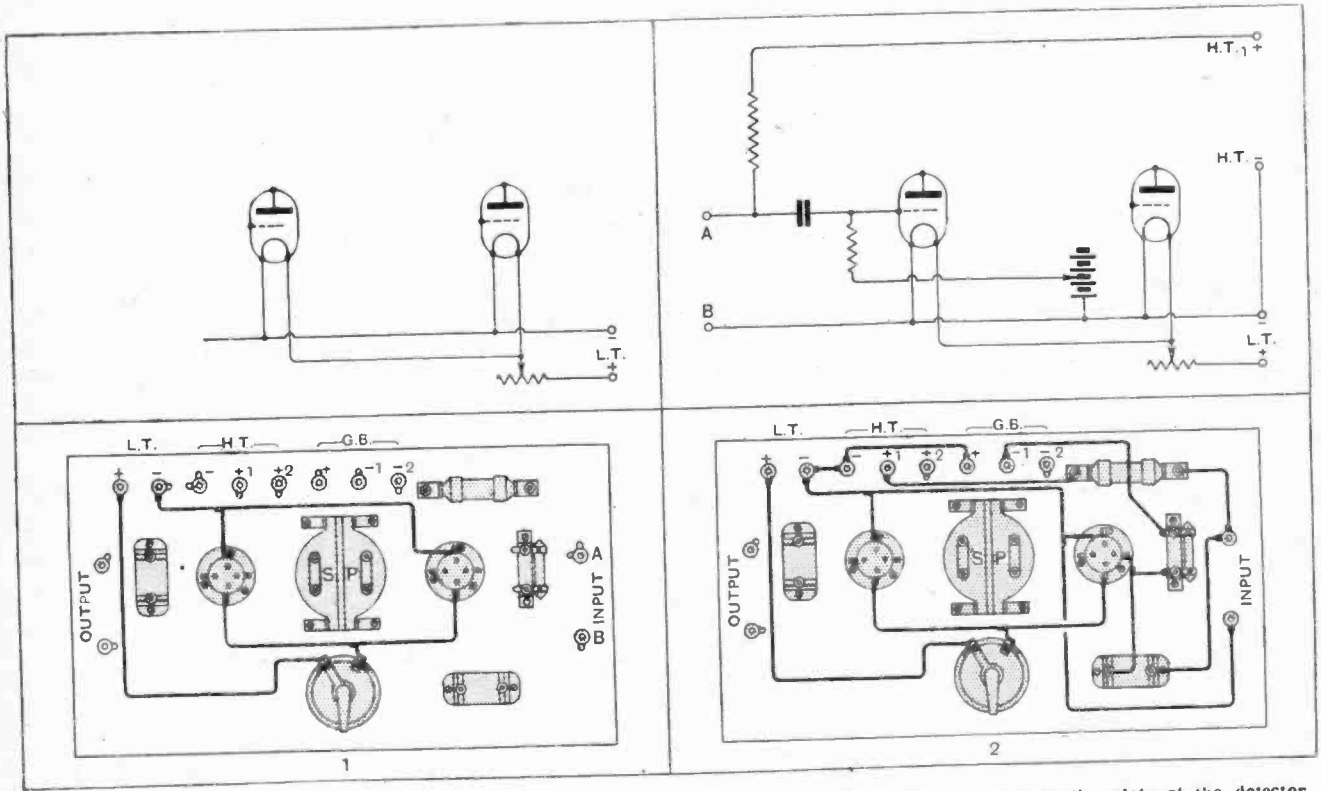

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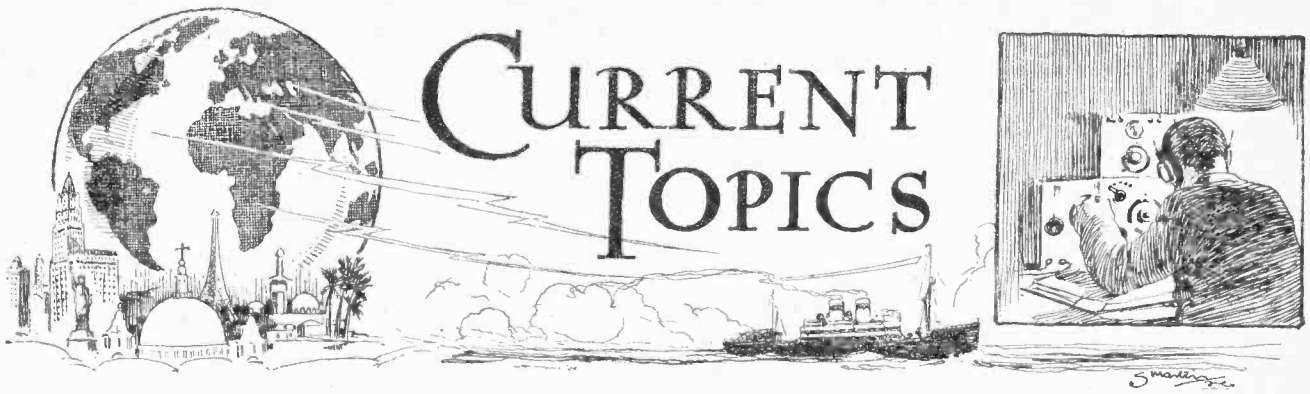
The input terminal A is connected to the plate of the detector valve, the circuit being completed through the anode resistance and H.T. battery. Voltage variations across the resistance are applied through a condenser to the grid which is biased negatively through its leak.



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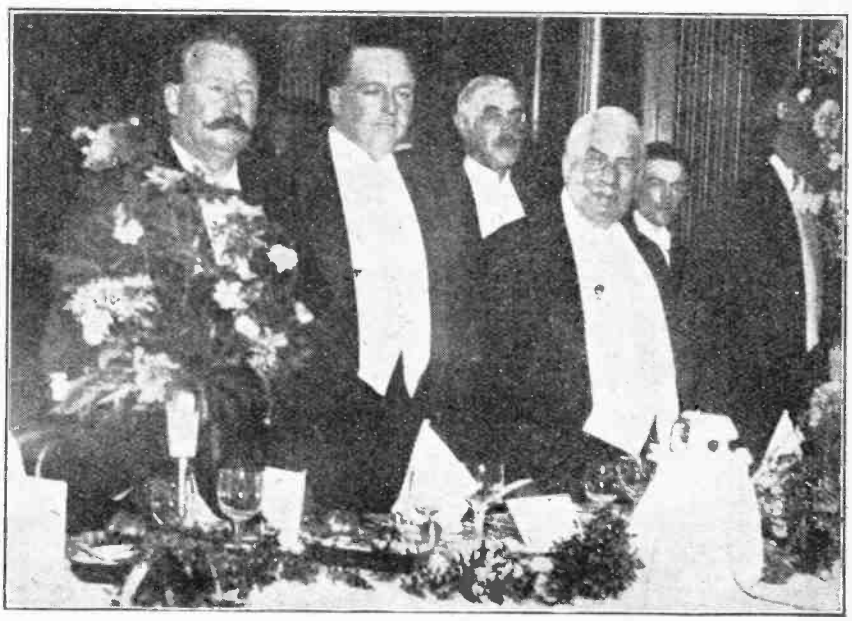

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Observers will be placed in about forty selected localities, and it is expected that with these reports and the large number expected from other listeners the engineers will have valuable data from which to draw their conclusions. The listeners are asked to compare the signal strength of the two receivers and to give their opinion of the relative reliability of the output. Listeners are also asked to indicate their preference.

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RECEPTION BY TOUCH.

An American professor has invented a telephone receiver in which a broadcast programme can be followed by using the sensitive tip of the thumb pressed against the vibrating diaphragm. A deaf man, it is said, can even follow a broadcast entertainer.

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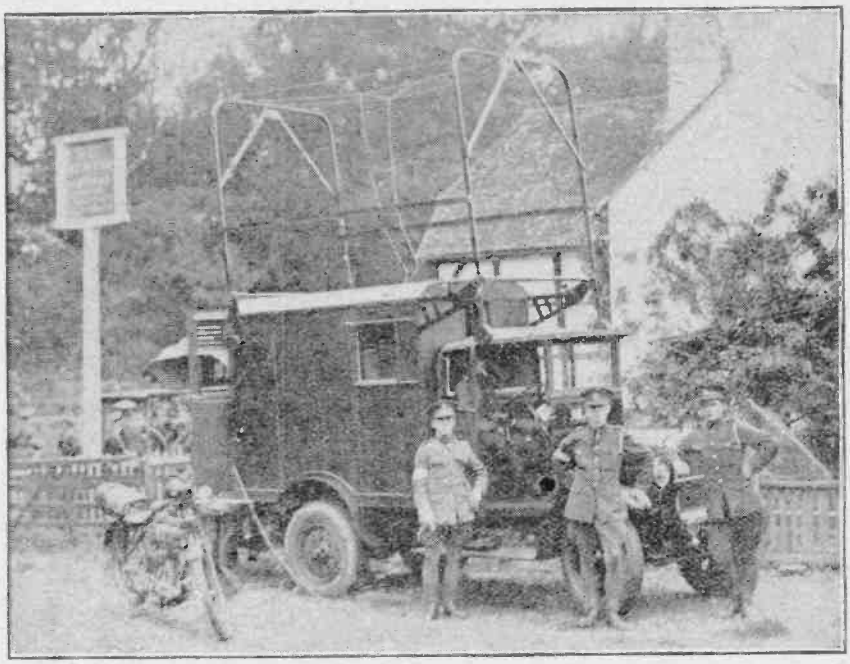
POLYTECHNIC WIRELESS COURSES.

Winter is undoubtedly the best season in which to acquire wireless knowledge. Courses in wireless and high-frequency engineering will open on Monday, September 27th, at the Polytechnic, 307-311, Regent Street, London, W.1, and will be conducted by several well-known wireless and electrical engineers.

The courses have been arranged to give the student and embryo wireless engineer a thorough training in the principles and technique of wireless and high-frequency engineering.

The reception laboratory is well equipped with all modern apparatus for experimental and instructional work, high-frequency testing and precision measurements; there is also a new transmission laboratory with a complete commercial installation for telegraphy and telephony.

Full particulars regarding enrolment can be obtained from Capt. W. H. Dale, B.Sc., at the Polytechnic, and it is advisable to make application without delay.

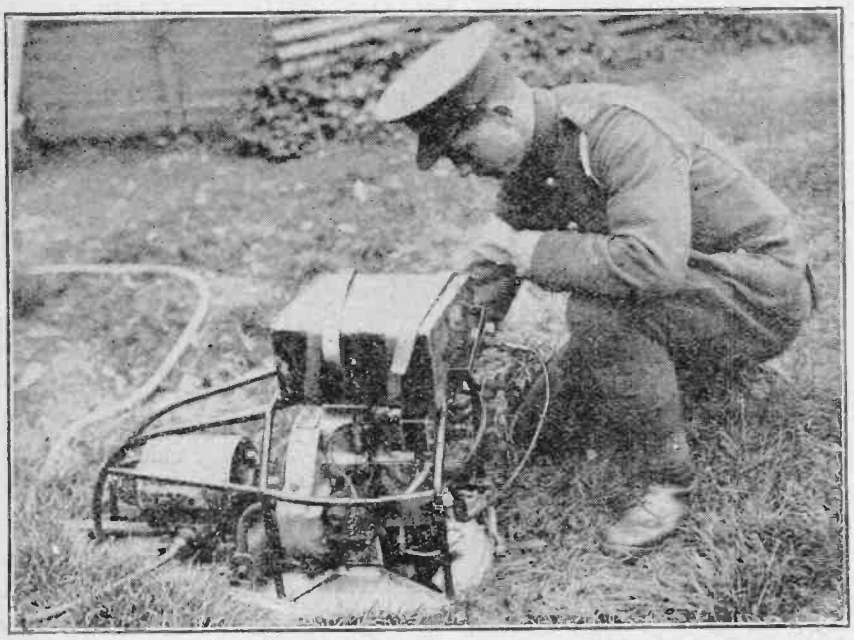


WIRELESS IN MIMIC WARFARE. A photograph taken during the recent three days "battle" in the Hampshire area, showing a mobile transmitter at headquarters, near Heckford.

IMPORTANT TRADE FUSION.

Mr. W. H. Lynas, chairman of the Society of Radio Manufacturers, announced last week the fusion of that body with the National Association of Radio Manufacturers, the new organisation to be known as the Radio Manufacturers' Association.

"The formation of the R.M.A.," said Mr. Lynas, "is a happy celebration of our joint exhibition at Olympia."



A PORTABLE GENERATOR. An interesting item of equipment seen during the Hampshire manœuvres. The generator is driven by a small 1½ h.p. petrol motor.

NEWS FROM THE CLUBS.

Signal Strength Tests in the Open.

Interesting experiments on the subject of signal strength under varying conditions were carried out during a field day held by the Lewisham and Bellingham Wireless Society at Eynesford, Kent, on August 22nd. The object of the experiments was to collect data regarding signal strength variations using bare and covered aerial wire, earth plates and counterpoises.

From the many tests carried out it appeared that, so far as the earth lead is concerned, high resistance is preferable to high capacity; in certain cases best results were obtained without any earth connection.

During the coming session the Committee hopes to arrange a comparative demonstration between two highly efficient receivers, one being a "straight" three valve set on an open aerial and the other a superheterodyne with a frame. These receivers are now under construction.

Hon. Secretary: Mr. J. H. Clark, 35, Boones Road, Lee, S.E.13.

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Wireless League at Kensington.

With reference to the notice appearing in *The Listener* for September regarding a forthcoming meeting of the Kensington branch of The Wireless League, we have been asked to state that the meeting in question is to be held on September 22nd.

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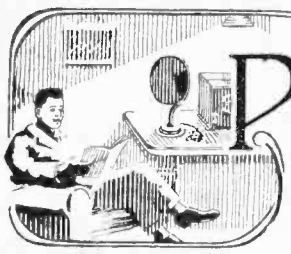
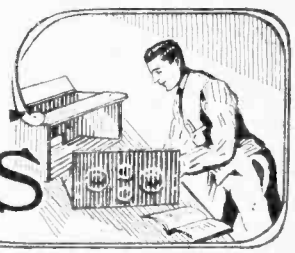
New Society for Wales.

An attempt is being made to form a new wireless society at Porth, Rhondda.

Full particulars can be obtained from Mr. D. N. James, 33, Hannah Street, Porth, Rhondda.



PRACTICAL HINTS AND TIPS



A Section Mainly for the New Reader.

ADDING H.F. TO A REFLEX SET.

A stage of high-frequency amplification can be added to a reflex receiver without any great difficulty, provided that a neutralised coupling is used and care is taken to prevent interaction between the coils. For example, in the arrangement shown in Fig. 1, which represents a good circuit of this description, it would be desirable to interpose metallic screens between the aerial-grid coil and the H.F. transformer, and also between this latter coil and the valve-to-crystal transformer. In any receiver the need for screening increases with the physical size of the coils, and it may be unnecessary when small ones are used. These, however, will not give such a high overall efficiency as will the larger and more efficient types.

The arrangement shown has three tuned circuits; if these are correctly designed, the selectivity should approach that obtainable from the standard circuit containing two balanced H.F. amplifiers and a valve detector. In fact, if the crystal is connected to a suitable point (only to be found by experiment) on the secondary of the transformer, its damping effect will be slight, and the loss of selectivity will be almost negligible under average conditions.

When making preliminary adjustments it will be as well to disconnect the crystal and to reduce the H.T. voltage applied to the second valve to a value suitable to convert it into an anode rectifier instead of a dual amplifier. Incidentally, the same effect may be produced by increasing its negative grid bias. Working under these conditions, it is easy to make any adjustments which may be necessary to the circuits associated with the first valve, which functions purely as an H.F. amplifier.

It will almost invariably be found of advantage to "earth" the low-potential end of the valve-to-crystal coupling transformer; this connection is shown in dotted lines in the diagram.

The provision of any form of reaction control, other than that obtainable by partial de-neutralisation, is quite unnecessary. It will clearly be advisable to mount both neutralising condensers, or at least that associated with the second valve, in an accessible position.

The tuning condensers may have maximum capacities of 0.0003 or 0.0005 mfd., depending on the design of the H.F. couplings, while that shunted across the secondary of the L.F. transformer should be small—in practice, about 0.0003 mfd. is suitable. The telephone by-pass condenser may be of 0.001 mfd.

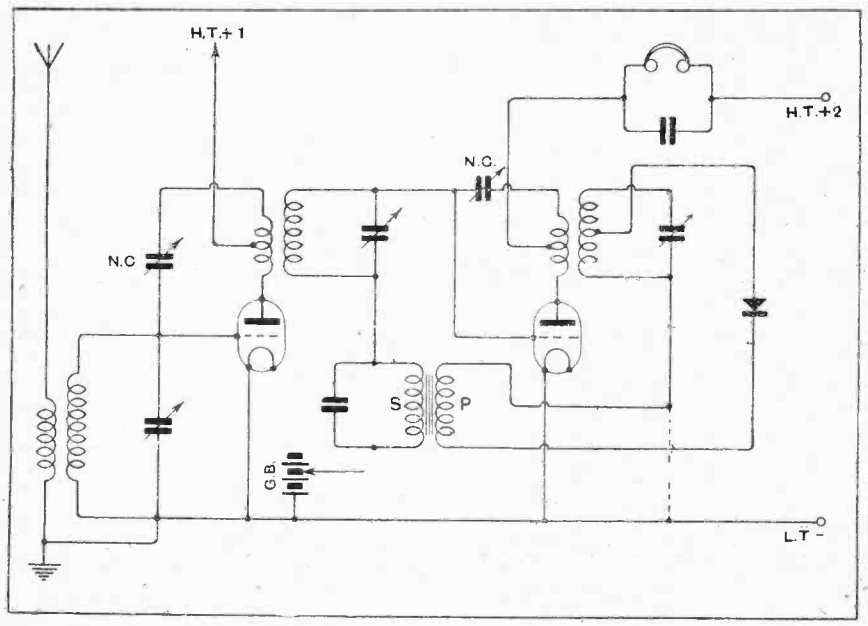


Fig. 1.—A reflex receiver with an extra stage of neutralised H.F. amplification.

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VALVE OR CRYSTAL RECTIFICATION?

A few hints as to the choice of a detector may be of assistance to those who are confused by what may seem to be conflicting statements concerning the relative merits of valve and crystal rectifiers. It will be as well, in the first place, to correct the popular misapprehension that only the crystal can give distortionless rectification. The conventional arrangement of a leaky grid condenser detecting valve can certainly account for an appreciable amount of distortion, particularly on loud signals, although it is doubtful if the distortion introduced by it can be detected unless both the L.F. amplifier and the loud-speaker represent the best modern practice. The anode rectifier, however, can give results comparable in every respect with those obtained from the crystal, although it requires a stronger signal for effective operation.

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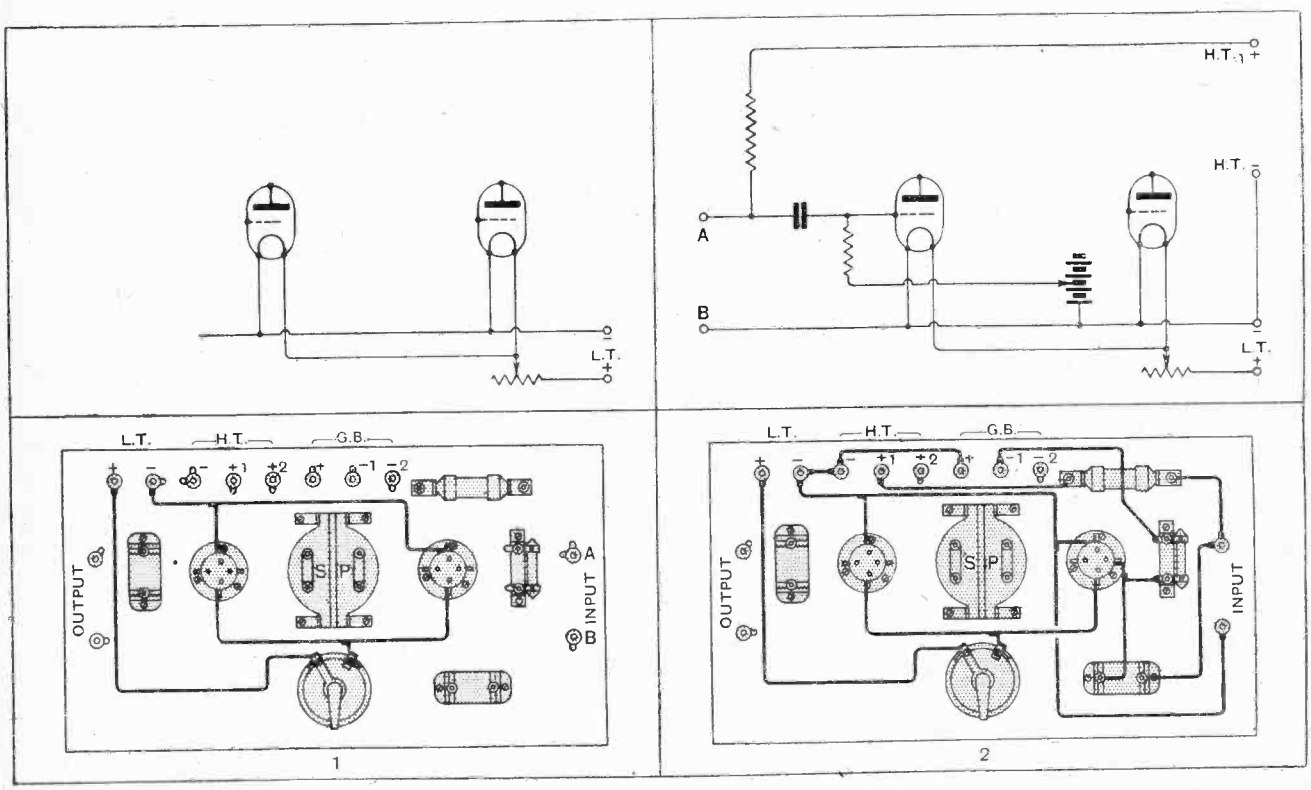

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The input terminal A is connected to the plate of the detector valve, the circuit being completed through the anode resistance and H.T. battery. Voltage variations across the resistance are applied through a condenser to the grid which is biased negatively through its leak.

WIRELESS AND THE GRAMOPHONE.

The Application of Electrical Methods to Gramophone Recording and Reproduction.

By A. DINSDALE.

AT the present time applied science is making such rapid and extensive strides that various fields, apparently widely separated, are commencing more and more to overlap. For example, who would dream that developments in the field of gramophone recording and reproduction would have an enormous effect upon the cinema performance as we know it to-day? Who would guess that the knowledge behind this development was gained from research work on the subject of telephony, and that the successful results achieved with the gramophone were arrived at by the translation of known electrical laws and formulæ into mechanical equivalents?

Such, however, are the facts, and they must serve as an excuse, if one is needed, for combining in one article descriptions of the world's two latest wonders, the perfect gramophone and "talking movies," for they are so interwoven that the one development leads naturally and logically into the other.

When radio broadcasting first commenced to revolutionise our social life, even the best of gramophones was not a highly satisfactory reproducer of music, and, with the introduction of broadcasting, many people thought that the gramophone was doomed. So it would have been had not the gramophone industry buckled to in search of ways and means of perfecting their product.

Their problem was two-fold, and may be stated to comprise the collection of sound waves in air, the transformation of them into mechanical vibrations which can be stored on some form of permanent record, and the eventual re-transformation of this record, *via* mechanical vibrations, back into sound waves again.

The Application of Electrical Methods.

Until recently all this work was done mechanically, and throughout the entire process suffered considerably from the effects of mechanical inertia and resonance effects. These difficulties have never been wholly overcome by mechanical means.

With the advent of broadcasting came a demand for electrical apparatus which would carry, amplify, and finally reproduce in the form of air pressure waves all musical frequencies, and this apparatus was speedily forthcoming. The design of horns for loud-speaker work was taken up where the gramophone industry left off, and the final result to-day is that there is available electrical apparatus which will amplify and reproduce musical frequencies in a manner which is well-nigh perfect.

In America the Western Electric Company and the Bell Telephone Laboratories, Inc., contributed very considerably to this development, for it is related to their main industry—telephonic communication.

Having perfected electrical means of sound reproduction, therefore, research engineers of these companies turned their attention to the gramophone, to see if they could not apply their knowledge to the improvement of gramophone recording and reproduction, and their first step was to transform the recording end from a mechanical into an electrical process.

At this point a brief description of mechanical recording and its attendant disadvantages may not be out of place. All the artists were, in the first place, required to attend at a studio attached to the record-making factory. Here they were crowded together in a manner very often unsuited to their temperaments and custom, before a huge megaphone, into which they played or sang.

Mechanical *versus* Electrical Recording.

This megaphone concentrated the sound waves on to a mechanical diaphragm to which was connected a cutting stylus resting on a revolving disc of soft wax, known as the "wax master." Thus, the mechanical vibrations of the diaphragm, communicated to the stylus, were impressed upon the wax by the stylus. From the "wax master" gramophone records, as we know them, are subsequently made.

The disadvantages of this method were many. In the first place temperamental artists could rarely give of their best under such conditions. It is obvious also that the power available for cutting the wax cannot be very great, being dependent wholly upon sound vibrations in the air. Thus it was difficult to make records under natural conditions of speaking, singing, or instrumental playing. In the case of weaker instruments, such as violins, these had to be placed in front of the other players, as close to the megaphone as possible, and usually a special type of violin, known as the "Stroh," had to be employed. This special violin is a device strung in the manner of a violin, but so arranged that the bridge vibrates a diaphragm attached to a horn, which horn was directed into the recording megaphone.

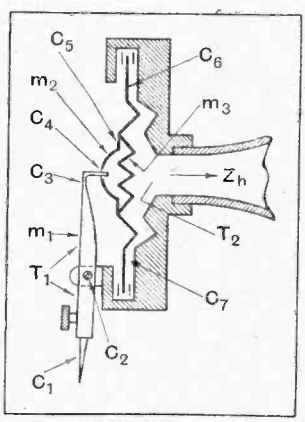

Fig. 1.—Diagrammatic sectional drawing of the "Orthophonic Victrola" gramophone reproducer.

With the new method of electrical recording, the artists may perform at a distance from the factory. They may group themselves in the manner to which they are accustomed and play their usual instruments, giving full rein to their normal artistic expression. Sensitive microphones pick up the sound waves and transform the mechanical vibrations into electrical vibrations, which are then amplified and relayed to the

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recording room, wherever this may be located, over many miles of land lines if necessary.

A further advantage is that the microphone may be placed at some distance from the artists, thus permitting of the proper blending of the various instruments with one another and with the acoustics of the studio, so that by the time the microphone is reached the sounds picked up by it are in every sense natural, as would be heard by a listener in an auditorium.

Other important advantages of electrical recording are the extreme sensitiveness of the system and the vastly increased amount of power available. The greater sensitivity allows perfect response to the most delicate and the softest of musical passages. In the case of mechanical recording, perfect response during soft passages cannot be obtained, and these have to be played more loudly than they should be in order to overcome the mechanical inertia of the recording system.

Similarly, during the loudest passages played, say, by a full orchestra, the full natural volume cannot be recorded, nor, consequently, reproduced later by a gramophone. With electrical recording methods, the limit of power which can safely be impressed on the wax master depends only upon the mechanical strength of the latter. Too much power would tear the wax and run one groove into the next. Within these limits, however, any degree of amplification can be employed and full natural volume recorded and subsequently reproduced.

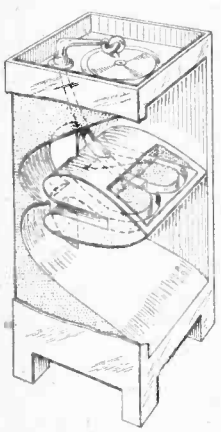

Fig. 3.—Sectional view of the sound conduit of the new type gramophone.

Brief Description of Recording System.

The system used for recording consists of a high quality microphone, a highly efficient vacuum tube amplifier, and an electromagnetic recorder. The microphone and amplifiers are so designed that the current delivered to the recorder circuit is essentially proportional to the sound pressure at the transmitter diaphragm, and the electromagnetic recorder is designed to conform with the characteristics of this system.

In addition to this equipment there is a volume indicator for measuring the power which is being delivered to the recorder and also an audible monitoring system. This latter consists of an amplifier the input impedance of which is high compared with the recorder impedance, and a suitable loud-speaking receiver. The monitoring amplifier is bridged directly across the recorder and operates the loud-speaker so that the operator may listen to the record as it is being made.

In the design of the recording and reproducing systems each part of the system has been made as nearly perfect as possible. Errors of one part have not been designed to compensate for inverse errors in another part.

General Basis of Design of Recorder.

A most interesting feature of the development of the

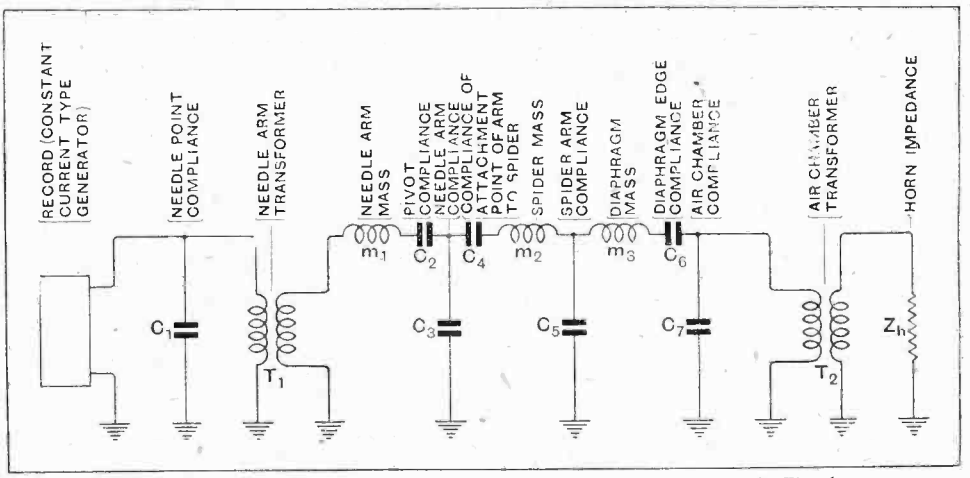

Fig. 2.—Electrical circuit equivalent to the mechanical system shown in Fig. 1.

mechanical and electromechanical portions of the recording and reproducing systems is their quantitative design as mechanical analogues of electrical circuits. The economic need for the solution of many of the problems connected with electric wave transmission over long distances, coupled with the subsequent development of accurate electric measuring apparatus, has led to a very full theoretical and practical knowledge of electrical wave transmission. The advance has been so great that this knowledge has surpassed all previous engineering knowledge of mechanical wave transmission systems.

Taking these facts into consideration, therefore, the research engineers working on the problem came to the conclusion that mechanical transmission systems could be designed more successfully if they were viewed as analogues of electrical circuits. While there are mechanical analogues for nearly every form of electrical circuit imaginable, there is one particular class of electrical circuits the study of which has led to ideas of the utmost value in guiding the course of the present development.

Electrical Filter Circuits.

This class of circuits consists of infinitely repeated similar sections of one or more lumped capacity and inductance elements in series and in shunt, and are commonly known as filters. Structures of this type with infinitely repeated sections will have one or more frequency transmission bands of zero attenuation and one or more bands having infinite attenuation.

In other words, such filters will pass a certain band of frequencies without distortion whilst cutting off entirely all frequencies lying outside this band.

Many early attempts were made to design mechanical

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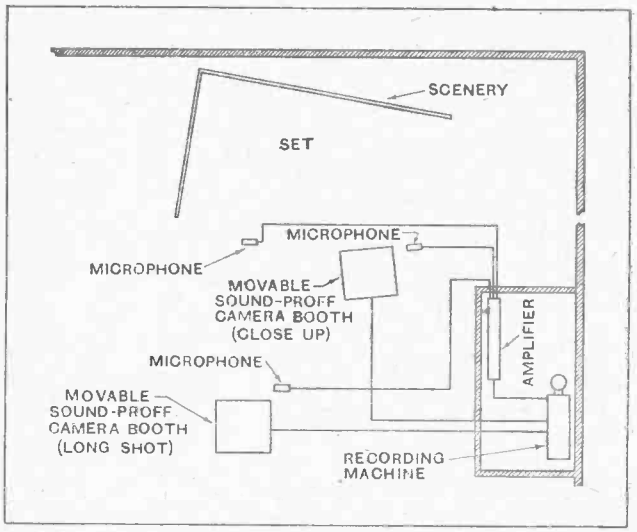

Fig. 4.—Diagram showing the layout of microphones and cameras in the scene depicted in Fig. 5.

transmission systems having a wide frequency range in which highly damped single or multi-resonant systems were employed. In these attempts both of the obvious methods of increasing the damping were used, namely, that of adding a resistance to the system and that of increasing the restoring force (compliance) and decreasing mass in such proportion as to maintain the same natural frequency.

The results of electrical filter theory have shown how these resonances should be co-ordinated so that when a proper resistance termination is used high efficiency and equal sensitivity are obtained over a definite band of frequencies by elimination of response to all frequencies outside the band.

In adapting this knowledge to their purpose, the investigators drew up a table of equivalent electrical and mechanical units, allotted to them appropriate symbols, and proceeded, by means of mathematics, to turn their electrical knowledge into mechanical knowledge. The results of these efforts enabled them to design an electromagnetic recorder the response of which is practically uniform over a range of audible frequencies ranging from 200 to 6,000.

Essentially, this recorder consists of an electromagnet, between the poles of which vibrates a diaphragm, to which is attached, by means of a lever, the cutting stylus. The incoming electrical impulses from the amplifiers pass through the magnet coils and cause the diaphragm to vibrate. These vibrations are communicated to the lever, which amplifies them mechanically before passing them on to the cutting stylus.

Redesigning the Reproducer.

Turning now to the reproducing end of the system, the gramophone, this instrument consists essentially of

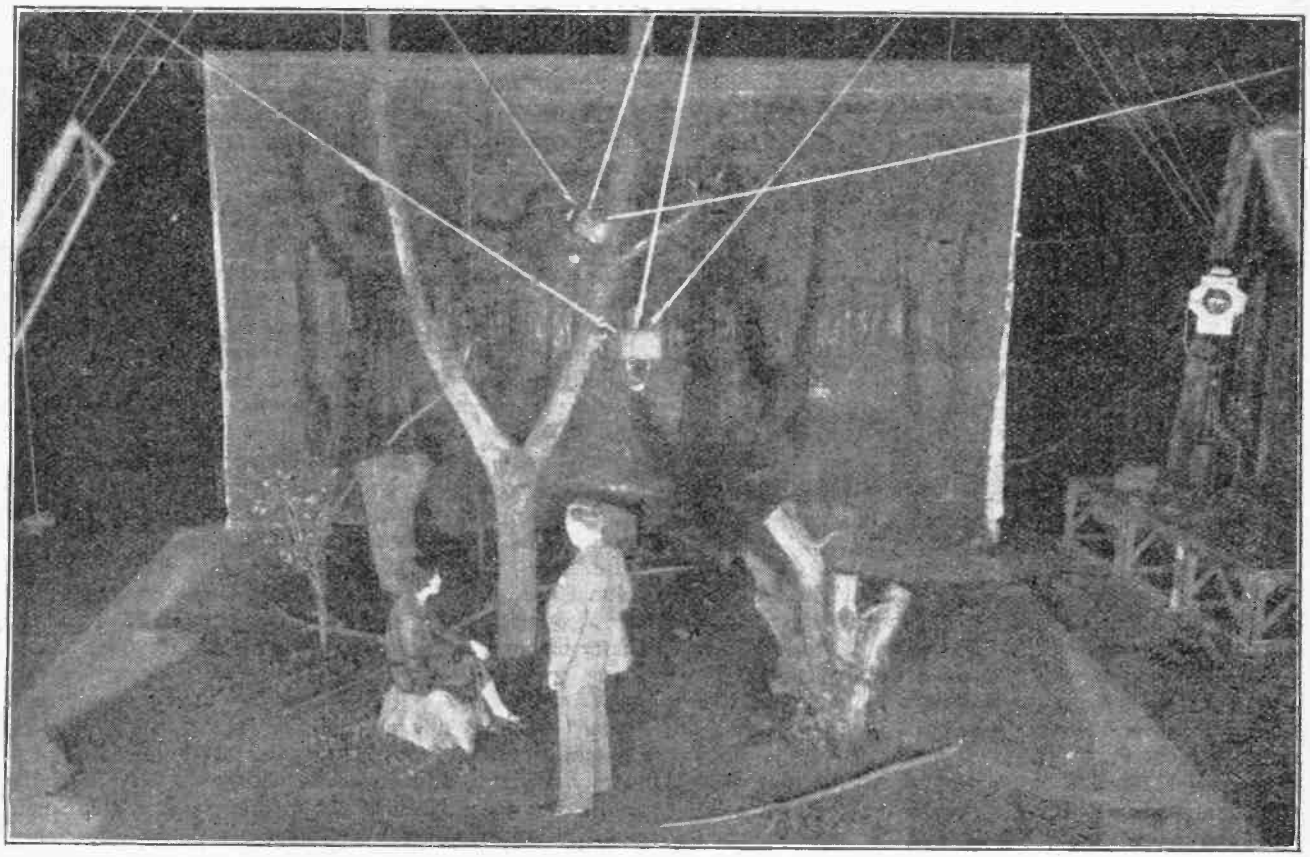

Fig. 5.—A scene being simultaneously filmed and recorded in the studios of Warner Brothers Pictures, Inc.

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two units, the reproducer (soundbox) and the horn. Considering the reproducer first, the redesign of this instrument was undertaken in the same fashion as that of the recorder, again making use of the mechanical analogues of a suitable electric filter circuit. In describing the development of the new electromagnetic recorder it was not possible within the scope of this article to go into details of the use of electromechanical analogues, for in the case of the recorder the analogy is somewhat obscure and difficult to follow. In the case of the reproducer, however, the analogy is much simpler and more easily understood.

The ultimate design of reproducer arrived at is shown in Fig. 1, whilst the equivalent electric wave transmission

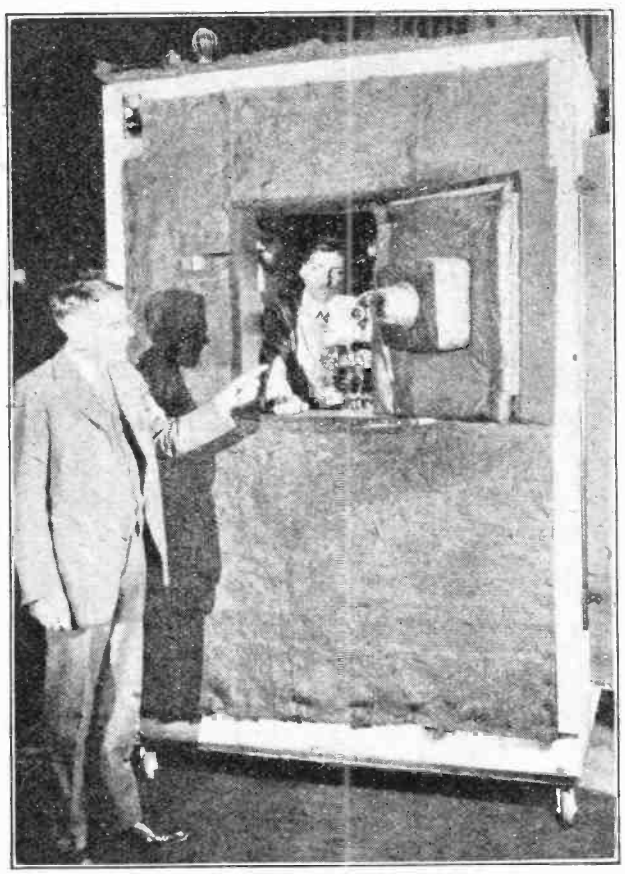

Fig. 6.—Sound-proof camera booth which prevents noises from the shutter mechanism being picked up by the microphones.

circuit, or analogue, is shown in Fig. 2. In the latter figure the record being played is represented as a constant current type electrical generator; the needle point as a compliance, or condenser; the needle arm lever as a transformer; the needle arm mass as an inductance; the pivot compliance as a condenser; and so on right through the circuit, as indicated in Fig. 2.

The spider referred to in Fig. 2 is indicated by m_2 in Fig. 1, and consists of a spider-like piece of metal, the six legs of which are attached to the periphery of the outer corrugation of the diaphragm. These legs distribute the drive of the needle arm, which is applied to the spider at the centre, or body. The object of this construction is to ensure that the diaphragm shall vibrate with a plunger action, which is more efficient than diaphragm action, for it imparts to the air column in the throat of the horn a much more powerful movement. With a view to still further reinforcing this effect, the shape of the air chamber behind the diaphragm is made to conform to the corrugations of the latter.

The Reproducer Diaphragm.

The effective mass of the diaphragm is 0.186 grains and the effective area can be made as large as .13 square centimeters. In order to obtain this low value of mass, together with such a large area, it was necessary to make the diaphragm of a very stiff light material. An aluminium alloy was therefore chosen, rolled into sheets 0.0017in. thick, and concentrically corrugated as shown in Fig. 1. These corrugations are spaced sufficiently close together that the natural periods of the flat surfaces are all above the transmission frequency band of the system.

The horn which has been used as a terminating resistance to the mechanical filter structure is a logarithmic one. Its general design and arrangement is shown in Fig. 3. There are two fundamental constants of such a horn—the first is the area of the large end and the second the rate of taper. The area of the mouth determines the lowest frequency which is radiated satisfactorily. By a suitable adjustment of the rate of taper, in accordance with mathematical equations, it is possible to build a horn having no marked fundamental resonance.

The Performance of the System.

The results of all these researches are now available commercially. For some time past gramophone records have been made by electrical recording methods, but until recently there was no gramophone on the market which could reproduce successfully what was actually on these records.

Now, however, such a gramophone, embodying the principles of design outlined above, has appeared on the market in America under the name of the "Orthophonic Victrola." The writer had the pleasure of listening to a demonstration of one of these instruments whilst in New York recently, and the results were truly marvellous.

Both instrumental and vocal music were reproduced in a manner so lifelike and realistic as to be absolutely startling! All the tones, ordinarily "dead" on a gramophone, rang forth full of depth, richness, and naturalness. They became vitalised. The range of volume, too, was astonishing. Listening first to a song, self accompanied by the singer and sung in a quiet, chatty manner, the volume was just right for the average living room. Using the same needle, a record of the performance of a full orchestra was then put on, and during the loudest passagses the volume was ample to fill quite a large hall! This range of volume, as previously explained, is contained within the record itself, and is due to the greater amount of power available when using electrical recording methods.

Throughout the entire range of volume the reproduction

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remained perfect. During the soft passages there was no evidence of "thinness," and during the very loudest passages there was no sign of strain, or what radio broadcasting people would call "blasting."

The writer could not help but conclude from this demonstration of the latest wonder of the gramophone industry that one might often do better to listen to the reproduction by such an instrument of the finest music as performed by the world's best musicians than go to a concert hall for the purpose of listening to them in person.

This statement is made advisedly, for during the recording process the acoustics of the recording studio are perfectly adjusted, and the microphones are so placed that a perfect blending of the music with these acoustics is obtained before the sound reaches them. Thus, not only the music, but also the all-important effect of "atmosphere" is recorded. Thus the acoustic conditions are fully met which are so essential for the listener's full enjoyment and appreciation of the programme, whereas the majority of halls in which the public performances of star artists are given are often so acoustically imperfect as to mar the pleasure of the audience.

The Vitaphone.

The only advantage to be gained from a personal visit to a public performance is the sight of the performers, and even this advantage has now been nullified by the presentation before the public of a perfected system of "talking movies." This invention, called the Vitaphone, is the product of the Western Electric Co., working in conjunction with Warner Brothers Pictures, Inc.

Since the cinematograph has been perfected, and also the means of sound recording and subsequent reproduction by electrical methods, what more natural than that these three scientific achievements should be combined and made to function together?

Efforts to do this were first made by Edison about fifteen years ago, but did not meet with very much success. As the result of years of research in the Bell Telephone Laboratories success has now been achieved,

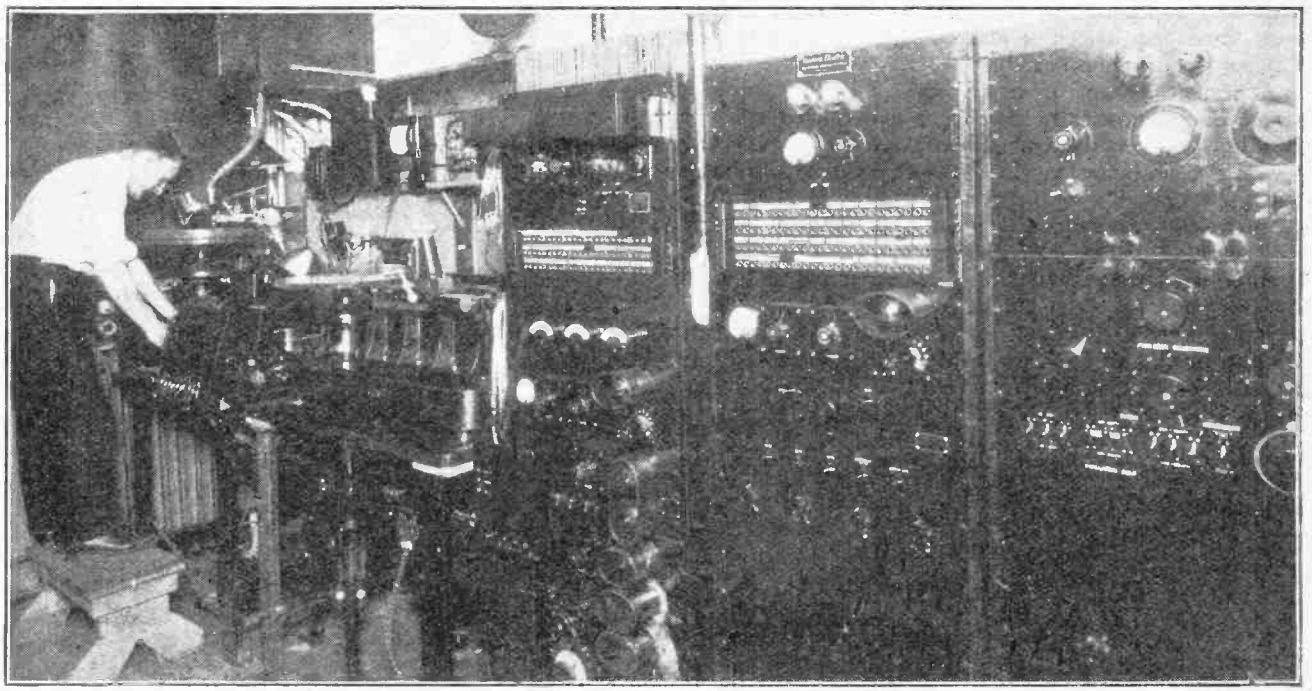

Fig. 7.—Amplifier panels and, on the left, the wax disc upon which the sounds are finally recorded.

and this latest invention brings to audiences in every corner of the world the music of the greatest symphony orchestras and the vocal entertainment of the most popular stars of the operatic, vaudeville, and theatrical fields.

Music is a necessary accompaniment to all films, especially in the case of the big feature films which run for months in the largest cities. Towns and villages throughout the world impatiently wait all this time to see these big films, and finally they are released for their benefit. It is not the same picture, however, for the reels have usually been cut, and the musical score which was used by the forty or fifty piece orchestra, say, on Broadway, is either not used in the smaller towns or is maltreated by an inadequate local orchestra.

The Vitaphone makes possible the presentation of the right music, played rightly by the leading orchestras of the great cities. Furthermore, it makes it possible for cinema audiences both to see and to hear the world's leading vocalists, orchestras, and choral singers with a degree of synchronisation between sound and movement which is absolutely perfect. Also the listener hears the sound coming from the exact position from which his eyes tell him it should come from. Neither the sounds which

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he hears, nor the figures which he sees on the screen are exaggerated in volume or size. In other words, the presentation is perfectly *natural*.

How it is Done.

For the purpose of making such pictures and sound records, Warner Brothers Pictures Inc. took over the old Manhattan Opera House in New York and now use it as a studio. The acoustics of this auditorium are extremely good, but can be altered at will by hanging rugs from the balconies and screening the stage with Celotex (composition board).

A scene, perhaps from an opera, is "set up," as shown diagrammatically in Fig. 4 and photographically in Fig. 5. Sensitive microphones are suspended above the scene, and two moving picture cameras are used, one for "close-ups" and one for "long shots." Both these cameras are enclosed in sound-proof movable booths, as illustrated in Fig. 6. The cameras have to be sound-proofed so that their clicking shall not be picked up by the microphones.

Instead of being driven by hand, the cameras are run by electric motors, and in an adjacent studio a similar motor runs the turn-table carrying the wax disc upon which the sound record will be made. Synchronism depends essentially upon all the motors being kept in step, and this is achieved in quite a novel yet simple manner.

Fig. 8.—A closer view of the wax disc and recorder. The operator is able to observe the depth of the groove cut by the stylus through a low-power microscope. Note the flexible rubber tube from the air exhausting apparatus which removes wax shavings as they are cut from the surface of the disc.

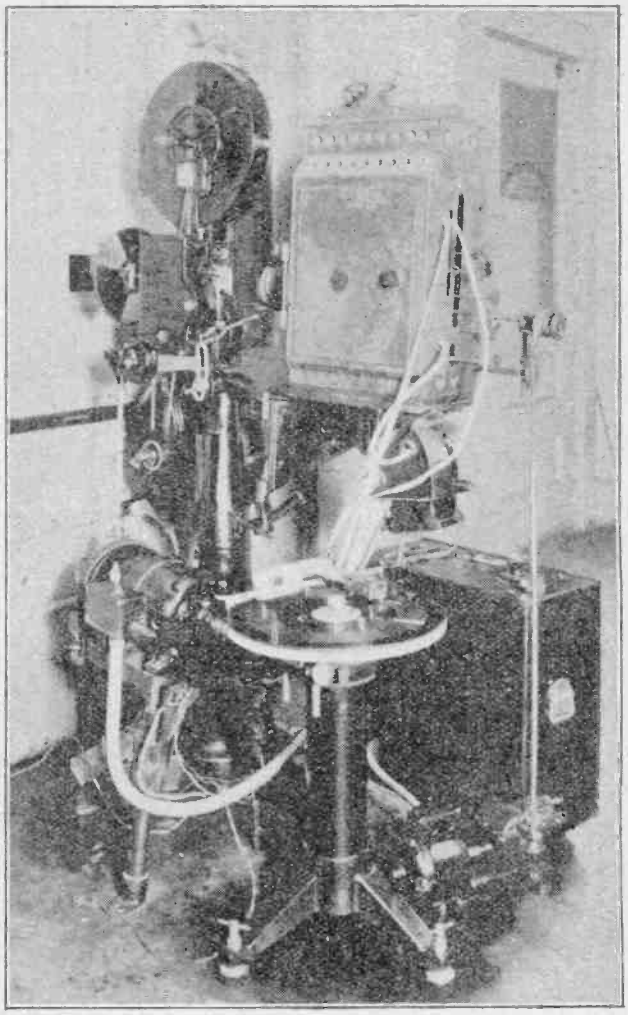


Fig. 9.—Projection machine with synchronised motor for driving the sound producing mechanism.

How Synchronism is Achieved.

The obvious and simplest way to secure synchronism would be to drive both the registering machine and the film from opposite ends of the same motor shaft, but since the camera must be free to swing for a change of view, two motors are used and geared together electrically so that they are held at the desired speed not only after they are up to proper running speed, but during the starting period.

These motors are of the series commutator type, interlocked electrically by tapping at three symmetrical points on each armature and by interconnecting the two rotors through slip-rings. Thus the motor driving the sound registering equipment and the motor driving the camera are independently supplied with electrical power, but through the slip-ring circuit there is sufficient interchange of power between their armatures to produce synchronism during the starting period.

Upon reaching the desired speed the motors are con-

verted into the synchronous type by putting a diametrical short-circuit between the commutator bars and disconnecting the interlock. The motors then continue to run as two independent synchronous motors, the speed of both being determined by the frequency of the power supply. If, however, a constant frequency is not maintained, a specially regulated source of alternating current must be supplied.

At this point, with the assurance that the film and the sound-registering equipment will be in step, the actual process of photographing and registration goes into operation. Fig. 7 shows the amplifiers which magnify the microphone currents to the extent necessary to actuate the electromagnetic recorder, shown on the extreme left. This registration process is the same as that already described in connection with the making of gramophone records. The only difference is that in this case the wax master is bigger, for it must run during the exhibition of a film for at least fifteen minutes.

The Presentation of the Talking Film.

In reproduction there is no necessity for having the sound reproducer and the picture projector physically separate. Therefore, simplicity can be practised, the desirability of which is obvious so that the system can be easily operated without the necessity for unusual skill on the part of the operator.

To meet these requirements both the film and the sound register are set in their respective machines in accordance with a given marker indicating the starting point. The two machines are then speeded up from rest together by having them coupled to opposite ends of the same motor. A view of the combined projector and sound register is given in Fig. 8, from which it will be seen that an ordinary standard projector is employed, the only difference being the addition of the sound register.

The speed of the driving motor is held constant by means of a special regulator, adaptable with slight manipulation to either A.C. or D.C. An essential here is that the mechanical gearing be so designed that mechanical vibrations and irregularities of load in the projector should not cause fluctuations in speed of the registration disc.

Speed Regulation.

The removal of vibrations and of small irregularities in turn-table speed is effected by means of a low-pass mechanical filter system situated between the last gear-driven shaft and the turn-table itself. This filter involves a fly-wheel with flexible connections. The flexibility of the spring connections and the moment of inertia of the fly-wheel (including that of the turn-table) "iron out" the ripples in speed. Frictional damping of the spring connection avoids "surges" in the filter system.

To bring the registered sounds to the audience, an electrical reproducer, similar in principle and action to the electrical recorder previously described, converts the movements of the needle in the groove on the disc into electrical vibrations. These vibrations then pass on to an adaptation of the Western Electric Public Address System, which consists of an amplifier with controlling equipment, wiring circuits and loud-speakers to project the reproduced sounds.

These loud-speakers, of an improved type, are capable of filling practically any cinema theatre. Regulation of the degree of amplification makes possible the use of a volume of sound and the attainment of a degree of naturalness that gives the desired illusion as to the source of the sound.

Distribution of Loud-speakers.

The manner in which the loud-speakers are arranged is as follows: One is placed behind the screen, and is used to reproduce the performances of artists shown in action on the screen, and one or more speakers are concealed in the orchestra pit for the purpose of providing the necessary musical accompaniment, synchronised sound effects, etc., for a big feature film. The manner of arrangement depends largely upon the acoustics of the theatre, which are carefully tested out during the initial installation of the system.

The writer was fortunate enough to be able to attend an exhibition of the Vitaphone at the Warner Brothers Theatre in New York, when the programme consisted of "Tannhäuser," performed by the New York Philharmonic Orchestra; *Caro Nome*, from "Rigoletto," sung by Marion Talley, of the Metropolitan Opera Company; variations from Beethoven's "Kreutzer Sonata," played by Efrem Zimbalist; "La Fiesta," sung by Anna Case; and *Vesti la Giubba*, from "I Pagliacci," sung by Giovanni Martinelli, of the Metropolitan Opera Company. A truly noteworthy programme.

Successful Results.

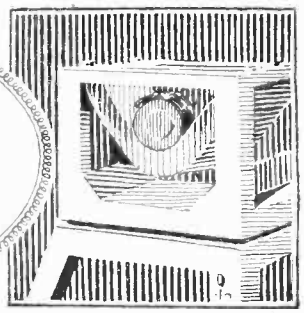
The effect upon the audience was astonishing. Notwithstanding the fact that they knew that what they saw and heard was the product of inanimate machinery, round after round of deafening applause greeted each item, and surely no greater tribute could be paid to this great invention. Perfection of synchronism was frequently demonstrated by interpolated close-ups of sections of the New York Philharmonic Orchestra. Every movement of the players could be identified with the sounds issuing from the loud-speaker at that moment.

Later, the actions of the vocal and instrumental artists could be followed in detail as they performed. One great advantage of this method of presentation over a personal appearance is that the audience, wherever seated in the auditorium, can easily follow every facial expression of a singer, which is impossible ordinarily unless the listener is fortunate enough to be seated in the front row, or uses glasses.

Thus, by combining three developments originating in the telephone art, synchronised music and films have become an accomplished fact. These three developments are: an electrical system of registration; a remarkable new electrical reproducer; and the perfection of loud-speaking telephones. Taken together they make possible the day's new marvel, which, in the humble opinion of the writer, provides an even better form of entertainment than would a visit to a concert hall or opera house.

EDITORIAL NOTE.—We have recently received from Messrs. Wurlitzer, 120, West 42nd Street, New York City, a booklet dealing with the various models of the "Orthophonic Victrola" available to the American public. The address of the manufacturers of this instrument is The Victor Talking Machine Co., Camden, N.J., U.S.A.

Broadcast Brevities



News from All Quarters: By Our Special Correspondent.

The Wavelength Dabblers.

Although the new wavelength scheme will not come into operation for two or three weeks yet, there is evidence that some of the Continental stations are behaving like the child who wishes to investigate its Christmas stocking on Christmas Eve. This premature experimentation with the wavelengths allotted by Geneva is naturally causing confusion.

A case in point occurred last week when Radio Toulouse jammed Bournemouth, the latter station having to move 2½ metres to clear the disturbance.

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Impatience.

It is interesting to note that the Post Office limits emergency changes of this kind to one per cent. either way. During the last week or two several stations have had to take advantage of this privilege in order to avoid the results of Continental impatience.

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A Classic Case.

Mention of Radio Toulouse and Bournemouth reminds one of the classic occasion, six months ago, when Geneva was able to solve an interference problem in a single night. Early one evening the Bournemouth engineers found that the French station was seriously interfering. A telegram was forthwith sent to Geneva and within an hour or two the authorities there had communicated with Radio Toulouse and tactfully secured the desired change in wavelength.

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A Lost Programme.

Amusement was caused in many households on the opening day of the Olympia Exhibition when the announcer in the Exhibition studio was understood to say: "It is now 7.40 p.m., and I am unable to make a further announcement at the moment as I have lost my orchestra."

Visions were conjured up of wild-eyed trombone players lost in the wilderness between Olympia and Savoy Hill; nor was the mystery quite cleared up until later in the evening, when the announcer explained that he had referred, not to the orchestra itself, but to the orchestra programme. The important piece of paper had been mislaid.

It's All Right.

After an absence of several weeks at the seaside, John Henry will return to 2LO on Tuesday next, September 21st.

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A Gilbert and Sullivan Coup.

After three years of negotiation, the B.B.C. has obtained permission for the first stage broadcast of Gilbert and Sullivan opera. This will take place on Monday next, September 20th, the opening night of the season, when "The Mikado" will be broadcast from the Princes Theatre.

THE "GILBERT AND SULLIVAN" FLAVOUR. This interesting picture from Japan arrives at an appropriate moment, coinciding with the announcement that the B.B.C. will present the first stage broadcast of "The Mikado," on Monday next, September 20th. The ladies in the photograph are employing their parasols as frame aerials, and their faces register satisfaction.

Various copyright difficulties have hitherto stood in the way of such a broadcast, and I understand that a good deal of persuasion was necessary before the copyright holders gave their consent.

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Honour to Whom . . .

The thanks of listeners, no less than the B.B.C., are due to Lady Gilbert, Mr. Herbert Sullivan, and Mr. Rupert D'Oyly Carte for granting permission for the broadcasting of two half-hour excerpts from what is regarded in many quarters as the most brilliant of the Gilbert and Sullivan group.

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A Source of Inspiration.

How many people are aware that "The Mikado" was inspired by the establishment of the first Japanese colony in London? The new colony settled in the "eighties" at Knightsbridge, almost opposite the Guards' Barracks, and no doubt Gilbert's sense of the bizarre was tickled by the study in contrasts afforded by the sight of the diminutive folk promenading alongside six-foot Guardsmen!

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Eastbourne Night.

An Eastbourne Night will be broadcast on September 24th. The programme will consist of the story of Eastbourne in brief by the mayor of that town, the Municipal Orchestra from Devonshire Park, "Pier Revels of 1926" from the pier, Albert Sandler from the Grand Hotel, Eastbourne, and dance music from the Devonshire Park Pavilion.

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Quite.

"Why do you call this a railroad radio?"

"Because it whistles at every station."
—*Judge*, New York.

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A Call from the Wild.

During the transmission of a "modernist" programme from 2LO the other night the telephone bell rang.

"I am speaking from Colney Hatch," said the voice. "Can I leave it to you to pack those people off to me, or shall I send a van?"

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Guarding Listeners' Interests.

The broadcast listener's need for corporate representation, as exemplified by the Wireless League in Great Britain, is also being recognised in Australia. Sydney listeners, I see, have formed the Broadcast Listeners' League, with headquarters at the Wireless Institute, Royal Society's Building, Elizabeth Street, and new members are rolling up in encouraging numbers.

Artists' Contracts.

Apropos of my note last week on "impersonations" in American broadcasting studios, an interesting case is reported at Savoy Hill. A well-known artist recently signed a contract to broadcast, but afterwards excused himself on the ground of illness, though no medical certificate was supplied. It is significant that the same artist had previously entered into a contract with a theatrical manager.

o o o o

The League of Nations Speeches.

The transmission of the League of Nations speeches from Geneva on Monday of last week was not a success. For a short period the engineers adhered to the original arrangement, making use of landline from Geneva to Paris and thence to London. It was then discovered that the Eiffel Tower was also broadcasting the speeches, so, in an effort to improve results, the B.B.C. engineers picked up this transmission with the Keston receiver, relaying to London and Daventry. It was soon found, however, that this arrangement was no better, if not slightly worse, and the Paris landline was reverted to. I understand that it was the intention to make additional experiments during the week, but as the results on Monday were so unsatisfactory no further attempt was made. This experience shows that the time is not yet when Geneva transmissions can appear as regular programme items.

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A Hero.

The list of "The World's Heroes" stands in need of revision. A man who deserves a place near the top is breathing at this moment in America. He styles himself the "Yes and No Man." This gentleman, whose occupation is to provide several columns of literary pabulum in one of the leading radio "monthlies," undertakes to answer intimate questions concerning broadcast artists, their private lives, professional training and personal eccentricities.

A pestilential job.

o o o o

Albert Hall as Studio.

The new B.B.C. project for a series of twelve national concerts in the Albert Hall will be welcomed by all listeners who appreciate the value of that immense building when used as a giant broadcasting studio. Opinion is still very divided on the studio question. In some quarters it is even suggested that the air-tight, sound-proof chamber of to-day may soon be displaced by an entirely different form of studio involving the use of a large hall with, perhaps, a dome or similar acoustic device.

o o o o

Programme of National Concerts.

The first Albert Hall broadcast under the new scheme will take place on September 30th, when Sir Hamilton Harty will conduct, the solo artist being Madame Olczewska. The dates of the subsequent concerts for this year are:

October 21st; conductor, Mr. Albert Coates.

November 9th; Dr. Richard Strauss.

November 25th: Sir E. Elgar (solo violinist, Albert Sammons).

December 16th; Otto Klemperer (artist, Freda Lieder).

The seven concerts of 1927 will be held on January 20th, February 3rd, and 17th, March 3rd, 17th and 31st, and April 14th.

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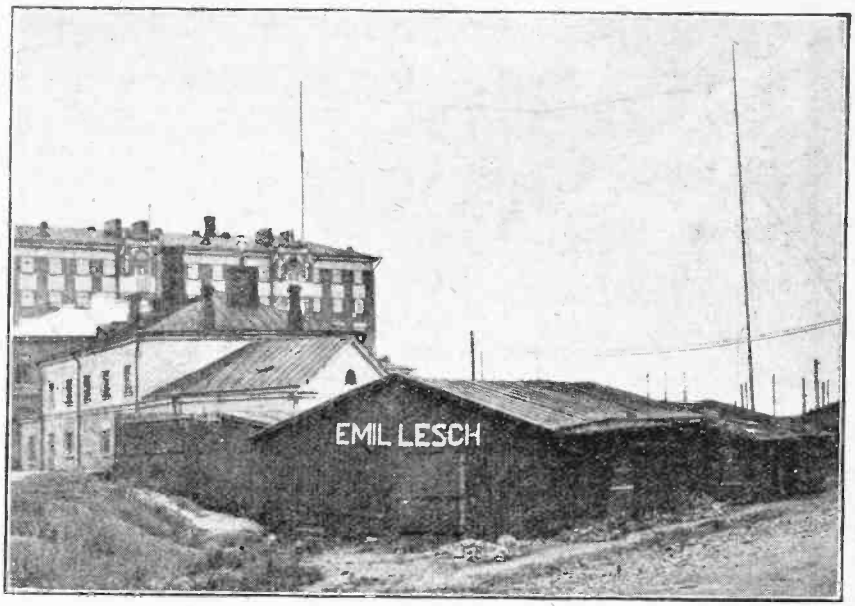

"FINLANDIA." A new photograph of the Helsingfors broadcasting station (Radiogra Taljcrona), which transmits every evening on 522 metres. Under the Geneva wavelength scheme, the station will change down to 500 metres. The laboratory and testing rooms are seen in the foreground.

FUTURE FEATURES.

Sunday, September 19th.

LONDON.—A Hungarian Programme.
CARDIFF. — The Royal Welsh Ladies' Choir.

Monday, September 20th.

LONDON.—The Band of H.M. Grenadier Guards.
DAVENTRY.—Welsh Programme.
BELFAST.—"The Missing Link," a play.

Tuesday, September 21st.

LONDON.—Programme conducted by Gustav Holst.
ABERDEEN.—A Light Ballad Concert.

Wednesday, September 22nd.

LONDON. — "The Rhesus" of Euripides.
DAVENTRY.—The Band of H.M. Grenadier Guards.
BIRMINGHAM. — Orchestral and Vocal Programme.

Thursday, September 23rd.

LONDON.—Excerpt from "Riverside Nights," relayed from the Lyric Theatre, Hammersmith.
ABERDEEN.—Ballads and Opera.
BOURNEMOUTH.—Favourites — Orchestral and Vocal.

Friday, September 24th.

LONDON.—Eastbourne Night.
GLASGOW.—"Venice."
MANCHESTER.—"An S.O.S. Announcement," a play.

Saturday, September 25th.

LONDON.—"Winners," presented by R. E. Jeffrey.
ABERDEEN.—Scottish Programme.
NEWCASTLE. — Varied Songs and Amusement.

Budgeting Ahead.

It is interesting and significant that the B.B.C., in preparing this scheme, have budgeted for next year, when broadcasting will be in the hands of the new corporation.

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The Vicar of Mirth.

Mr. Vivian Foster, "The Vicar of Mirth," will be in the Newcastle Studio on October 1st. On the same evening the London Radio Repertory Players will present "An Elder of the Kirk" for the benefit of Newcastle listeners.

o o o o

How News is Collected.

Listeners are to have a peep behind the scenes of the news world to-morrow evening, when Mr. H. Jeans, chief editor of Reuters, is to speak on "How News is Collected and Distributed," a fascinating subject, but one about which the newspaper reader normally hears very little, so efficiently and unobtrusively do the various news agencies carry on the work of obtaining and distributing the day's happenings to the individual papers.

o o o o

Daventry Relays Bournemouth.

The Bournemouth evening concert to-morrow (September 16th), which is being relayed to Daventry, will be of a popular character, and will include Miss Wynne Ajello (soprano), and Mr. Walter Glynne (tenor) who is visiting Bournemouth Station for the first time

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.

The Rice Neutrodyne.

I am thinking of constructing a three-valve receiver embodying one H.F. stage, using the Rice method of neutralising, and shall be glad if you can give me the necessary circuit diagram.

The Rice system of neutralising in its original form appeared in 1918, and is therefore, one of the original methods of neutralising. It is an exceedingly efficient circuit, and in its modified form is fully equal to the more conventional methods of neutralising the inter-electrode capacity of H.F. valves. We give in Fig. 1, a circuit which should be suitable to your needs. There are, of course, several other variations and modifications of the original circuit, which have appeared from time to time, but the circuit given herewith will be found to be one of the most straightforward and effective of them. Centre tapped coils of the well-known "Dimic" type may be used, and thus enable the receiver to be used on the normal B.B.C. wavelengths, or on the Daventry wavelength by the employment of the appropriate coils.

On wavelengths below 600 metres, the aerial should be connected to A_1, when it will be found that the instrument is exceedingly selective, and the setting of the two tuning condensers for a given wavelength will be approximately the same. For Daventry, however, the aerial should be coupled to A_2, whilst terminal A_3, should only be employed when a short indoor aerial is used.

When first setting up the receiver, the local station should be tuned in and a rough adjustment of the balancing condenser made by turning out the H.F. valve, and attempting to silence the local transmission by adjusting the balancing condenser. It will be impossible to entirely cut out the local station in this manner unless the whole receiver is screened, owing to the direct pick up of the anode coil and the various leads in the receiver, since it must be remembered that since this coil is tuned to the local station, it will readily pick up the local station's signals by itself unless carefully shielded.

The neutralising condenser should therefore, be adjusted to point where the signals of the local station are weakest and then a more distant station should be tuned in, and a more perfect adjustment of the balancing condenser made. There should be not the slightest difficulty in balancing this circuit so that no oscillation occurs over the whole tuning range, but since in any case a certain amount of regeneration is useful in reducing the damping caused by the use of cumulative grid rectification and to assist in the getting of distant stations, it would be as well, to deliberately deneutralise slightly so that a certain amount of regenerative effect was present over the whole tuning range, but very careful adjustment should be made so that no actual oscillation occurs on any wavelength within the compass of the set.

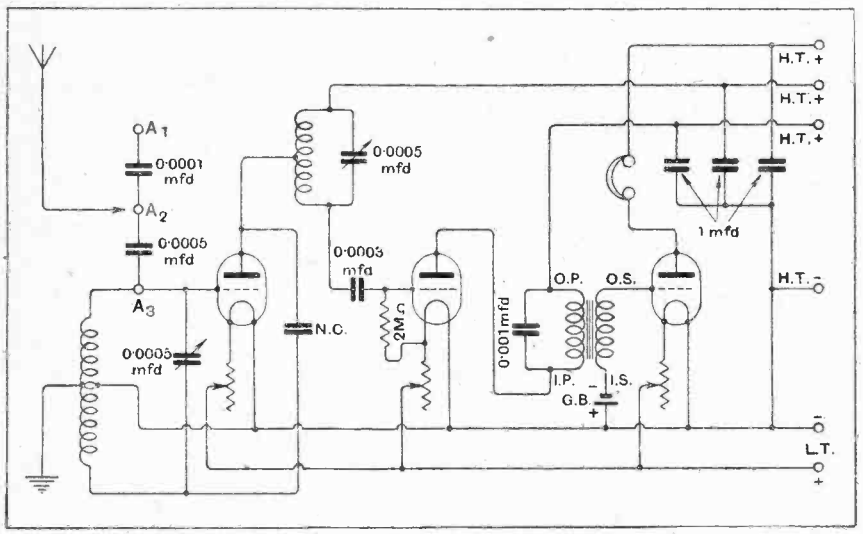

Fig. 1.—The Rice Neutrodyne.

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A Problem of Inductance.

I well understand that if I obtain two 200-microhenry inductance coils and connect them in series with each other the resultant inductance is 400 microhenries. If now, still keeping the inductance coils in series, I place them so that their magnetic fields interact will the total inductance of the circuits be changed? F. B. H.

If the two coils are arranged so that their magnetic fields interact, the inductance of the circuit will be, of course, changed owing to the mutual inductance thus introduced between the two coils as distinct from their individual self-inductance. Whether the mutual inductance increases or decreases the total inductance of the circuit, of course, depends on the precise manner in which the coils are coupled together. If they are placed so that their individual magnetic fields are acting in opposition to each other, then of course the effect will be to cancel out a part of the magnetic field of each coil, the exact number of lines of force cancelled out depending upon the degree of coupling existing. Thus, the total inductance of the circuit would be reduced. By reversing one of the coils, however, the magnetic lines of force associated with each coil would be in the same direction and would thus virtually assist each other. In this case, therefore, the total inductance of the circuit would be increased. The well-known variometer is, of course, constructed on the above principle, two inductance coils being suitably mounted so that the interlinkage of their magnetic fields can be varied both in the "assisting" and in the "opposing" direction.

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THE OLYMPIA SHOW. SOME POINTS OF CRITICISM.

NOW that the Olympia Wireless Show is over we have the opportunity of considering at our leisure the effect of the Exhibition on the public, and whilst there is no doubt that, taken as a whole, the Show has proved to be a remarkable attraction to the public and has exceeded all previous wireless exhibitions in the success which it has achieved, there yet remain certain unfavourable impressions which it may be well to record whilst they are freshly in mind.

One of the objects of the Exhibition, in our opinion, should be to impress upon the public the pleasures of listening to broadcasting and to make visitors to the Show feel that they cannot continue without broadcasting in their homes. Broadcasting from loud-speakers was conducted in the Hall, and one cannot but say that as a demonstration in so large an area it was very well done; but there was something about it which left a feeling of disappointment. The music and speech seemed to us unnaturally harsh and far below the quality which one is familiar with when broadcasting is received in the home under satisfactory conditions. We doubt if anyone visiting the Exhibition who had not previously heard broadcasting from loud-speakers would be favourably influenced.

We would urge that for any future show the idea of filling the hall should be forsaken, and instead should have a demonstration room suitably furnished and arranged so as to exclude external noise, and provide this room with one or more loud-speakers, giving a degree of amplification consistent with what should be expected in the home.

As conducted at Olympia, broadcasting did little, we believe, to whet the appetite of the new recruit to broadcasting.

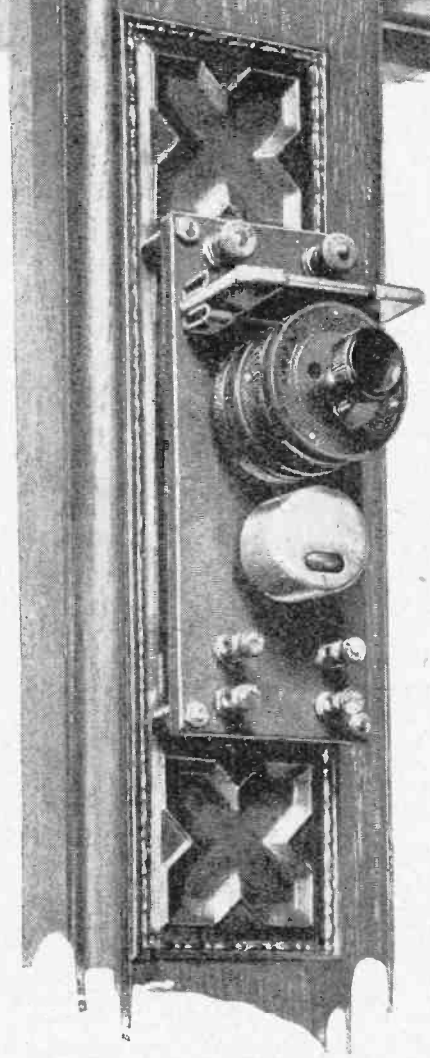
As to the manufacturers' apparatus on show, practically every stand was a credit to the manufacturer concerned, and in appearance and finish there was little left to criticise in the sets. But the public cannot judge a set by its external appearance, and it would seem that it should be possible to contrive some system whereby individual sets could be demonstrated.

On the front cover of our issue this week we reproduce a picture of the Exhibition Hall in Berlin, which has been specially built for wireless shows. Here arrangements were made whereby practically every stand-holder had a sound-proof demonstration room at the back of his stand; it must be admitted that, although every demonstration stand took a lead off a common aerial, yet the interference at the Exhibition was not serious, and there is no doubt whatever that these facilities were of enormous assistance to the manufacturer as well as helping the public in their selection of a receiver.

We realise that this problem of providing means whereby a demonstration can be given is beset with difficulties, but, nevertheless, we deplore the effect of the silent display of apparatus which should sell on its performance and not on its appearance.

CONTENTS.

The "MURAL" CRYSTAL SET



Simplified Construction.

IN the early days of broadcasting, manufacturers of wireless apparatus liked their clients to regard their products as delicate pieces of scientific apparatus, and to this end they assembled their components in impressive ebonite-topped boxes bearing a strong resemblance to the Wheatstone bridge and other electrical instruments familiar to the scientific layman. This procedure was no doubt justified when applied to some of the multi-valve, multi-circuit enormities turned out by newcomers to the wireless industry, but it was surely carrying the illusion too far when the simple crystal set—that homely household utensil—was required to pose as a scientific instrument, often standing in splendid isolation on a table specially prepared to receive it. But then, if one was to ask and obtain £4 10s. for a crystal set, something had to be done to disguise its inherent simplicity.

Convenience First.

The set described in this article is for people who require "to listen to the Broadcasting" in an unobtrusive way without pretentious fuss—people who will not be greatly perturbed or turn green with envy because the man next door has set aside a separate room for wireless reception and covered whole tables with an impressive array of switches and meters. This crystal set can be screwed to a door-post or window frame in any out-of-the-way place and will function indefinitely with no other attention than an occasional turn of the crystal adjusting wheel. The adoption of plug-in components ensures that the wavelength range of the set may be adjusted to cope with the future activities of Wavelength Conferences.

Interchangeable Components.

First obtain a piece of sheet ebonite 6in. x 2in. x ¼in. and drill, or cause it to be drilled, according to the dimensions given in Fig. 1. The holes for the coil unit sockets are spaced as for a standard valve holder.

Now fit the terminals, condenser clips and sockets for the coil unit and crystal detector. These will be locked to the panel with nuts at the back so that a further set of nuts may be used to secure the wiring, and the use of a soldering iron will be unnecessary. Note that the "feet" of the condenser clips are turned inwards (clips outwards) in order to economise space.

The next step is to wire up the back of the panel according to the diagram in Fig. 2. This is best carried out with No. 22 S.W.G. tinned copper wire which is easy to work.

Finally the panel is fixed to a finger-plate of suitable size, which may be chosen according to individual taste. Care must be taken that the plate does not come into contact with any of the metal parts on the back of the panel; in the set shown in the photograph the panel was supported at each corner on ebonite pillars ½in. long and ½in. in diameter.

Tuning-in.

The receiver is tuned by an interchangeable McMichael fixed condenser and a Polar Coil Unit connected as a variometer. The condensers enable the wavelength to be increased by fixed steps while the coil unit provides a continuous variation of wavelength between these steps. Of course, the wavelength cannot be stepped up indefinitely by means of the condenser, and a point is reached when it becomes necessary to substitute coils with more turns. This must be done when changing over to Daventry from the 300-500 metre broadcast band.

The "Mural" Crystal Set.—

Tested on a standard single wire 100ft. aerial 30ft. in height, the following wavelength ranges were obtained :—

		Wavelength (Metres) Min.	Max.
Coils 300 and 400	Without cond.	285	365
	With 0.0002 mfd.	365	480
Coils 1100 and 1450	Without cond.	1000	1250
	With 0.0002 mfd.	1250	1750

The minimum readings are obtained with the coils screwed up tightly together with the windings in opposition. To obtain the maximum reading the coil is pulled off, turned through 180 degrees, replaced on the contact

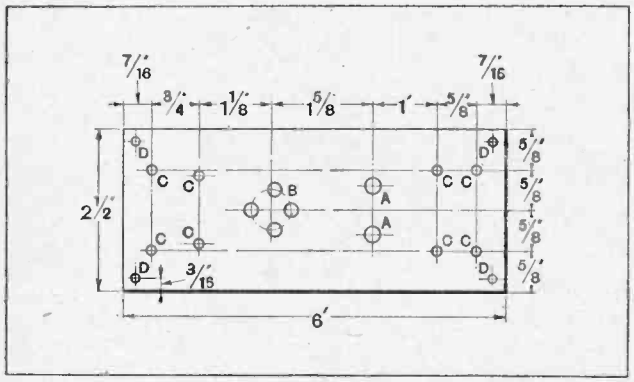


Fig. 1.—Drilling details of the ebonite panel. Sizes of holes are as follow: A, ¼in. dia.; B, 5/32in. dia.; C, ⅛in. dia.; D, ¼in. dia.

pins, and again screwed up tightly. Intermediate wavelengths are passed through as the upper coil is gradually raised and then lowered after reversing the connections. It should clearly be understood that in reversing the coil the white marking spots should still remain on top; the coil must not be turned over as well as rotated through 180 degrees.

The wavelength given in the above table will naturally vary with individual aerials, but will serve as a guide in choosing suitable coils from the list supplied by the manufacturers (The Radio Communication Co., Ltd.). A small aerial will necessitate larger coils, and *vice versa*. It is interesting to note that the 0.0002 mfd. fixed condenser is suitable for both the short and the long wavelengths.

The crystal detector is adjusted by rotating the wheel *in one direction only* until a suitable spot is found. The spots giving loudest results are not always the most permanent. A useful method of detecting a spot that is likely to remain permanent is to "back" the adjusting wheel a fraction. If the signal strength remains the same it may be safely assumed that the crystal will not require readjustment for three or four days. A fresh line of points on the crystal cylinder may be explored by removing the cover and sliding the catwhisker clip a short distance along its support.

The Circuit.

Having described the construction and operation of the receiver in sufficient detail for a beginner to build the set and receive broadcasting, a few words in justification of the circuit may not be out of place for those who may

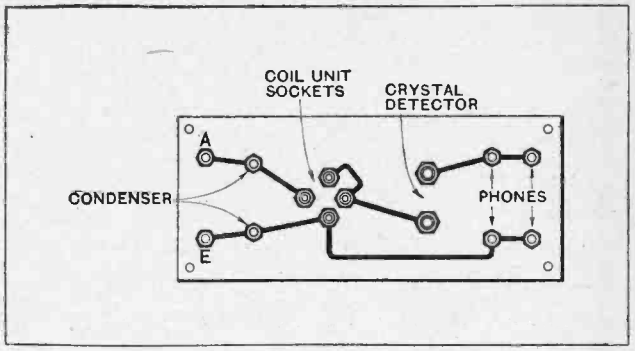
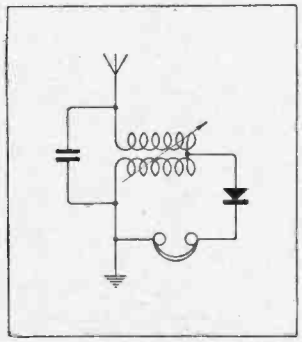


Fig. 2.—Back-of-panel wiring diagram.

be interested in the technical side of the design. Turning first to the tuned circuit, it will be seen from Fig. 3 that this consists of an inductance and condenser in parallel. It is not necessary that the high-frequency resistance of this circuit be reduced to an absolute minimum; air dielectric condensers and coils of air-spaced Litz wire are quite out of place in a circuit in which the combined resistance of aerial and crystal contact are shunted across the tuned circuit. In such circumstances one is free to choose robust components which have the merit of neatness.

The ratio of inductance to capacity and the number of turns of the coil across which the crystal is shunted both influence the strength of signals obtained in the telephones. The components chosen enable both these factors to be varied until the best combination of values is obtained.

To vary the L/C (inductance to capacity) ratio a different condenser is substituted, and both coils are



COMPONENTS REQUIRED.

- *1 Ebonite panel, 6in.×2½in.×¼in.*
- *1 Coil unit base and spindle (Polar).*
- *4 Coils, Nos. 300, 400, 1,100 and 1,450 (Polar).*
- *1 Fixed condenser, 0·0002 mfd., with clips (McMichael).*
- *1 Crystal detector (Harlie).*
- *2 Terminals ("Aerial" and "Earth").*
- *4 Telephone terminals.*
- *1 Finger plate (Woolworths).*
- *Wire, screws, etc.*

Approximate cost - 25/-

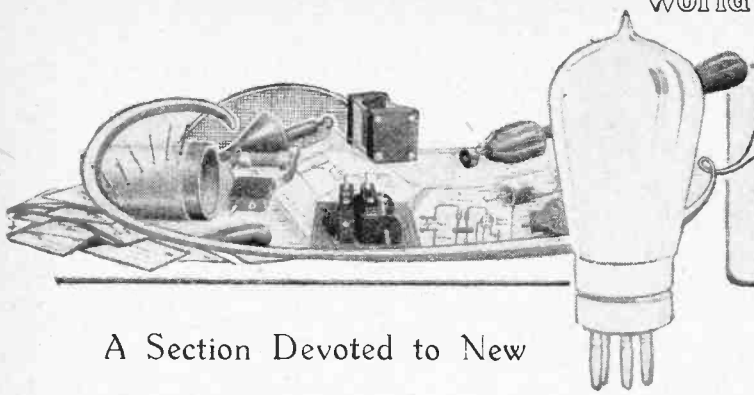
Fig. 3.—Circuit diagram.

changed, larger coils being used for a given wavelength if the capacity has been reduced, and *vice versa*.

The tapping point for the crystal can be varied (1) by choosing coils with a different ratio of turns, *keeping the total turns the same*. (2) By transposing the position of the existing coils in the variometer if these are slightly unequal. The second method is the more practicable, since the ratio of turns in the coils cannot be increased without reducing the tuning range of the combination.

Finally, there is the question of telephone connections. Experiment shows that stronger signals are obtained with the 'phones in parallel than when they are connected in series.

F. L. D.



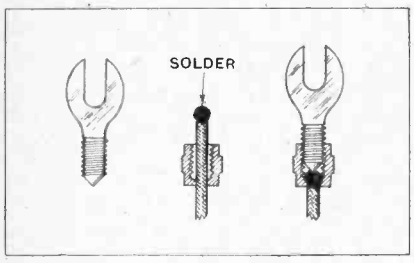
READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

FLEXIBLE LEADS.

There is often difficulty in fixing spade terminals to flexible battery leads in such a way that the final result will be both neat and permanent.

The diagram shows one method of achieving this end. The insulation is carefully removed with a sharp knife, leaving about ½in. of the wire exposed. Then, with a fairly cool iron, a blob of solder is persuaded to adhere to the end of the wire.



Method of fitting spade terminal to flexible lead.

When the wire is clamped in the spade terminal the pointed screw will penetrate into the solder and make a secure and lasting connection.—F. H. B.

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COMBINED EARTH PIN AND AERIAL SUPPORT.

This device consists of a combined aerial support and earth pin for use with portable wireless sets using an ordinary aerial.

One end of the aerial is usually slung over a high branch of a tree, leaving a free end to be attached to the set, direct to the aerial terminal. Unless the set is rather heavy, which portable sets should not be, the whole arrangement is very unstable.

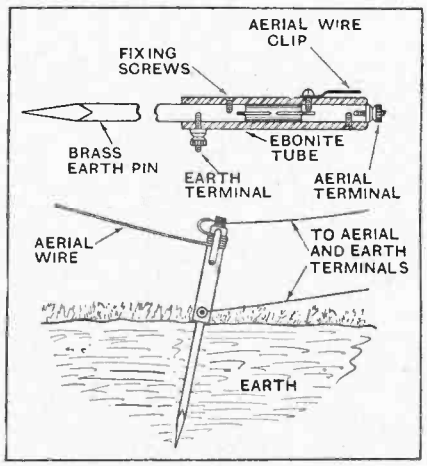
This device, whilst securely anchoring the free end of the aerial, provides an efficient earth at the same time. It consists of a length of ebonite tube, the top end of which has secured therein a short brass rod by means of countersunk screws. An ordinary terminal is screwed centrally into this or may be formed integral therewith, and is utilised as the aerial terminal. A longer brass rod of the same diameter is fitted into the bottom end of the ebonite tube and secured in a like manner. A space is left between these, thus insulating one from the other. An earth terminal which screws into the earth pin is provided near the bottom of the tube. The earth pin is pointed to facilitate its entry into the ground. The aerial wire is wound several times round the top of the ebonite tube and is held in position by means of a spring clip, as shown. The aerial wire may be fastened to the top terminal after having been secured by the clip on the tube, or taken direct to the terminal on the set. Short lengths of insulated wire can connect the terminals on the device to the respective terminals on the set.

A lightning arrester may or may not be fitted as shown in the drawing.

When not in use the device could be conveniently carried in the lid of the portable set.—T.W.K.

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.



Combined earth pin and aerial support for use with portable wireless sets.

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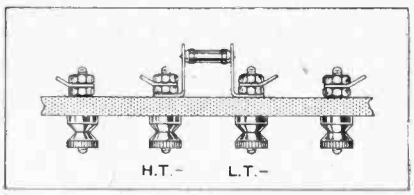
FILAMENT FUSE CONNECTIONS.

Instead of providing a special holder on the baseboard for cartridge-type filament fuses, the clips may be attached to the H.T.– and L.T.– terminals at the back of the receiver, when the fuse will serve as the connection between the H.T. and L.T. batteries.



Filament fuse mounted between the H.T.– and L.T.– terminals.

Not only is the fuse more accessible in this position, but the extra wiring ordinarily associated with this additional component is avoided.—J. S.

KDKA 309.1 METRE TRANSMITTER.

A High-power American Station within the Range of Broadcast Receivers.

IN a few weeks' time conditions will be propitious for the reliable reception of American broadcasting stations, for the background of noise due to summer-time atmospherics will have subsided and " good " nights when reception is clear and crisp will be more frequent.

Perhaps the most famous American broadcast station, at least as far as British amateurs are concerned, is the short-wave station KDKA at Pittsburgh, Pa., working on 62.7 metres; but the ordinary broadcast transmitter of the same station operating on 309.1 metres should be quite easily received in this country, since the power used is approximately 27 kW. (16 kW. in the aerial). Further, the wavelength lies in the band used by the B.B.C., and any sensitive broadcast receiver may be used; it is not necessary to build a special receiver as for the 62.7 metre station.

For those who may be successful in receiving the 309.1 metre station the following details taken from a recent paper before the Institution of Radio Engineers may be of interest.[1]

Aerial System.

Fig. 1 shows the aerial system which is supported on four spruce poles 80ft. in height. The flat top is a special arrangement of five interconnected cages, in which the high potential points are well removed from the supporting insulators. The vertical feed is through a 1½in. copper tube supported with porcelain insulators on the mast nearest the station buildings, the aerial ammeter and load coil being supported on similar insulators at the base of the same mast. Seven counterpoise cages radiate under the aerial from a point just below the aerial ammeter.

The constants of the aerial system are as follows:—

Natural period, 281 metres.

Effective height, 20 metres.

Total resistance at 309.1 metres, 10.8 ohms.

Normal aerial current, 40 amperes.

[1] *Proc. I.R.E., August*, 1926. " KDKA," by D. G. Little and R. L. Davis.

Oscillator Unit.

The oscillator frame is shown on the left in Fig. 2. Four 10 kW. type WO-41 water-cooled valves are grouped in parallel to generate the H.F. energy, a duplicate set being provided in case of breakdown.

The primary oscillating circuit consists of a 52 micro-henry flat strip inductance mounted on top of the frame and a 500 micro-microfarad air condenser, the vertical plates of which will be distinguished at the back of the frame. Frequency adjustments are made by means of a single turn variometer mounted at one end of the primary inductance, the final setting being made by observing the beats with a quartz crystal controlled oscillator occupying the panel in the extreme left of Fig. 2. The precision of adjustment is such that, under normal working conditions, the wavelength can be set to within 0.05 metre of its allotted value of 309.1 metres.

A schematic circuit diagram of the oscillator and modulator units is given in Fig. 3. Perhaps the most interesting feature of this circuit is the method of feeding the aerial circuit. A single lead, which includes a H.F. choke, is used for this purpose, and is connected between the lower end of the A.T.I. and ammeter and a suitable

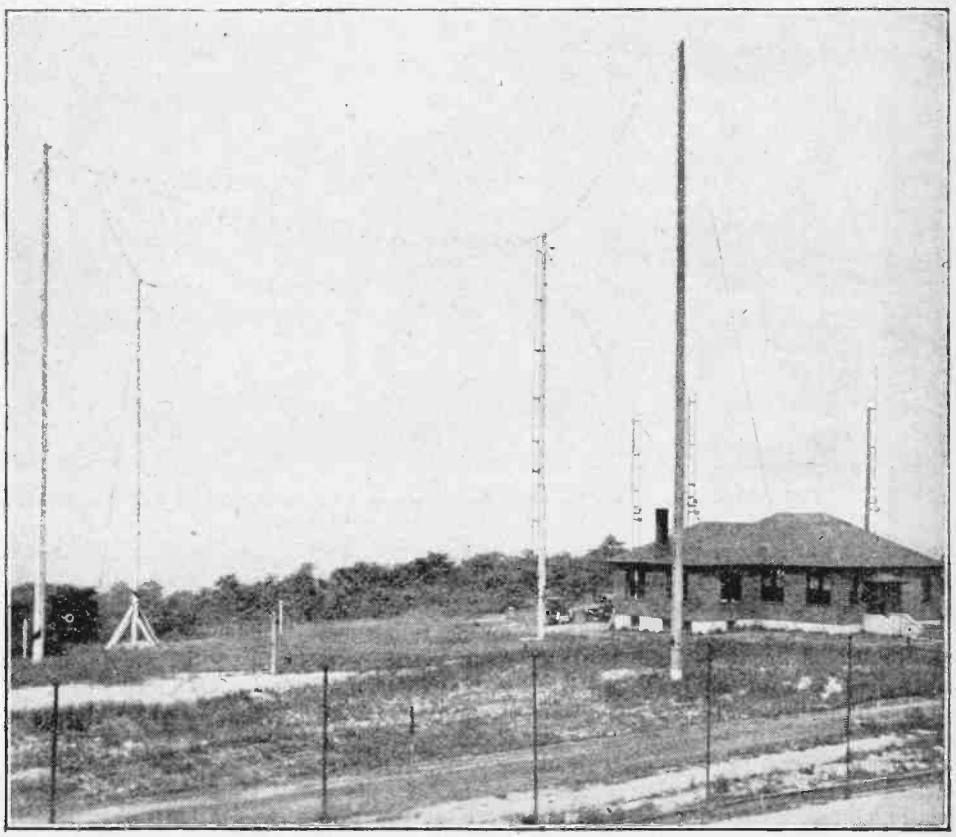


Fig. 1.—General view of KDKA showing the 309.1 metre aerial system.

KDKA 309.1 Metre Transmitter.—

point on the primary circuit inductance. The oscillator itself is, of course, earthed through the +L.T. lead. With only a single lead connecting the aerial to the transmitter, the losses incurred in transferring energy to the aerial are considerably reduced. The choke coil inserted in the feeder is for the purpose of suppressing harmonics. The normal anode voltage of the oscillator is 9,000 volts and the corresponding anode current is 3 amperes.

Modulator.

Type WO-41 valves of 10 kW. capacity are employed in the modulator, which is capable of accommodating 12 valves in parallel. Under normal conditions nine of these valves are in operation, but special switches are provided so that valves may be added or subtracted from the group under load to comply with fluctuating conditions.

Valves are grouped in pairs, and damping resistances are connected in each grid lead to suppress parasitic oscillation between valves.

The input from the L.F. amplifiers is applied to the grids through an oil-immersed transformer, and the appropriate negative bias is obtained from dry cell batteries. A milliammeter in series with the secondary winding gives immediate warning if the valves run into grid current.

The normal anode voltage to the modulator valves is 9,000, and the corresponding grid bias is 540 volts. This gives a modulation of 70 per cent. without running to grid current, and over this range the distortion does not amount to more than 3 per cent.—an interesting figure from an engineering point of view, but entirely negligible as far as acoustic results are concerned.

L.F. Amplifiers.

The microphone input from the land lines is passed through three amplifier units before being impressed upon the modulator. The arrangement of these amplifiers is briefly as follows:—

No. 1 Amplifier.—One 5-watt valve; anode volts, 200; push-pull transformer coupled.

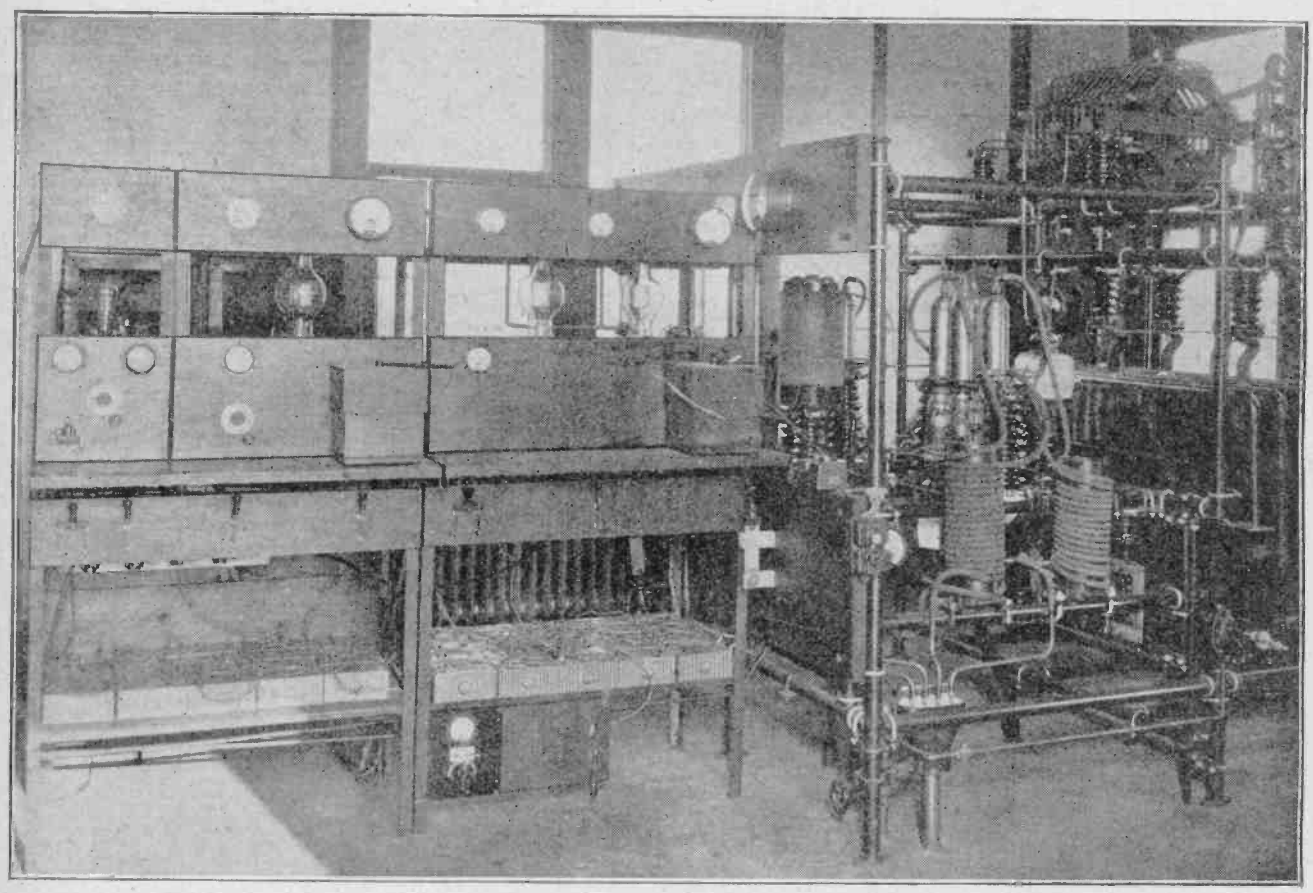


Fig. 2.—Main oscillator frame and quartz crystal controlled oscillator panels

No. 2 Amplifier.—One 50-watt valve; anode volts, 2,200; push-pull transformer coupled.

No. 3 Amplifier.—Two 50-watt valves in parallel; combined choke and push-pull transformer coupled.

For the anode current supply to the 5-watt valves, accumulator H.T. is used, while for the 2,200-volt supply to the 50-watt valves rectified and smoothed A.C. is employed. A potentiometer arrangement is also available by means of which all valves may be supplied from the A.C. source. Filament current is derived from a 12-volt storage battery.

The input amplitude to the amplifiers is kept under observation by means of a valve voltmeter, and the

KDKA 309.1 Metre Transmitter.—

average value kept constant by means of a potentiometer. In case of emergency the output from the amplifier can be controlled at the transmitter.

Power Supply.

Power for the station is obtained from two neighbouring sub-stations of a public supply company. The supply is 3-phase at 4,000 volts and 60 cycles, and on arrival is immediately transformed down to 220 volts.

The filament current for the oscillator and modulator power valves is obtained through the medium of motor generator sets, giving a D.C. output at a pressure of 15 volts.

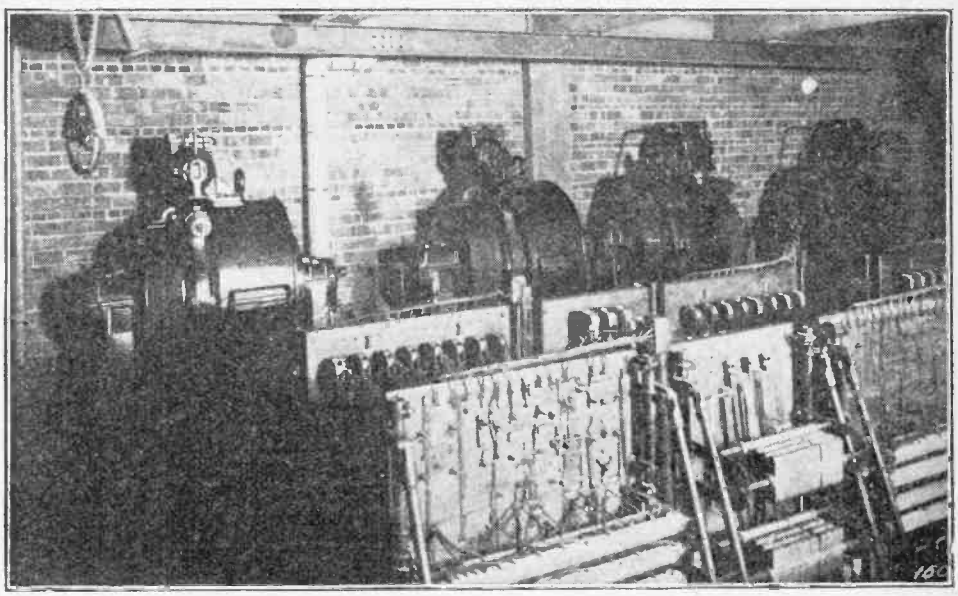


Fig. 4.—A corner of the machine room.

High-tension current for the transmitter is supplied from the A.C. mains through a step-up transformer, rectifying valves, and a smoothing circuit. Three single-phase transformers are used to step-up the supply from 220 to 22,000 volts, the power being regulated by chokes in series with each primary winding. Filament heating current is supplied from a specially insulated transformer connected in one phase of the supply, the filament voltage being read from a meter on the rectifier panel supplied through a 1 to 1 transformer. This permits the use of long leads without affecting accuracy.

There are three rectifier frames, each containing twelve WC-61 type water-cooled valves, and a conservative rating of the power output is 12 amps. at 16,000 volts from each rectifier. The valves are mounted in pairs, and are effectively protected from transient phenomena by surge gaps and chokes. A special delayed-action relay is also connected in the filament circuit to prevent application of the full filament voltage before the filaments have warmed up; this is necessitated by the exceedingly low resistance of the filaments when cold.

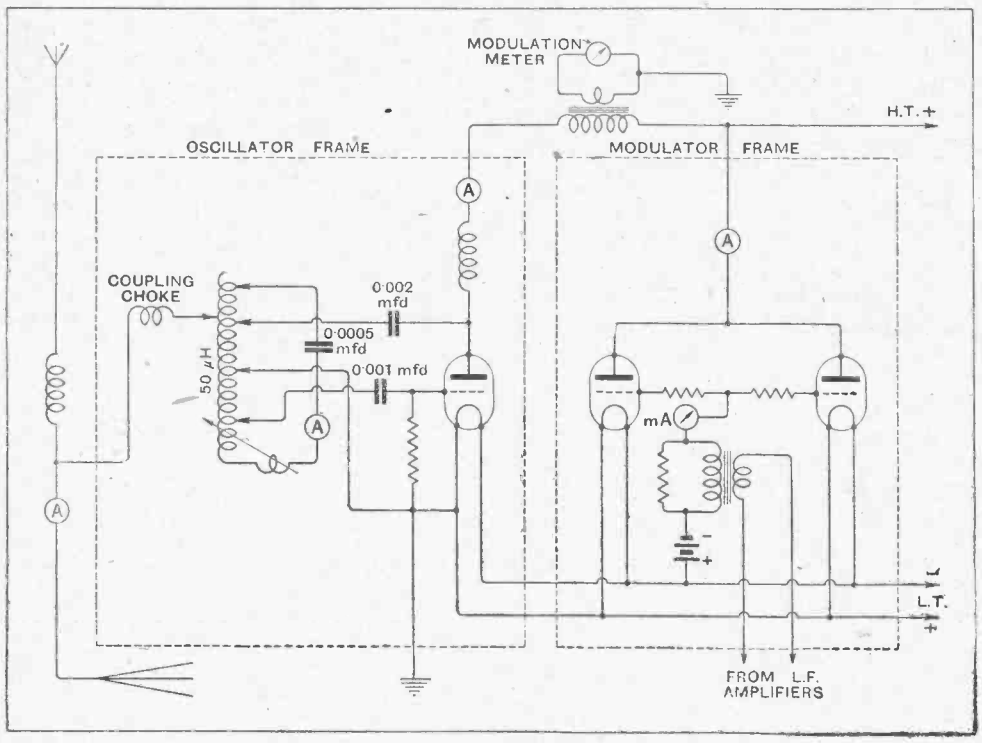


Fig. 3.—Fundamental circuit of the 309.1 metre transmitter.

The filter circuit consists of a 5-henry choke coil and a 12 mfd. condenser of unit construction built for a normal operating potential of 10,000 volts. This voltage ripple after passing the choke is inaudible, and cannot be detected in the oscillograph when using a 3in. deflection.

Two similar 5-henry inductances are used for the modulation choke, and are installed in the basement along with the smoothing choke.

Control.

The whole station may be controlled from one desk, which follows generating station practice in

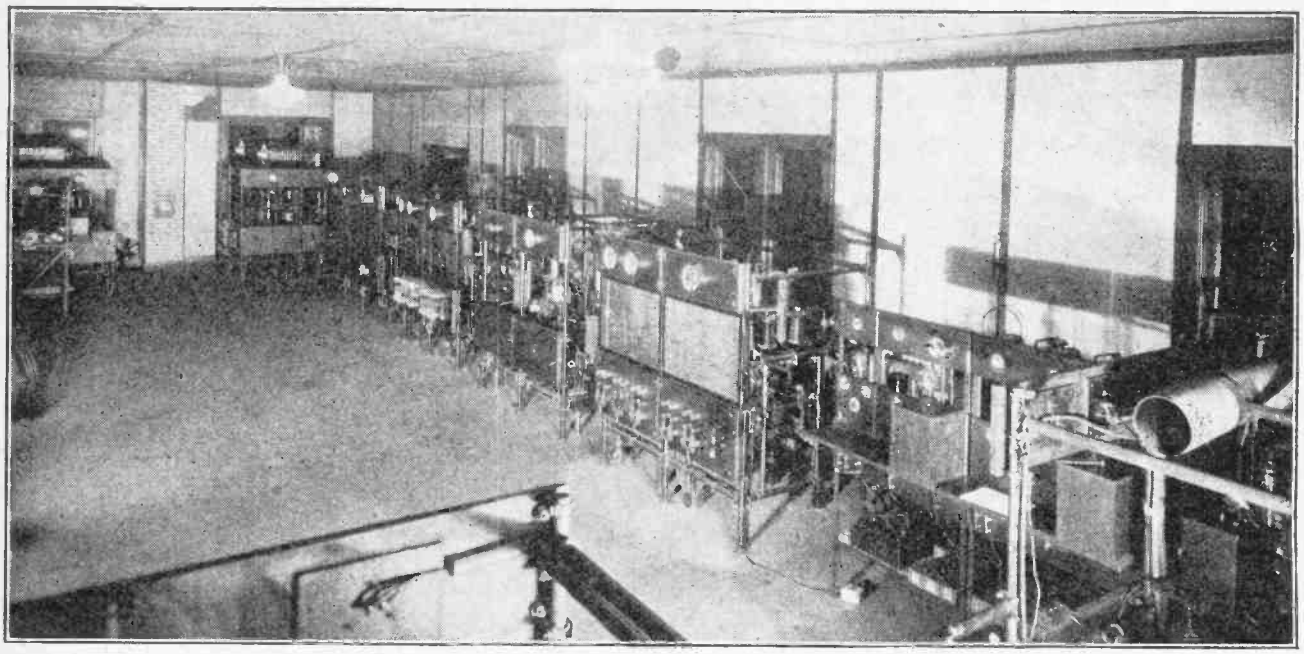


Fig. 5.—General view of the apparatus room at KDKA.

being adequately provided with push buttons and signal lights. The chief operator is stationed at this desk, a second operator being stationed in the apparatus room for the purpose of making adjustments of wavelength, filament voltage, etc.

Station Efficiency.

The use of water-cooled valves enables the efficiency of the station to be arrived at with a considerable degree of accuracy. The oscillator efficiency, *i.e.*, the ratio of power in the aerial to power in the anode circuit of the valves, was found to be 67 per cent. over a wide range of powers. This is a remarkably good figure having regard to the fact that the station is built on a commercial basis.

The aerial circuit resistance, arrived at by the usual method, came out at 10.8 ohms, while with the heat loss method a value of 10.73 ohms was obtained—a difference of less than 1 per cent.

The primary circuit resistance was found to be 0.3 ohms by two independent methods.

During the early tests of this station some interesting comparisons were made by transmitting alternate items of the programme, from the old station at East Pittsburgh and the new station, reports being sent in from Westinghouse representatives in all parts of the United States. Observers were unanimous in reporting a considerable increase of signal strength, especially at distances over 300 miles.

"Accumulator Charging, Maintenance and Repair." Intended for the use of all interested in the charging and upkeep of accumulators for wireless work, motor car lighting and starting equipment, and for country house lighting plant, by W. S. Ibbetson, pp. 118, with 33 illustrations and diagrams. Published by Sir Isaac Pitman & Sons, Ltd., London; price 3s. 6d. net.

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"Five Simple Wireless Sets." A simple Crystal Set, a Selective Crystal Set, a Single-Valve Reaction Receiver, a Single-Valve Amplifier, a Two-Valve Amplifier; by J. H. Watkins, pp. 46, with 17 illustrations and diagrams. Published by the Radio News Bureau, Ltd., London (being No. 1 of the *Home Wireless* series); price 1s.

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"Bildrundfunk (Transmission and Reception of Pictures and Television)," by Dr. A. Korn and Dr. E. Nesper, pp. 104, with 65 illustrations and diagrams. Published by Julius Springer, Berlin.

BOOKS AND CATALOGUES RECEIVED.

We have received from the Bell Telephone Laboratories, Inc., New York, reprints of various papers by members of their technical staff, including the following which relate to wireless matters:—

No. B185.—"Theory of the Operation of the Howling Telephone," by Harvey Fletcher.

No. B192.—"A Static Recorder," by H. T. Friis.

No. B194.—"Directive Diagrams of Antenna Arrays," by Ronald M. Foster.

No. B199.—"Portable Receiving Sets for Measuring Field Strengths," by Axel G. Jensen.

Valco Limited (Tabor Grove, Wimbledon, London, S.W.19.). Price list of valve repairs.

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Clarkes (Redditch, Lancs). Leaflets descriptive of "Sinew" terminals and system of set wiring.

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Excelsior Motor Co., Ltd. (King's Road, Tyseley, Birmingham.). Catalogue of Excelsior Wireless Products.

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The M.A.P. Company (Gt. Lister St., Birmingham). New catalogue of wireless sets, transformers, coils, etc., etc.

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Radio-Arc Electrical Co., Ltd. (Bennett Street, Chiswick, W.4.). Catalogue of "Liberty" Wireless Specialities, including sets, accessories and components.

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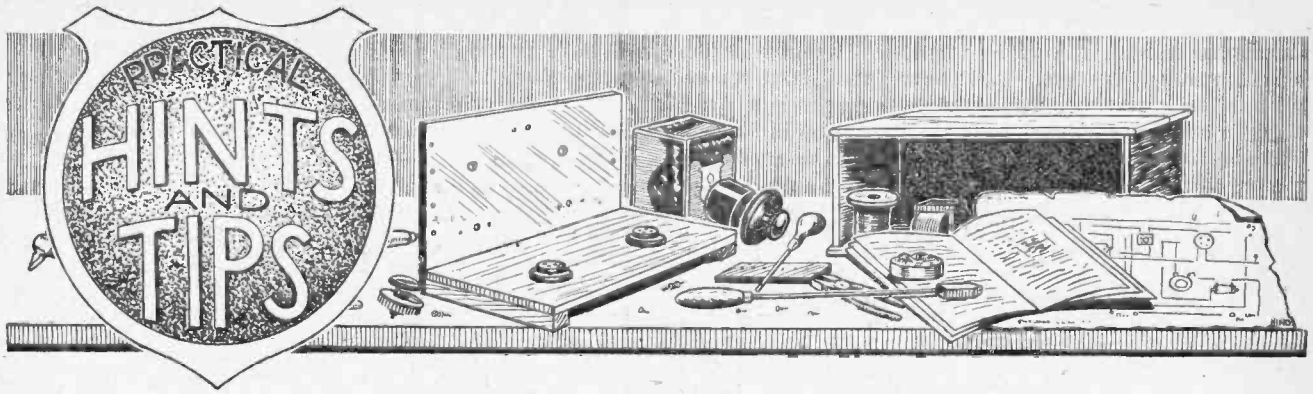
The Benjamin Electric Ltd. (Brantwood Works, Tariff Road, Tottenham, London, N.17). Catalogue of Benjamin wireless products and details of Benjamin shortpath valves.



A Section Mainly for the New Reader.

VALVE OR CRYSTAL RECTIFICATION.

In last week's issue we considered superficially some of the factors involved in deciding whether a crystal or valve should be used as a rectifier, primarily from the point of view of rectification as such, and also in view of the problem of coupling the detector to an L.F. amplifier. It is now proposed to treat the subject of the alternative methods of rectification as they effect sensitivity, selectivity, and H.F. amplification.

It may be said at once that there is little advantage, from the point of view of range, in adding a crystal detector to an H.F. valve unless a carefully designed coupling is used. The same remark really applies to any form of H.F. amplification, but as the crystal cannot supply regeneration or reaction, as can the valve, inefficiency in this respect is more clearly evident. Thus, when the latter detector follows even a very poor H.F. stage, the real inefficiency is masked by the fact that a considerable degree of reaction is obtainable from one or both of the valves, and the set as a whole may appear to be sensitive, although the H.F. valve is more or less a "passenger."

In considering whether we shall use a simple detector valve or an H.F. valve with crystal detector, the fact that an extra tuned circuit is obtainable with the latter combination must be taken into consideration, as this will give an improved overall selectivity, due to the filtering effect of the circuit. Moreover, there will be no need to insert a leaky grid condenser with positive bias, thus the grid circuit of the valve will be practically undamped except for the possible load of the aerial, and greater selectivity and sensitivity will result.

If crystals of the more popular types are used, with conventional couplings, such as are shown in Fig. 1, the damping in the anode circuit will be so high that little advantage will be gained. In the diagram (*a*) represents the usual tuned-anode arrangement, and (*b*) the tuned transformer method of coupling. To make the use of the crystal worth while, it is necessary to reduce its damping. This can be done by increasing the proportion of capacity to inductance in the tuned circuit by using a large condenser; this is not altogether a practicable method, due to the difficulty in covering a reasonably wide wavelength band, although it may be adopted with success with detectors such as carborundum, which have a fairly high resistance and do not call for an exceptionally large capacity to give a fair degree of selectivity and sufficient freedom from damping. Generally speaking, however, the methods shown in Fig. 2 (*a*) and (*b*) are preferable. Here the voltage applied to the detector (and consequently the current taken from the tuned circuit) is reduced by connecting the crystal and output circuit across only a portion of the total inductance.

Generally speaking, if a sufficiently low damping is arranged for, some form of neutralised or balanced coupling must be used. The general

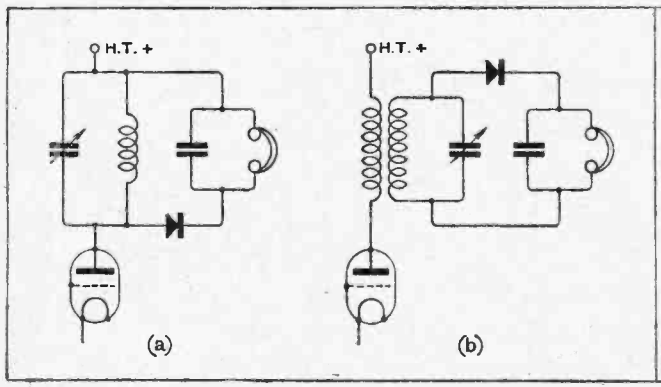


Fig. 1.—Coupling a crystal to an H.F. valve. (a) Tuned anode; (b) Tuned transformer.

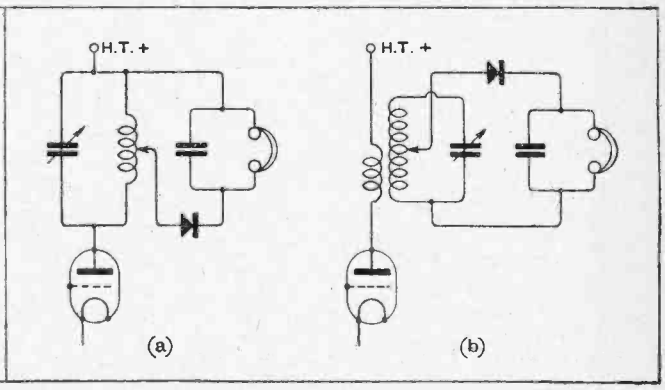


Fig. 2.—Valve-crystal H.F. couplings giving increased selectivity with reduced damping.

design of a modern intervalve H.F. transformer may be closely followed, bearing in mind, however, that there will be little object in reducing losses beyond a certain point.

It is unfortunate that the resistance of a crystal combination varies considerably with different points of contact and the degree of pressure; this feature, in spite of the undoubted advantages of this type of detector, will probably prevent its extended use, in conjunction with H.F. valves, except by experimenters and those who are not averse to making occasional adjustments, with, at the same time, a fair knowledge of the reasons for such adjustments.

ELIMINATING THE H.F. VALVE.

Regular readers will have noticed that, as a general rule, switching arrangements for H.F. valves are not shown in the pages of this journal. This is because experience has shown that there is a grave risk of introducing capacity and other losses.

There is, however, little difficulty in cutting out a single neutralised H.F. stage. This may be done by merely switching off the filament. It will, as a rule, be necessary at the same time to deneutralise by a slight movement of the balancing condenser. If this does not give sufficient signal strength, it is permissible to light dimly the filament of the H.F. valve. Worked under these conditions, the valve is probably taking only a very small current in both filament and anode circuits, and the arrangement may be considered as efficient.

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THE AERIAL LEAD-IN.

Ex-Government field telephone cable, having a number of strands of tinned steel wire with an insulated covering, is still widely sold for use as aerial wire. It has been found that this wire, when bared for connection to an external lead-in terminal, is apt to rust. This may be prevented by twisting the various strands together and coating with solder.

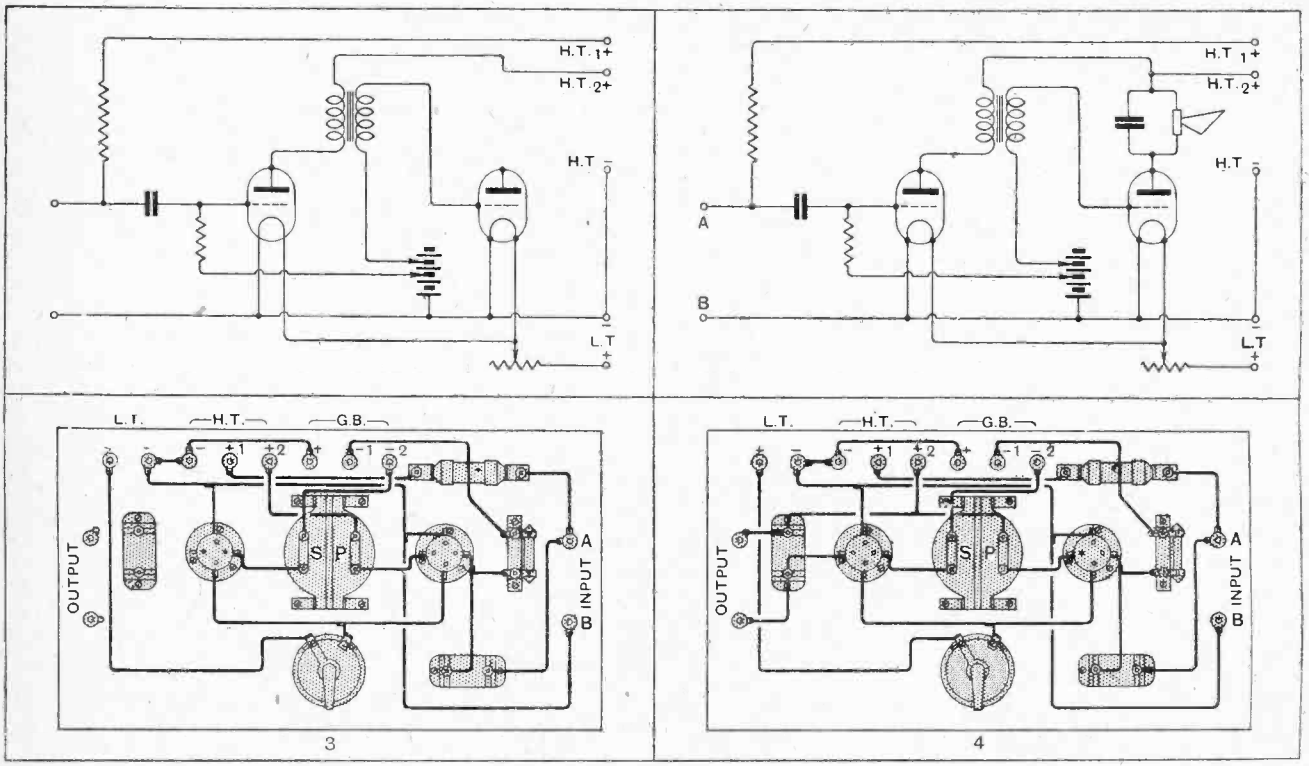
DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 44 (b).—A Two-stage L.F. Amplifier.

(Concluded from last week's issue.)

In this series of diagrams it is hoped to make clear the steps to be taken in converting theory into practice in the construction of various typical wireless instruments. The L.F. amplifier shown below, which is suitable for connection to a detector valve with or without H.F. amplification, has one resistance- and one transformer-coupled stage, and is of a type which can be recommended.



The L.F. transformer is wired up with its primary in the anode circuit of the first valve. One end of its secondary connects to the grid of the second valve, and the other end to filament through a bias battery.

The anode circuit of the second valve is completed through the loud-speaker (with its shunting condenser) and the H.T. battery. The input terminals, *A* and *B*, are for connection to plate and filament of the preceding detector valve.

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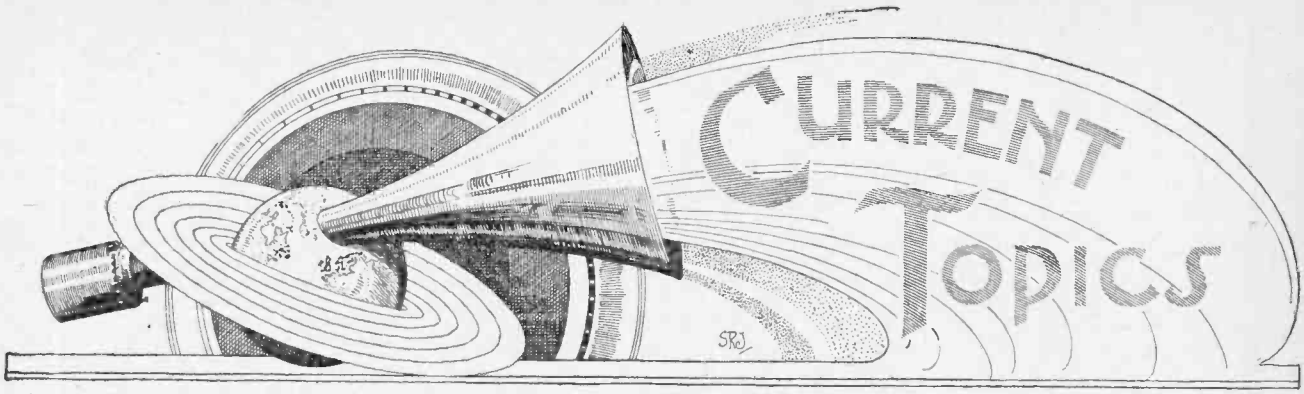

News of the Week in Brief Review.

HAPPY MAN.

A writer in the North says that wireless is a powerful agent for keeping people quiet. There are evidently no oscillators in his neighbourhood!

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FIRE BRIGADE WIRELESS.

The Vienna Fire Brigade is being equipped with wireless telephony transmitters and receivers in order that communication can be maintained with headquarters during attendance at a fire.

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HEART BEATS BROADCAST.

The High School for Physical Development situated at Spandau, a suburb of Berlin, has installed a low-powered broadcasting station. The programmes, which are broadcast every Tuesday evening on 300 metres, include the transmission of heart beats and similar biological phenomena.

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JOY IN POLAND.

Listeners in Poland are now enjoying greater freedom in view of the withdrawal of Government restrictions on wireless reception. The procedure for obtaining licences has been simplified, but it is understood that severe penalties will be imposed on "pirates."

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BANISHING BOREDOM ON TRAINS.

The Canadian National Railways, in issuing a list of broadcast programmes for reception on express trains during September, invite passengers to send in their opinions of the service. Special efforts are being made to provide light programmes which will appeal to the traveller without boring him.

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MARCONI'S LOUD-SPEAKER "A NUISANCE."

The Dartmouth Town Council passed a hearty vote of thanks to Senatore Marconi recently for the pleasure afforded by the nightly broadcasting of music from the loud-speaker on board the *Elettra* in Dartmouth Harbour. One resident had written complaining of the "nuisance," but the Mayor regretted that there was someone "so narrow as to consider those splendid performances a nuisance."

THE DANGEROUS CASQUETS.

The new radio-electric "lighthouse" at the Casquets, off Guernsey, has just been put into operation.

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A RADIO PROCESSION.

The opening of the Radio World's Fair in New York last week was signalled by a procession down Broadway headed by a mobile broadcasting station. Using the call sign 6XBR, the mobile station transmitted a programme, which was relayed by the local broadcasting station WFBH. The Mayor of New York received the procession and greeted manufacturers and guests of honour.

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DID YOU MEET HIM?

One evening during the Olympia Show an enterprising gentleman made a tour of the stands selling tickets in a raffle for a large box of cigarettes, explaining that the draw would take place at 8 p.m. at a certain well-known stand. When at 8 o'clock the expectant ticket-holders visited the stand in question they found that nothing was known of the persuasive gentleman, who has not been seen since.

BELGIAN RADIO EXHIBITION.

Belgium is holding an International Radio Exhibition this week at the Palais des Fêtes, Ghent, under the auspices of the Radio Club Gantois.

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NO CHANCE FOR THE PROFITEER.

Traders of the "smart" type are having an unfruitful season at Toulouse, where loud-speakers have been set up in all the public markets. For three hours every morning *Radio Toulouse* keeps the public informed by means of the loud-speakers as to the correct current prices for the various commodities.

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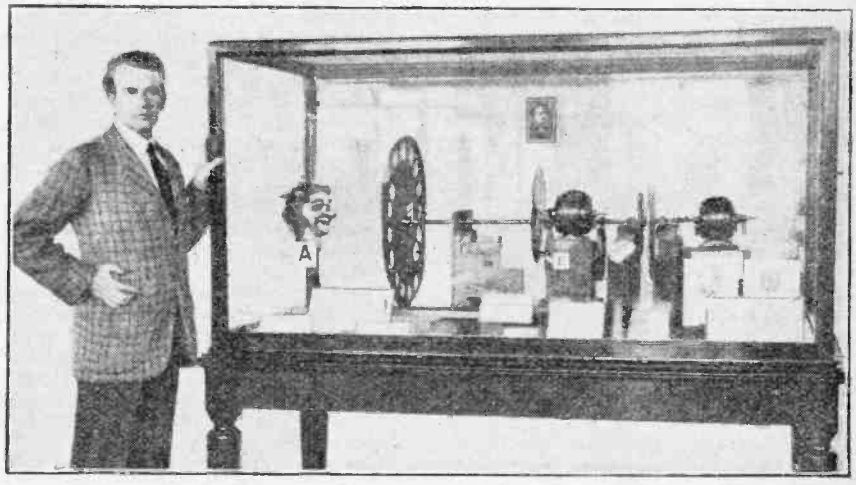
RADIO SOCIETY OF GREAT BRITAIN.

The Radio Society of Great Britain will hold the opening meeting of the 1926-27 session this evening (Wednesday) at 6 p.m. (tea at 5.30) at the Institution of Electrical Engineers, Savoy Place, W.C.2. Prof. W. H. Eccles, D.Sc., F.R.S., will open a discussion on "The Relative Values of Long and Short Wave Communication and their Future Possibilities."



TELEVISION IN THE MAKING. Mr. John L. Baird photographed beside his television exhibit at the Science Museum, South Kensington. The apparatus on view consists of the gear used by Mr. Baird in his earliest experiments.

BROADCASTING OF THE FUTURE.

"Successful broadcasting will be a judicious assortment of the grave and gay, the educational, moral, and religious, and what is called rather vaguely the economic. If wireless annihilates space it had better do it effectively; and to do it effectively it must operate with impartiality and judgment in many spheres."—*The English Review*, September, 1926.

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RADIO CROPS.

So remarkable have been the results attending experiments with crops in the vicinity of wireless aerials near Potsdam that the Prussian Government has appointed a scientific commission to investigate the phenomenon.

Two fields, one with a number of aerials and the other without them, are being used for the tests. It is reported that the field with the aerials, notwithstanding poor soil, has produced rich crops of wheat, rye, potatoes, and other vegetables, whereas the other remains unproductive.

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WHAT THE TRAVELLER SAW.

"No one who has not stayed in remote hamlets can have any idea of the difference which the wireless set has made in the life of the countryside. The intellectual isolation of the countryside is a thing of the past. The old-time cottager had only a dim perception of the great world beyond his narrow world; to-day the voices of prince and politician speak to him in his own cottage."—H. V. Morton in the *Daily Express*.

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"HALLO" FROM THE ATLANTIC.

Passengers on board the Atlantic liner "Leviathan" can now avail themselves of a commercial wireless telephone service to any city in the United States while the vessel is within 2,000 miles of New York. Conversation is also possible with other ships.

The charge for the new service is £1 per 1,000 miles for a three-minute conversation.

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A WIRELESS DEBATE.

A debate on the subject: "That it is impossible to obtain absolute purity with a valve detector," is to be held by the Institute of Wireless Technology on October 6th at the Engineers' Club, Coventry Street, London, W. The debate will be opened at 7 p.m. by Mr. Y. W. P. Evans, M.I.R.E., in support of the motion, and Dr. F. T. Fawcett, M.A., Ph.D., D.Sc., will speak against.

A further meeting of the Institute will be held on November 10th.

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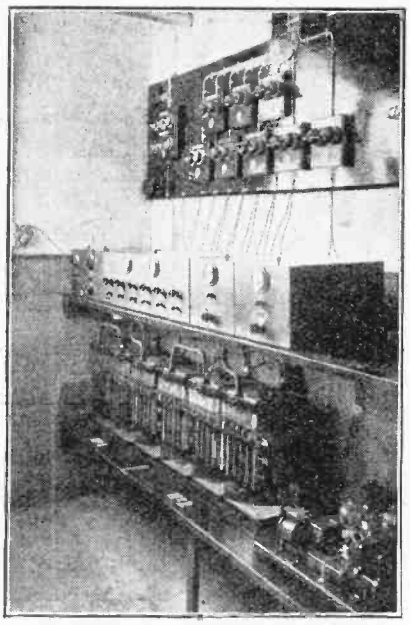
BROADCASTING AND THE CLUBS.

By arrangement with the Radio Toulouse Station, the Federation of the South Western Radio Clubs of France will make use of the microphone in order to broadcast the reports, observations, and suggestions of the seventeen radio clubs which comprise the association. The Toulouse broadcasting authorities will thus be brought into close touch with the expressed opinions and the requirements of the chief sections of wireless amateurs in the south of France.

DELUGE IN U.S. PATENT OFFICE.

A flood of radio patent applications is threatening to overwhelm the United States Patent Office. Although the number of examiners handling wireless applications has been almost trebled, 1,850 petitions are pending, as compared with 1,594 on January 1st, and the wireless department is five months in arrear.

Applications increased to such an extent after broadcasting attained popularity that a separate department was constituted in August, 1924, but even with twelve assistants it has steadily lost ground since the beginning.



WORLD'S LARGEST HOSPITAL SET? This receiver installed in the North Evington Infirmary, Leicester, operates 652 pairs of headphones and 20 loud-speakers. The H.F. and detector unit can be seen on the extreme left, followed by the amplifiers. The installation is described below.

WIRELESS FOR THE SICK.

The North Evington Infirmary, Leicester, has been equipped with what is probably the largest wireless receiving installation in any hospital in the world. The cost of the equipment, which was met by spontaneous public subscription, was nearly £1,200, the whole of the money being collected in a very few weeks.

There are 652 plugs for the attachment of headphones, and 20 plugs for loud-speakers, the latter being on a separate circuit.

The set comprises one H.F. stage which can be switched out of circuit; a detector followed by one stage of resistance capacity coupling, and a series of amplifying valves, one for each 100 headphones, three for the loud-speaker circuit, and two for the Maternity Block and New Nurses' Home circuit.

Two banks of accumulators supply L.T., one bank being in circuit and the other on charge from the mains by means of a Tungar unit. H.T. is also obtained from the mains.

NEWS FROM THE CLUBS.

Proposed New Birmingham Society.

It has been proposed to form a radio society for the Birchfields and Witton districts of Birmingham. Wireless enthusiasts interested in the proposal are asked to communicate with Mr. S. J. Phillips, 61, Broadway, Handsworth, Birmingham.

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New Transmitters' Society.

The inaugural meeting of the QRP Transmitters' Society was held at Wanstead on Friday, September 10th. The Society has as its object the furtherance of low-power transmission and short-wave work generally. Hon. secretary: Mr. L. J. Fuller (6LB), Glenburn, 13, Seagry Road, Wanstead, Essex.

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Preston Society's Ambitious Programme.

At the third annual general meeting of the Preston and District Radio Research Society, held on September 6th, an unusually interesting syllabus was discussed. Among the subjects which will come under review during the winter session will be "Modern Loud-speaker Design," "Microphones and Amplifiers used by the B.B.C.," and "Behind the Scenes in Broadcasting," the last named to be dealt with by Mr. Edward Liveing, the station director of 2ZY. A competition is to be held in which prizes will be given for (1) neatest sets, (2) most novel sets, and (3) most efficient sets.

The reports on the Society's work during the past year showed a sound position, notwithstanding an active and expensive season.

Full particulars of membership can be obtained from the hon. secretary, Mr. John B. Cookson (2BDA), 14, Lune Street, Preston.

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Selfridge Radio Exhibition Prizes.

We have been asked to publish the following list of prizewinners in the competition for amateur-built sets organised in connection with the Selfridge Wireless Exhibition:—

SECTION 1.

First.—A. H. Hatton, Hackney and District Radio Society.

Second.—Oglanda Radio Society (hon. sec. J. Sewell).

Third.—P. J. Muscutt, Croydon and District Radio Society.

SECTION 3.

First.—H. Budd, Woolwich Radio Society.

Second. R. W. Emerson.

Third.—R. W. Emerson (Wireless League).

SECTION 6.

First.—Oglanda Radio Society.

Second.—H. Budd, Woolwich Radio Society.

Third. — A. Brackensey (Wireless League).

SECTION 7.

First.—P. Emsley (Selfridge Radio Society).

No awards were made in Sections 2, 4, and 5. One prize only was awarded in Section 7.

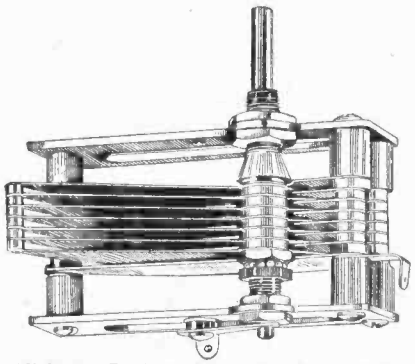
SEEN ON THE STANDS.

Further Interesting Show Items.

THE NEW DEVICON CONDENSER.

Radio Devices Co. introduced during the exhibition a new type of condenser designed to give straight line frequency tuning. The plates as well as the end mounting pieces are of brass, the fixed plates being supported at three points instead of two, as is often the case with the very narrow type of straight line frequency plate. The employment of three securing points for the fixed plates is probably a good feature, particularly when ebonite is used for the insulating material, as it must not be overlooked that, should the ebonite supports warp, the plates will become displaced and the condenser will in consequence lose its calibration. In the case of the Devicon condenser, however, the spindles which support the fixed plates also serve as spacers between the end mounting plates, and therefore the use of three spindles is perhaps all the more important.

The top bearing is nearly 1in. in length and is conical in shape, the spindle being



All-brass Devicon condenser fitted with conical type bearing and ball race thrust bearing, and designed to give straight line frequency tuning.

driven up into position by a ball race thrust bearing at the lower end. The setting of the plates is adjusted by means of a screw and locknut. The moving plates are spaced by means of brass washers and are bonded together at the tips. Reliable contact with the spindle is made by a hard bronze spring pressing on the end of the shaft. The condenser is attached to the panel by one-hole fixing, whilst a tapped hole is also available for taking a screw to prevent the condenser rotating.

A cleanly moulded 4in. Bakelite dial is supplied with brass bush and grub screw, the scale being divided into 180°.

Radio Devices Company, Newdigate Street, Nottingham.

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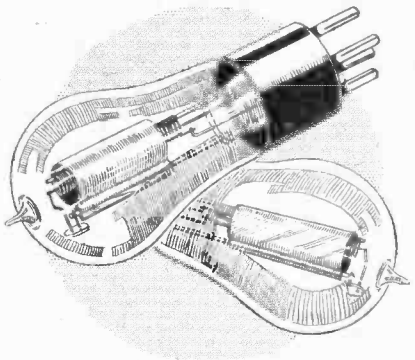
THE NEW COSMOS VALVES.

The new "Cosmos" valves are constructed on the "shortpath" principle, as are most of the earlier types produced by the same makers, and are of extremely high efficiency.

The Type S.P.55/R is shown as having a voltage amplification factor of 6, with the very low internal impedance of 3,500 ohms. It takes a filament current of 0.25 amp. at 5.5 volts, with H.T. up to 120 volts with a bias voltage of 12. It will thus handle voltage swings of large amplitude without valve distortion, and would seem to be particularly suitable for following a choke or resistance-coupled stage, as

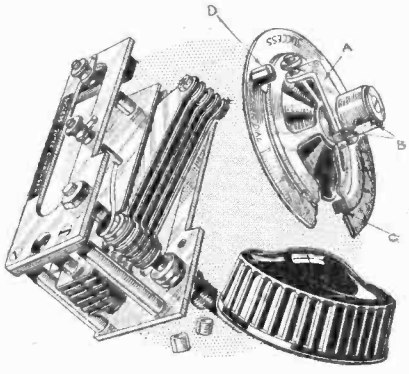


The new Cosmos valves, type DE55 and SP55R.

in this position the avoidance of grid currents is a matter of great importance. It is also suitable for use in transformer-coupled amplifiers where greater volume than usual is required.

Hitherto, a power-handling capacity of this order has usually been associated with an amplification factor of only about half that claimed for this valve.

Another interesting new valve is the S.P.55/B, which has a voltage amplification factor of 35 with an impedance of



The new Success Super condenser and vernier dial. A ring of india rubber, *C*, is compressed by the small steel wheel attached to the arm, *A*, the expanding effect of the india rubber under pressure giving a critical yet positive propulsion to the spindle. The arm is fitted with a double ball race bearing, *B*. A quick adjustment is obtained by rotating the knob, *D*, which is conveniently situated for operation when gripping the large diameter fine tuning control.

only 55,000 ohms—a very low figure. Its filament consumes 0.09 amp. at 5.5 volts. It should be particularly suitable for use as a "bottom bend" detector, with a high resistance in its plate circuit, and also for H.F. amplification with a neutralised tuned anode circuit. Indeed, it might even be possible to design an H.F. transformer for it. As far as L.F. amplification is concerned, the application of the valve would appear to be limited by its small power-handling capacity, although it may be that the published curves are flattened considerably when a large resistance load is imposed on the anode circuit.

Metro-Vick Supplies, Ltd., Trafford Park, Manchester.

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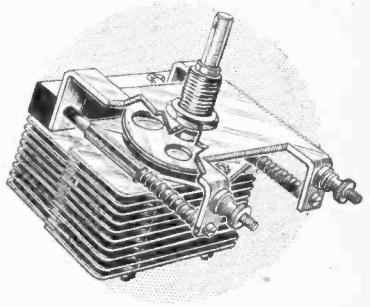
THE "SUCCESS" CONDENSER.

Beard & Fitch, Ltd., exhibited a new type of variable condenser, which is of excellent workmanship and good design. It is constructed mainly of brass, including the plates, with steel bearings. As is the case with all up-to-date components of this type, the rotor is in electrical contact with the frame; a good connection is provided through a "pigtail" of phos-



A new type of variable condenser, giving critical control without the use of gearing, and occupying a panel space of only 3½×2½ in.

phor bronze strip. A three-hole fixing is used.

The slow-motion dial is of unusual and apparently very effective design. The drive is transmitted through a well-made friction reduction gear, which is engaged by the pressure of rubber pads which bear on the panel. No backlash can be detected. All the brass parts are polished and gold-lacquered.

Beard & Fitch, Ltd., 34, Aylesbury Street, Clerkenwell, E.C.

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SLIDING PLATE CONDENSER.

An entirely new principle in variable condenser design has been adopted in the new condenser shown by Ripaults, Ltd. The elongated plates used in the construction of straight line frequency condensers fitted with rotating plates necessitates the allowance of liberal spacing on the instru-

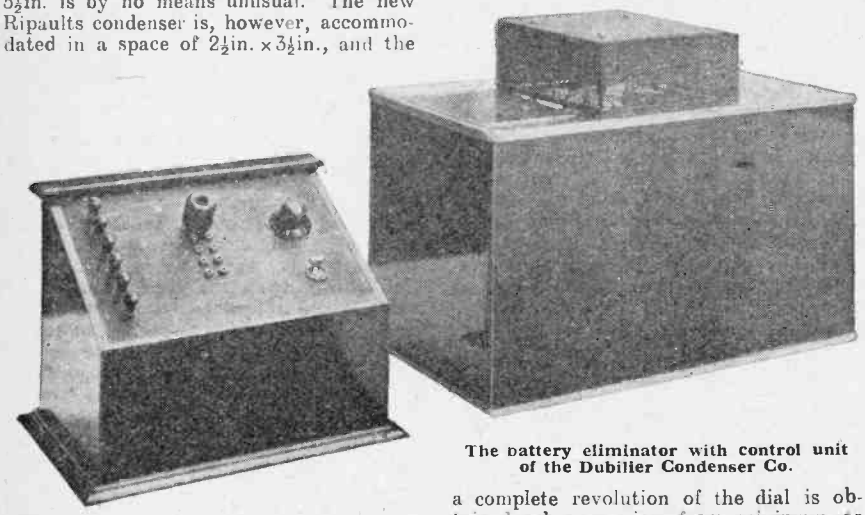
ment panel in order to prevent the tip of the plates from fouling other components, and the provision of an overall length of 5½in. is by no means unusual. The new Ripaults condenser is, however, accommodated in a space of 2½in. x 3½in., and the plates can be designed to give either straight line wavelength or straight line frequency tuning.

Both sets of plates are roughly rectangular in shape, the fixed plates being attached by two bolts to an ebonite bar carried on a stamped brass frame. The moving plates, which are similarly held together by two bolts, are secured to a carriage which is arranged to slide on a pair of brass bars. Two springs normally drive the moving plates forward so that they mesh with the fixed plates, giving maximum capacity. A spiral cam engages on a roller attached to the moving plates, which causes them to slide along the guide rods. Reliable contact is made with the moving plates both through the long split sleeves on the guide rods and by soldering the ends of a pair of tension springs to the frame and the moving plates. A piece of fibre packing is held down under a spring washer to serve as a thrust bearing to the spindle and to provide a suitable degree of friction.

The principal merit of the design is that a complete revolution of the dial is obtained when moving from minimum to maximum capacity, so that fine tuning is obtainable without the need for gearing, whilst the capacity change in regard to any given movement of the dial for the purpose of producing straight line capacity or straight line frequency tuning is controlled by the contour of the cam which propels the moving plates.

A 4in. dial is fitted cleanly moulded in Bakelite and divided into 360°. This condenser is attached to the instrument panel by the usual one-hole fixing method.

Ripaults, Ltd., King's Road, London, N.W.1.



The battery eliminator with control unit of the Dubilier Condenser Co.

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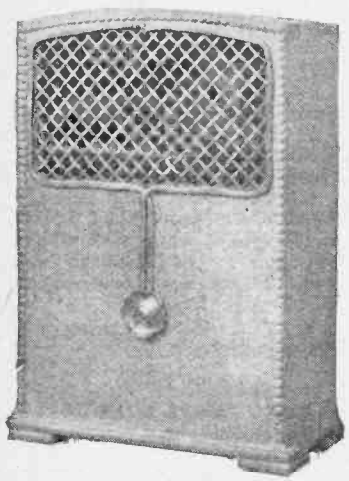
DUBILIER BATTERY ELIMINATORS.

Perhaps the most interesting battery eliminators to be seen at the Show were those developed by the Dubilier Condenser Co., Ltd. Models are shown for use with A.C. or D.C. supply which, although of somewhat extravagant design, probably represent the most perfect form of eliminators yet produced. Both D.C. and A.C. sets are built as two units, one including the H.T. rectifying or potential adjusting and smoothing apparatus, together with the equipment for filament current supply, while the other is a control unit which is used near a receiving set and connected with the mains apparatus by means of a multi-wire cable. The principal feature in both the A.C. and D.C. sets is that two secondary batteries are incorporated, which are placed on charge and discharge at regular intervals by means of an automatic switch, so that when one battery is connected through to the set the other is on charge.

In the A.C. unit a small Philips gas discharge valve is used for providing the battery-charging current, whilst the rectifying valve for H.T. supply makes use of two filaments and a common plate so as to obtain more than one potential output with a single valve.

Dubilier Condenser Co., Ltd., Ducon Works, Victoria Road, North Acton, W.3.



Gent and Co.'s new loud speaker. It is of particularly attractive design, adjustment of the pole pieces being obtained by rotating the rosette on the front.

TRADE NOTES.

A "Beco" Novelty.

To the novelties obtainable from a judicious combination of rotating cardboard shapes there appears to be no end. The latest is a cardboard representation of the "Beco" loud-speaker, marketed by the British Electrical Sales Organisation, 623, Australia House, Strand, W.C.2. By revolving the cardboard disc different spaces are made to appear in which to insert notes of tuning adjustments for various stations.

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Attractive Marconiphone Publications.

Three interesting booklets have reached us from the Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1. One is a re-issue of the Marconi Log Book which contains many pages suitably ruled for recording stations heard, wavelength, tuning adjustments, etc., etc. "The Story of the Marconi Valve" deals with valve history from Fleming's early experiments up to the present day. In the booklet entitled "Circuits for Building Radio Receivers" the reader will find many useful tips and a guide to Marconiphone and Sterling components.

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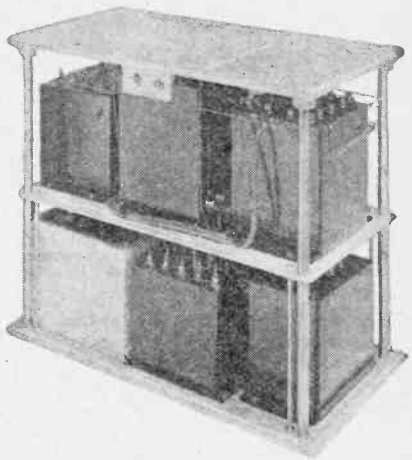
Bowyer-Lowe Radio News.

Messrs. Bowyer-Lowe, of Letchworth, are members of a growing number of radio firms who keep their customers posted on points of manufacturing interest by means of a printed periodical. The "Radio News" for the 1926-7 season contains an interesting article on superheterodyne reception and covers a wide range of accessories and components.



Dubilier battery eliminator with cover removed.

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Secrets of Ebonite.

In a fascinating little brochure entitled, "The Gentle Art of Choosing One's Panel," the manufacturers of Radion panels outline the various points to be looked for in selecting ebonite for an efficient wireless receiver. The booklet is obtainable from the American Hard Rubber Company (Britain) Ltd., 13a, Fore Street, London, E.C.2.

THE RUBEN RECTIFIER.

A New Contact Rectifier for Trickle Charging.

By A. DINSDALE.

THOSE readers who are blessed (or cursed, according to the point of view!) with an A.C. electric lighting supply will be thoroughly conversant with the trials and tribulations inseparable from attempts to charge their own L.T. and H.T. accumulators from this source. The transmitting amateur who endeavours to make the mains supply the high voltage D.C. required by his transmitting valves may also incline to bitterness on the subject, unless he be one of those plutocratic high power merchants who can afford to instal a two-electrode valve rectifier, and even he may become annoyed when a valve burns out.

Electrolytic Rectifiers.

Electrolytic rectifiers are frequently used for charging accumulators, but they have many disadvantages peculiar to themselves. Solutions have a wonderful way of turning green, brown, and purple, of crawling out of the jar and playing havoc with carpets, or growing a rich layer of mould which smells worse than it looks. In any case, the lady of the house usually has something to say about it, even in the case of those rectifiers with good, well-behaved solutions in them, for even they can be spilled.

In the face of these disadvantages, therefore, it is not to be wondered at that inventors have for many years been trying to evolve a solutionless form of electrolytic rectifier, making use of the unilateral conductivity of certain substances when placed in contact. Efforts in this direction met with little practical success, however, as a brief outline of the work of Pawlowski (one of the leading investigators along these lines) will show.

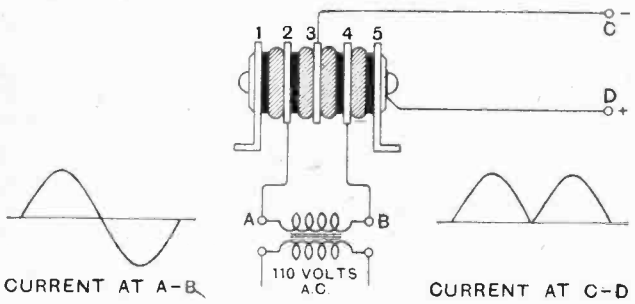

Fig. 1.—Diagrammatic arrangement of the Ruben rectifier unit. The shaded sections represent the composition discs and the unshaded sections the metal discs. The black sections indicate a non-rectifying junction between the metal and composition discs, and 1 and 5 are in metallic connection through the clamping bolt.

In 1904 Pawlowski produced a rectifier based upon the polarisation effect of a "couple" composed of plates of aluminium and cuprous sulphide. Such a "couple," in a sense, forms an asymmetrically conductive arrangement which allows current to pass only in one direction, for when the aluminium plate constitutes the negative terminal, current readily passes through the couple. When it is used as the positive terminal, however, very little current is passed.

The Pawlowski cell did not function as a rectifier until it was "formed" by sparking between the two plates, and this forming process had to be gone through not once, when the cell was new, but every time it was started up. This fact, together with its short life, rendered the cell totally unsuitable for commercial development.

Quite recently, however, Samuel Ruben, an American investigator, has solved the problem, and produced a solutionless electrolytic rectifier which is a thoroughly commercial proposition.

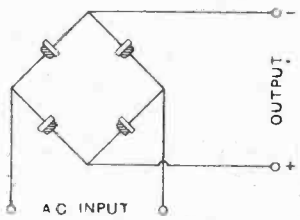

Fig. 2.—Equivalent circuit to Fig. 1. Showing bridge method of connection.

The new Ruben rectifier makes use of no solution whatever. It consists essentially of a pair of discs between which is formed a thin film, which is an important contributory cause of the rectification. There is, however, no more moisture between the discs than there is present in the air under ordinary conditions, and the discs do not attract moisture. One of the discs is of metal, and the other one is made of a composition containing several different substances, most prominent amongst which are crystals of a copper compound.

The exact composition and treatment of the compound disc determines the life, current rating, and breakdown voltage of the rectifier. To find the best method of preparing the best discs for a particular purpose is a long, slow process of trial and error, and the inventor naturally does not care to divulge these details publicly until the patent situation has been consolidated.

A Commercial Proposition.

The new rectifier has made its commercial *début* in America under the trade name of the Elkon Trickle Charger. This instrument contains three units similar to that illustrated diagrammatically in Fig. 1. Referring to this figure, the A.C. output of the step-down transformer, AB, is fed to the two metal discs 2 and 4. During one half of the applied A.C. cycle the current goes from 2 to 3 and from 4 to 5. During the following half cycle the current flows from 4 to 3 and from 2 to 1, thus accomplishing full-wave rectification, for the individual couples are bridge connected, as shown in Fig. 2.

A highly important point in connection with all electrolytic rectifiers is that when the working voltage per cell is run up beyond a certain limit, the wear goes up at a tremendous rate. Thus, a type of aluminium cell that will operate for hundreds of hours at 30 volts can be worn out in 20 hours at 90 volts, or in 20 minutes at 120 volts.

The Ruben Rectifier,—

For the Ruben cell the safe voltage is 15. If this is exceeded very much the life goes down very fast. Thus, if a charger is required for a 6-volt lighting battery one Ruben cell will not be sufficient, because the gassing voltage of the battery is 7.5, and the secondary voltage of the charging transformer must run above that to produce a charging current. The reverse voltage tending to break down the rectifier is the sum of these two voltages. If the R.M.S. transformer voltage is only 8, then the peak voltage will be about 11. Added to the battery voltage this becomes 18.5, which is too much for one cell.

Details of the Elkon Charger.

Actually, in the Elkon Trickle Charger, the transformer voltage is above 8, and three rectifier cells are used in series, so that each cell is working well below its safe limit, thus tending to give the combination a long life.

Those who have operated a valve transmitter with an electrolytic plate supply rectifier know how extremely difficult it is to make a number of cells work properly in series. Some of them simply insist on doing nothing but make fireworks, while others go dead entirely, leaving the remaining ones to do the work. This throws an extra strain on the active cells, so that they rapidly wear out and die. The result is that although one cell may handle 100 volts, it takes about 10 cells to handle 300 volts, or 100 to handle 3,000 volts, working half-wave all the time. There is a perfectly sound reason for this. If for any reason a single cell breaks down for an instant the remaining cells have to handle a little extra voltage. Very soon one of them gives up altogether, and this rapidly becomes general.

The cure is to let each cell work for its own transformer secondary, but in a 3,000-volt rectifier this would obviously be impossible.

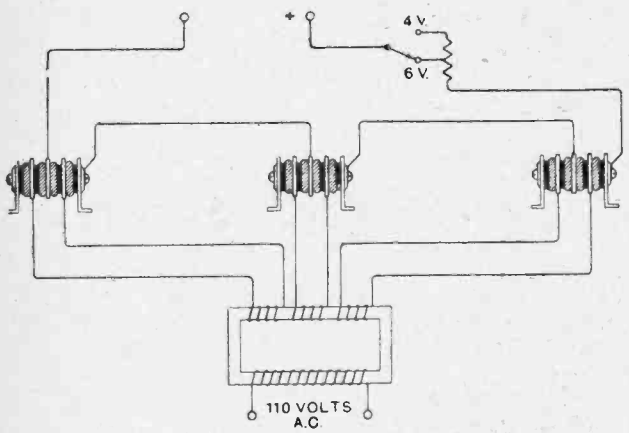

Fig. 3.—Circuit diagram of a practical trickle charger employing three Ruben units in series.

In a 6-volt battery charger, however, it is perfectly practicable to operate several little bridge-connected rectifiers from separate transformer windings and to connect their D.C. outputs in series. This is done in the case of the trickle charger under consideration, the full connections being as shown in Fig. 3. Thus, if one cell fails, no extra strain is thrown on the others, and, as the cells are plug-in units, they can easily be replaced. Working so far below the maximum safe voltage, however, the possibility of failure is very remote indeed, and it is claimed that the working life of the complete rectifier is practically indefinite.

Through the use of the Ruben rectifier cell the new trickle charger is the first to operate efficiently without the use of liquids. It discharges no gases or vapours, and is therefore eminently suitable for use in high-priced cabinets and bureaux.

Some idea of the contrast between the original Pawlowski cell and the Ruben device can be obtained when it is considered that the former required an intense formation current to cause the necessary decomposition of the

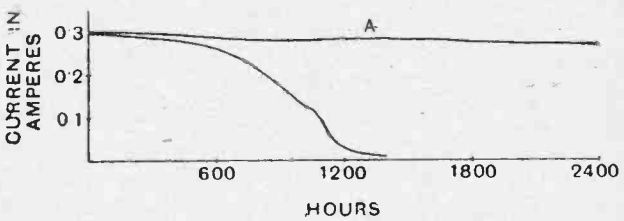

Fig. 4.—Comparative discharge curves for the Ruben cell (A) and the older Pawlowski cell (B).

active surfaces. The latter requires no formation current at any time. Wide variations between limits, due to continuously repeated sparking and reformation in the course of operation, were characteristics of Pawlowski's unit, and the maximum obtainable output gradually fell off with age. In the case of the new Ruben unit, the output remains consistently steady from first to last. (See Fig. 4.)

Other features of the new instrument are that it is applicable to high voltages for H.T. battery use; it requires only a small size transformer; it can be arranged in series-parallel for the development of any output; there is no sparking or re-formation required, and its life is practically indefinite.

Rectifiers of this type have been put on continuous test for 2,400 hours, at the end of which period there was no measurable loss in efficiency. During the tests, stability characteristics were everything that could be desired.

Other Applications.

Development is now proceeding with a view to introducing a companion device to the trickle charger, an H.T. battery eliminator. One already devised by Mr. Ruben has given exceptionally fine results. It has an output potential of 140 volts and a current capacity of 150 milliamperes. It will, of course, be necessary to use a smoothing circuit in conjunction with such a rectifier in order to get the absolutely steady D.C. required by receiving valves.

The inventor has also proved the adaptability of his device for uses other than rectification, such as the production of oscillations, after the fashion of the oscillating crystal, and as a cut-out to prevent the flow of inverse currents.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

By our Special Correspondent.

The Daventry Aerial.

A fortnight ago I drew attention to the technical improvements in hand at 5XX for the purpose of extending Daventry's range. The engineers' desire for secrecy forbade mention of the specific nature of the work, but it is revealed in the official announcement that a new aerial has been erected.

The aerial is V-shaped, this arrangement overcoming the disadvantage of a central lead-in, which placed a considerable strain on the weakest portion of the system and actually brought down the aerial during a snowstorm last winter.

At present there is no perceptible difference in signal strength from 5XX.

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More Oscillation.

A noticeable increase is recorded in the number of letters arriving at Savoy Hill on the subject of oscillation. The "Oscillating Oscars" are evidently returning from the seaside.

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Eve at the Show.

Before I visited the Show the reports from Olympia led me to believe that women were manifesting an unprecedented interest in all branches of wireless and that the coming winter would see the fair sex devouring technical journals, building sets, and leaving father to nurse the baby. Half an hour at Olympia told a slightly different story.

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The Feminine Taste.

For women the paramount appeal of wireless still lies in broadcasting. Stands with a technical flavour drew few women enthusiasts at Olympia, and it seemed to me that tasteful cabinets enshrining two- and three-valve sets evoked more feminine admiration than the "world beaters" with half a dozen dials and blue prints thrown in.

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Broadcast Programmes for the Colonies.

Now that the season favourable for long-distance reception is rapidly approaching, the question has been raised as to whether the B.B.C. could, and should, establish a short-wave station for the benefit of news-starved settlers in the Dominions. There is nothing startlingly new in this idea, which formed a topic of discussion in *The Wireless World* last April.

The broadcast experiments on 32.5 metres conducted by WGY, Schenectady, have demonstrated that the short-wave can work wonders in the matter of long-distance transmission, but the B.B.C. engineers are still sceptical regarding the immediate possibility of establishing a service over really long distances.

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Obstacles.

Quite apart from the technical difficulties, however, there are the restrictions imposed by our cautious Post Office on the use of wavelengths below 300 metres. In the extremely improbable event of permission being granted for short-wave broadcasting, changes would be necessary in the wavelengths of Government stations. We may take it as virtually certain that the B.B.C. will embark on no short-wave broadcasting scheme for many moons to come.

BROADCASTING THE PIPES. A snap taken at Braemar, on September 9th, on the occasion of the famous games. Mr. Neil McLean, the Aberdeen Station Director, is seen behind the microphone. He is evidently shielding the instrument from the full blare of the pipes.

No Juice?

Husband: Hm! Funny pudding, this.

Wife: Yes, dear. That's as far as I got with the recipe when the radio broke down.—*Eve.*

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No Pole, No Rent.

Attack is the best method of defence, and I think the old adage must have inspired those courageous tenants of municipal houses who are now demanding aerial poles as part of the household equipment. A year ago borough councils had the audacity to place restrictions on the erection of wireless aerials, but the boot is now on the other foot. Why, in these enlightened days, should a house boasting of "every modern convenience" be handed over to a tenant minus its wireless pole and insulated chimney bracket?

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A Glimpse into the Future.

Considering that broadcasting has run its course for nearly four years, it is hardly surprising that many houses "For Sale" now include an aerial and earth system as part of the property. Startling developments may occur in the next few years. We may read:—

BRIXTON.—Commodious mansion, 5 mins. stn., 3 miles 2LO, 3 bed, 2 sit., earth (buried bath), counterpoise (useful as hammock), 100ft. aerial (no spiders); also 6-valve Oscilladyne; owner going abroad; thinks it advisable.

And later, when wireless has gained a still greater hold on the community:—

WIGAN.—Close to pier. Magnificent 60ft. aerial. Bungalow attached.

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A Danish "Push."

Denmark is launching out this winter. I hear that a new station is to be erected at Kalundborg of sufficient power to be heard by crystal users throughout the country. Moreover, the relay stations at Hjorring and Odense, which have been closed during the summer months, will soon blossom forth again with programmes from Copenhagen. These programmes are also relayed from Sorö on 1,150 metres.

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"Scandinavia Calling."

The progress of broadcasting in Denmark may be gauged from the fact that the number of licensed listeners has swollen from 30,000 to 90,000 since January last. An interesting scheme is under review for extensive co-operation between the broadcasting authorities of Denmark, Norway, and Sweden. We may soon hear "Scandinavia calling."

Where Selectivity is Essential.

It is not only in the wireless sets designed by the No. 8 hats that you come across real selectivity. You will also find it at the telephone switchboard at 2, Savoy Hill. The following conversation, I am told, took place the other night :—

Lady Caller : Can I speak to an engineer about my set?

Highly Selective Operator : Sorry, the engineers have gone home.

L.C. ; Oh, well ; perhaps you can help me?

H.S.O. : Perhaps

L.C. : You see, I can't hear a thing. Do you think it would improve matters if I warmed the set?

H.S.O. : You might try.

L.C. : Thanks awfully ; good-bye.

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Talks.

The B.B.C.'s programme of winter talks opens this week. Many familiar names figure in the list of speakers, including those of Mr. James Agate (dramatic critic), Mr. G. A. Atkinson (film critic), and Mr. Percy Scholes (music critic). French readings will be continued by M. E. M. Stéphan, and the popular talks on "Music and the Ordinary Listener" will be resumed by Sir H. Walford Davies. Among speakers new to the microphone will be Prof. J. Arthur Thomson, Mr. C. Lewis Hind, and Mr. R. A. Watson Watt.

"Atmospherics and the Atmosphere" will be the title of Mr. Watson Watt's talk from 2LO on October 6th.

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Fiction and Humour.

An attractive series consisting of fiction and humour opens on September 24th, and will be continued weekly until the end of the year. Among the "stars" contributing to the series will be Mr. A. P. Herbert ("A. P. H." of *Punch*), Mr. Ashley Sterne (of *The Passing Show*), Mr. F. Anstey, and Mr. Collinson Owen ("C. O." of the *Evening Standard*).

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Cutting Costs in Caledonia.

Dignified exuberance has been occasioned in Scotland by the discovery of a kind of red sand which will function as a detector and cost half the price of galena.

This is all very well in its way, but it falls short of the ambitions of my friend, Mr. Angus McHaggis, of Aberdeen, who long ago suggested that free battery juice could be obtained by harnessing the "Falls o' Clyde." You may also remember his brilliant plan for a cheap means of hardening soft valves. "Give them a week in Aberdeen," he said.

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Water, Water Everywhere . . .

Remarks have been passed upon the "watery" nature of several recent broadcasts. We have had talks from a Thames diver and a Channel swimmer, and a fortnight ago were treated to the masticatory noises made by sea perches at the Zoo while enjoying their submarine supper. And now comes the news that arrangements are going forward for broadcasting the undersea sounds created by ships of the Navy and Mercantile Marine.

A writer in the *Manchester Guardian* puts forward the suggestion that the B.B.C. is anxious that its last moments shall be associated as fully as possible with all the heroic traditions of a watery grave!

FUTURE FEATURES.

Sunday, September 26th.

LONDON.—Massenet Programme.
BIRMINGHAM.—Symphony Concert.
CARDIFF.—Famous Overtures.
MANCHESTER. — The Mexborough Excelsior Male Voice Quartet.

Monday, September 27th.

LONDON. — New Zealand Programme.
BOURNEMOUTH.—Manchester Calling Bournemouth.
MANCHESTER.—Manchester Calling Bournemouth.
NEWCASTLE.—Autumn Programme.
GLASGOW.—Light Orchestral Programme.
ABERDEEN.—The Aberdeen Radio Players in "A Gentleman's Gentleman."

Tuesday, September 28th.

LONDON.—"Young England," a Light Opera by Basil Hood.
ABERDEEN.—Light Opera and Musical Comedy.
BELFAST. — The Round Table Singers.

Wednesday, September 29th.

LONDON.—A Chinese Programme.
BIRMINGHAM.—Varied Half-Hours.
BOURNEMOUTH.—An Instrumental Recital.
CARDIFF.—Light Descriptive Music.
MANCHESTER. — Mildred Dilling, America's Greatest Harpist.

Thursday, September 30th.

LONDON.—B.B.C. National Concert relayed from the Royal Albert Hall. First Concert.

Friday, October 1st.

LONDON.—The Victor Olof Sextet.
CARDIFF.—Irish Programme.
NEWCASTLE.—The London Radio Repertory Players in "An Elder of the Kirk."
EDINBURGH. — Scottish Command Military Searchlight Tattoo relayed from Dreghorn Castle, near Edinburgh.

Saturday, October 2nd.

LONDON.—The Radio Follies' Concert Party.
MANCHESTER.—Madrigals of Tudor Days.
GLASGOW.—Scots Programme.
ABERDEEN.—Light Orchestral Programme.

Ye Chaste Stars!

If there is anything better than a "Knickerbocker Glory" at the soda fountain for making the average American gurgle with delight, it's a genuine pat on the back. He likes it laid on thick.

The U.S. Department of Commerce knows this as well as you do, hence the trouble it has gone to in preparing an "honor roll of radiocasting stations." This roll carries the chaste names of all those stations who maintain their wavelengths with high accuracy. So far only 37 stations out of 600 are on the list; most of these use quartz resonators.

But the idea of the "honor roll" is grandiose. What about it, Geneva?

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Light Opera Revived.

2LO will broadcast, on September 28, the light opera, "Young England," which was originally produced at Daly's Theatre in 1916. The book is by Basil Hood and the music by G. H. Clutsam and Hubert Bath. Included in the cast are the following well-known broadcasters :—Miss Mavis Bennett, Robert Chignell, Joseph Farrington, Tommy Handley, Harold Kimberley, Miss Gladys Palmer and Stuart Robertson.

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A Yodelling Turn.

Mr. Peter van Dyke will be heard on September 29 in light Dutch numbers and yodelling. Mr. Jerome Murphy, the Irish entertainer, is another artist to broadcast on the same evening. The compère for this programme will be Mr. Leonard Henry, a newcomer to broadcasting.

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Music Recitals Retimed.

The music recitals which have hitherto been given nightly at 7.25, are now put on at 9.45, when more people may be able to listen. Further, the recitals are not to be confined to the pianoforte, but are to include well-known wireless singers such as Miss Vivienne Chatterton, Dale Smith and Tom Goodey. Arrangements are also being made for violin recitals by William Primrose.

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A Scottish Military Tattoo.

Portions of the Scottish Military Searchlight Tattoo, which is being held in the grounds of Dreghorn Castle, will be broadcast from Edinburgh on September 28 and 30 and October 2. On Friday, October 1, the entire performance will be relayed.

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"Tommy, Make Room for your Uncle."

"Riverside Nights," now playing at the Lyric Theatre, Hammersmith, will furnish a broadcast to-morrow, September 23. One of the items, "In Queen Victoria's Ampler Days," will be preceded by a few words from Mr. Nigel Playfair, introducing Mr. T. S. Lonsdale, who wrote and composed the song which has been revived for "Riverside Nights,"—"Tommy, make room for your Uncle," as long ago as 1876. Mr. Lonsdale is expected to make a brief reply which will also be broadcast.

WIRELESS CIRCUITS
in Theory and Practice.

21.—Low-frequency Amplification.

By S. O. PEARSON, B.Sc., A.M.I.E.E.

THE resistance-capacity method of coupling valves in cascade in an amplifier, as described in the last instalment, was seen to be suitable for both low-frequency and high-frequency amplification, because the amplification obtained is more or less independent of the frequency of the oscillations. It was pointed out, however, that even this method is not efficient on high-frequencies where the wavelength is below about 1,000 metres owing to the shunting effects of the various circuit and valve capacities. No intervalve coupling has been found which is suitable for all frequencies ranging from those corresponding to the shortest wavelengths down to the lowest audible note frequencies, and therefore in general the intervalve couplings have to be designed to suit the range of frequencies over which the amplifier is to operate. For this reason amplifiers are divided into two distinct categories, namely, high-frequency amplifiers and low-frequency amplifiers (or note magnifiers). The valve couplings described in the present instalment are suitable for low-frequency amplification only, and comprise two well-known methods of coupling—choke-capacity coupling and transformer coupling—the object being to give the fundamental principles involved, and the considerations which are necessary for obtaining the most efficient amplification whilst at the same time giving the truest possible reproduction of the original wave shapes applied to the input terminals of the amplifier.

Choke-capacity Coupling.

In many respects the choke-capacity method of coupling valves in cascade is similar to the resistance capacity method, the circuit arrangement being exactly the same, the choking coil merely taking the place of the anode resistance (see Fig. 1). The choke is wound to have a high inductance value, so as to offer a high impedance to the audio-frequency variations of plate current, whilst its ohmic resistance is comparatively low. Thus the great advantage of using a choke instead of a plain resistance is that the D.C. potential drop in the plate circuit is negligibly small and a high-tension battery of much lower voltage is required compared with that necessary when an ordinary anode resistance is used. The remarks applied here to the choking coil can be equally well applied to the primary winding of an intervalve transformer, the primary merely acting as a choking coil.

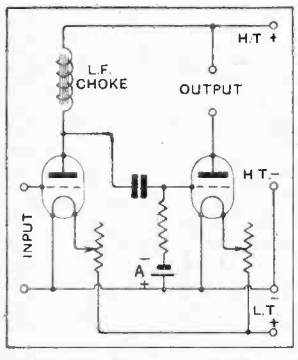


Fig. 1.—Choke-capacity method of coupling two valves in cascade.

It was shown in Part 14 (June 16 issue) that the voltage amplification obtained from a valve with a choking coil of inductance L henries in the plate circuit was given by $\mu\frac{Z}{Z_t}$, where Z is the impedance of the choke itself and Z_t is the total impedance represented by the choke and the internal resistance of the valve in series, μ being the amplification constant of the valve. If the

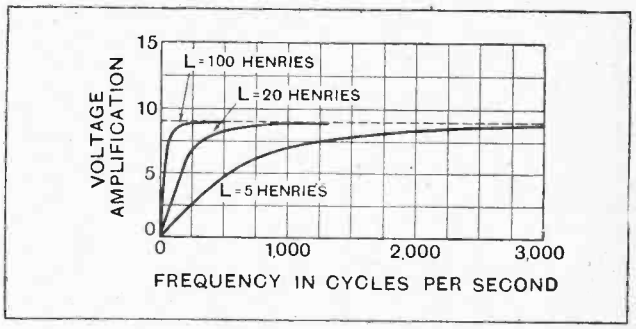


Fig. 2.—Curves showing how the inductance of the choke coil or transformer primary winding affects the amplification at various frequencies.

ohmic resistance of the choke is small enough to be neglected compared with its reactance (which is usually the case) and R_a is the internal resistance of the valve, the voltage amplification is given by $\mu\frac{X}{\sqrt{X^2 + R_a^2}}$ where $X = 2\pi fL$ is the reactance of the choking coil at the frequency f. From this formula we learn two main points—first, that the amplification obtained is not independent of the frequency, but, unlike resistance capacity coupling, falls off for low values of the frequency. This is the essential difference in principle between the resistance coupling and choke coupling. Secondly, to obtain reasonable amplification the reactance of the choking coil at the lowest frequency to be applied must be large compared with the internal resistance of the valve. This in turn means that it is essential to use a choke of high inductance value if all the bass notes are to be amplified in the same proportion as the higher notes, a very necessary condition for high quality reproduction. Taking as an example a valve with an amplification factor of $\mu = 9$ and an internal resistance of $R_a = 25{,}000$ ohms and calculating the voltage amplification for various values of inductance over the range of audible frequencies up to 3,000 cycles per second, we obtain the results which are shown graphically in Fig. 2, the particular inductance value being marked on each

curve. These curves show how very important it is to employ a high value of inductance. For instance, using an inductance of 5 henries, frequencies of 500 cycles per second are only amplified five times, whereas those over 2,500 per second are amplified nearly nine times. In practice this gives a high pitched piercing result which is very unpleasant, all the bass notes being more or less suppressed. The more valves there are in cascade the worse will this effect be, as the following consideration will show: With two valves the 500 cycle notes are magnified $5 \times 5 = 25$ times, whereas the 3,000 cycle notes are magnified nearly $9 \times 9 = 81$ times. Thus the ratio of magnification of the 3,000 cycle notes to the 500 cycle notes is 1.8 to 1 with one valve, 3.2 to 1 with two valves, 5.8 to 1 with three valves, and so on. With the 100 cycle bass notes matters would be worse still, the magnification being only 1.1 for a single valve and 1.33 for three valves in cascade and no bass notes would be heard at all.

With the 100-henry choke, on the other hand, good amplification is obtained for frequencies even as low as 100 cycles per second, with the result that, providing the loud-speaker and other parts of the circuit are in good order, the music will have a rich, full tone, with all the bass notes present in their proper proportion.

Importance of High Inductance.

We see then that it is most important that the choking coil should be properly designed to suit the valve in the plate circuit of which it is connected. The curves of Fig. 2 show that for obtaining really good results the inductance value of the choke in henries should be of the order of four times the internal resistance of the valve divided by 1,000. For instance, for a 20,000 ohm valve the inductance of the choke should be about $\frac{4 \times 20{,}000}{1{,}000} = 80$ henries. Choking coils of this nature are necessarily bulky and expensive and there are not many to be found on the market. It is quite a common practice to use chokes of lower inductance values and to shunt them with fixed condensers to by-pass the higher frequencies to a certain extent and so produce a mellower tone. But this is not recommended, as it has two evil effects; it lowers the average amplification and produces non-uniform amplification of the higher notes. In fact, it may sometimes produce a resonance hump in the voltage amplification frequency characteristic, causing a small band of frequencies to be amplified to a much greater extent than the remainder and resulting in very unpleasant blasting when notes within that band of frequencies come through.

Self-capacity.

As a condenser connected in parallel with the coupling choke has a detrimental effect on the quality of reproduction it follows that any excessive self-capacity in the winding of the choke will have the same effect. In constructing a choking coil of high inductance value the winding should be designed to have as small a self-capacity as possible. Perhaps the best type of coil is that which is wound in flat sections or slabs which are mounted co-axially on the central laminated iron core.

The Magnetic Circuit.

For low-frequency work an iron core is nearly always used in a choking coil or transformer because the high permeability of the iron results in a very much higher value of inductance being obtained for a given size of coil. In some types of choking coil the core consists simply of a bunch of straight soft iron wires, but in the better types of choking coils and in transformers a closed iron core is used and consists of laminations of special steel alloy which has good magnetic properties. The iron core is laminated or made up of thin sheets of the material in order to reduce the eddy current losses. The losses are produced by circulating currents in the iron itself, being set up by the magnetic fluxes which are actually cutting the iron parts. These losses are greatly reduced by splitting up the iron core into laminæ at right angles to the direction in which the eddy currents would flow, the laminations being insulated from each other by thin sheets of paper or insulating varnish. Sometimes the oxide scale on the iron sheets is relied upon to provide the necessary insulation.

When using a closed iron core for the magnetic circuit of a choke or transformer, it is necessary to guard against distortion due to the non-uniform permeability of the iron; that is to say, due to the fact that the magnetic flux in the iron is not directly proportional to the magnetising current. But the proportionality is fairly good for low flux densities, and therefore in order to eliminate distortion the magnetic density in the iron must not be excessive. This means that the number of turns on the coil and the length of the iron core must be designed to suit each other. A subsequent instalment will be devoted to the consideration of the magnetic circuits of choking coils and transformers.

Choice of Valves.

The difficulty of obtaining or constructing high-inductance choking coils can be overcome to a certain extent by using valves of extra low impedance, but it must be remembered that in general a valve of low internal impedance has a low amplification factor, necessitating perhaps the use of an extra stage, and such valves have the disadvantage of taking rather a large plate current, increasing the cost of high tension battery upkeep. A very suitable valve for use with a 25- or 30-henry choke is the Marconi or Osram D.E.5 dull emitter for running on a 6-volt battery. Its internal impedance is 8,000 ohms and it has an amplification factor of 7, which is quite a high value for such a low impedance. The filament current is 0.25 amp. With a plate voltage of 100 the negative grid bias should be about 6 to 9 volts.

The grid condensers and leak resistances referred to in connection with resistance coupling are arranged in exactly the same way for choke coupling and they have the same values, their functions in each case being precisely the same.

Input and Output Considerations.

It was pointed out in Part 14 that when a choke of high inductance is connected in the plate circuit of a valve, the plate current contains practically no oscillating component at all even when an oscillation is being applied to the grid, but that an oscillating potential difference is

Wireless Circuits in Theory and Practice.—

set up across the choke and varies the plate potential in such a manner as to maintain the plate current practically constant It is this potential difference, built up across the choke, which is passed on to the next valve for further amplification. It must be realised that a valve is a potentially operated device; that is to say, it does not take any current to operate it but merely an electrical pressure. This means that no energy is consumed at all on the input side of the valve and that therefore we do not require any *energy* output from the plate circuit of the preceding valve but merely an oscillating potential difference. This is quite an important point as it shows that none of the valves in the amplifier except the last one need be capable of giving any appreciable energy output. The most important thing to consider in each stage is "grid swing," i.e., the maximum range of voltages through which the grid of each valve is varied during operation. The grid swing on each succeeding valve is greater than that on the preceding one in the proportion of the voltage amplification given by the respective valves. For instance, suppose that there were three valves in cascade each giving a voltage amplification of 6, and suppose that an oscillation the amplitude of which is 0.3 volt is applied to the grid of the first valve. Then on the grid of the second valve the amplitude of oscillation will be $0.3 \times 6 = 1.8$ volts, and on the grid of the third $1.8 \times 6 = 10.8$ volts. Now under no circumstances must grid current be allowed to flow and, as this always occurs when the grid potential becomes positive with respect to the negative leg of the filament, we see that for the first valve the negative grid bias need not be more than 1 volt, for the second it must be at least 2 volts, and for the third about 12 volts.

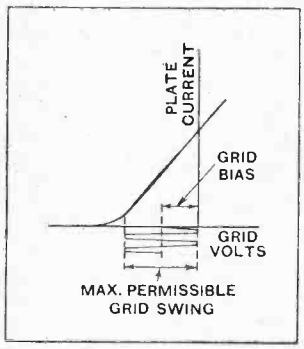


Fig. 3.—Oscillation amplitude permissible for a given valve and plate voltage.

It is of the utmost importance to choose valves capable of dealing with the oscillation amplitudes in question without operating round the bends in the anode characteristic curves. A valve will be suitable for a given amplitude if the distance measured in volts between the lower bend in the anode characteristic curve and the vertical zero ordinate of the graph is at least equal to twice the amplitude of the oscillation applied to the grid. Reference to Fig. 3 will make this clear. It follows then that each succeeding valve must be capable of dealing with the increased amplitudes and so-called "power valves" will have to be employed in the last stages if the amplification is carried to any considerable degree.

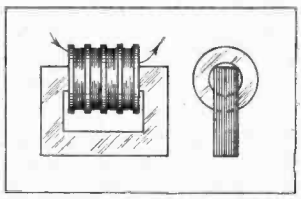


Fig. 5.—Choke coil wound in sections to reduce self-capacity.

Transformer Coupling.

The only essential difference between choke-capacity coupling and transformer coupling is in the method of transferring the amplified oscillations of potential in the plate circuit of the first valve to the grid of the succeeding valve, otherwise all the broad principles discussed above for the choking coil still hold good as far as the plate circuit of the first valve is concerned. The transformer itself consists essentially of two separate windings on the same iron magnetic circuit, that winding which is connected in the plate circuit and to which the amplified oscillations are applied being called the primary winding. The other winding called the secondary is connected between the grid and filament of the next valve, as shown in Fig. 4.

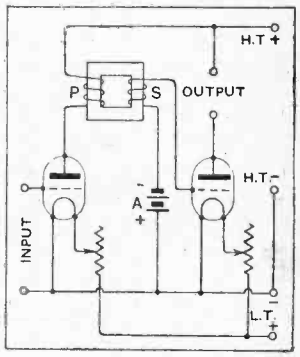


Fig. 4. — Transformer method of coupling two valves in cascade.

When an alternating voltage is applied to the grid of the first valve, an amplified voltage is set up across the terminals of the primary winding, which acts purely and simply as a choking coil if no current is taken from the secondary. The resulting alternating component of the magnetic flux produced in the iron core generates or induces a back electromotive force in the primary winding. Now, as this same flux is linked with the secondary winding, it follows that the latter will also have an E.M.F. induced in it, and the induced E.M.F. in each turn of the secondary winding will be exactly equal to and in phase with the back E.M.F. induced into each turn of the primary. From this it follows that the ratio of the total voltage across the primary winding to the total voltage across the secondary will be in the direct ratio of the number of primary turns to the number of secondary turns.

Voltage Step-up.

By winding the secondary with more turns than the primary, we are able to make the transformer itself give a step-up of voltage and so increase the amplification per stage. It must be remembered that when the correct grid bias is used the grid circuit of a valve takes no power whatever theoretically, and, therefore, the secondary winding of each intervalve transformer is really on open circuit all the time, and thus the primary acts purely as a choking coil, and must have a high value of inductance if the lowest frequencies are to be efficiently amplified.

If N_1 and N_2 are the numbers of primary and secondary turns respectively on the transformer, and X is the reactance of the primary at a given frequency, then the total voltage amplification given by one stage is given theoretically by $\mu \frac{N_2}{N_1} \cdot \frac{X}{\sqrt{X^2 + R_a^2}}$, where μ is the amplification factor of the valve and R_a its internal resistance as before. The greater the ratio of N_2 to N_1 the greater will be the amplification obtained theoretically, but in practice there is a definite limit to this ratio, which

Wireless Circuits in Theory and Practice.—

is decided by the self-capacity of the windings. The primary *must* have a sufficient number of turns to give the requisite inductance, and, therefore, to obtain a large step-up ratio, a great many turns would have to be put on the secondary winding, and this number is limited by the self-capacity, which increases very rapidly as the number of turns is increased. In any case it will be found that in the best transformers the windings are specially wound in sections to minimise self-capacity.

The self-capacity of the secondary winding has exactly the same effect as shunting the winding by means of a fixed condenser, and this will obviously reduce the amplification of the higher pitched notes in the musical scale, resulting in a muffled tone. Unless a transformer is exceptionally well designed, a step-up ratio greater than 3 to 1 is not to be recommended. The most important thing is to see that the primary has a sufficiently high self-inductance. The writer has sometimes found it advantageous to connect two transformers in series in each stage. If the transformers are identical, the secondaries can be connected either in series or in parallel, giving a choice of two ratios.

The transformer method has not only the advantage of giving a step-up ratio, but, as the primary and secondary windings are insulated from each other, the latter can be directly connected between the grid and filament of the succeeding valve without the necessity of a grid condenser and leak resistance, the grid bias battery being included as shown at A in Fig. 4.

CALLS HEARD

Extracts from

S.S. "Lord Antrim" (Belfast to Montreal) and S.S. "Carrigan Head" (Montreal to Belfast).
(July and August).

Great Britain :—G 2GO, 2OG, 2QB, 2SZ, 2LZ, 2KF, 2NM, 2KZ, 2XY, 2NH, 2VQ, 2VG, 2NT, 5TZ, 5BY, 5UW, 5KZ, 5JW, 5SZ, 5MS, 5QV, 5HX, 5AD, 5MQ, 5XY, 6YC, 6QB, 6OO, 6TV, 6CL, 6TD, 6OH, 6FA, 6UT, 6KO, 6YD, 6NF, 6LJ, 6IA, 6NX, 5DH, BVJ, GFR, GBM, G1LQ. Northern Ireland :—GI 2IT, 5GH, 5NJ, 6YW, 6WG. Irish Free State :—GW 18B, 19B. France :—F 8WW, 8FCR, 8VVD, 8JN, 8BN, 8TIS, 8UT, 8CAX, 8CT, 8CS, 8HU, 8TBY, 8JF, 8VO, 8WNM, 8AG, 8CL, 8JRT, 8BA, 8PRD, 8CA, 8AI, 8KV, 8XH, 8KK, 7VX, FW, OCDJ. Belgium :—B B7, E9, G33, O2, BI, M8, V33, 4ZZ. Holland :—N OPM, OPX, OWC, 2PZ, PB3. Denmark :—D 7ZM, 7BX, 7XU, 7MT. Italy :—I IGN, IAX, IBA, IAY, IAU, IBD, ICR, IRM, IDO. Sweden : — SMZN. Spain :—EAR26. Portugal :—P IAE. Switzerland :—H 9XD. Yugo-Slavia :—YS 7XX. Faroes :—7JO, OXUA. Morocco :—FM 2CNP, 8MB. U.S.A. :—U ICH, IXV, IAWQ, IBHS, IMY, IAG, IAXX, IQB, IBIE, IZK, IBVX, IBMS, IBJK, IBIG, IAAY, IZD, IQZ, ICCX, IBVL, ICMP, IADM, ICYE, IAHC, IAMS, ICRE, ICNZ, IVA, IAZA, IADL, IYC, IXF, ICYS, ICCZ, IAKM, IBKE, IAKZ, IKA, IADL, IAXA, 2CXL, 2APV, 2RV, 2WC, 2CYQ, 2ANX, 2API, 2AKV, 2APT, 2BYG, 2BCB, 2AYJ, 2AGI, 2QU, 2BUR, 2AWQ, 2PV, 3ACB, 3ABX, 3AHA, 3CDK, 3BVA, 4IZ, 5AFS, 5QL, 5ASK, 5AKL, 8BBE, 8BF, 8DFR, 8RH, 8BRC, 8BPL, 8KF, 8AJ, 8DRJ, 8DBB, 8DIS, 8PL, 8DOE, 8ZAE, 9ATQ, 9KD, 9BHT, 9EK, 9BXG, 9ADK, KDKA, 2XAF, 2XG, NOT, NEU, NISS, WNP. Canada :—C 1AM, 1ED, 1RM, 2BE, 2BH, 2HV, 3BT, 3BY, 3JW, 3UR, 4BT, 8AR, 8AZS, Brazil :—BZ 1AO, 1AW, 1BD, 2AB, 9QA. Mexico :—M 1N. Uruguay :—Y 2AK. Australia :—A 3BD, 3CB. New Zealand :—Z 1AX, 4AA, 4AM. Various :—SGL, SGC, SME, FL, DA, B 82, BM JH, UH BW, PCLL, PCMM, PCRR, PTF, AGC, GLKY, 9SA, MFL.

E. Megaw
(GX 6MU).

(0-v-1) Modified Reinartz.

Moseley, Birmingham.
(June 16th to August 30th.)

U.S.A. :— U 4JK, 4DD, 4FT, 4IZ, 4QY, 5AMT, 5FR, 6DNK, 7VH, 7WU. Canada :—C 1AM, 1AR. Mexico :—M 1N. Porto Rico :—PR 4JA. Chile :—CH 2LD. Brazil :—BZ 1AC, 1AD, 1AF, 1AJ, 1AK, 1AR, 1AD. 1AV, 1AW, 1AX, 1BD, 1BH, 1BI, 1QA, 2AB, 2AF, 2AJ, 5AB, 6QA, SQ1X. Argentina :—R AF1, DB2, DX8, HA2, NA2. Uruguay :—Y 1CD, 1CG, 2AK. Australia :—A 2BK, 2IJ, 2TM, 2YI, 7CW, 7HL. New Zealand :—Z 2AC, 2AE, 2XA, 3AI, 3AK, 3AR, 3XB, 4AA, 4AC, 4AM. France : — F OCDJ, OCMV, OCNG, OCTU. Germany :—K AYY, I2, 4YAE. Portugal :—P 1AW, 1AY. Sweden : — SMUI, SMUK, SMUS, SMVL, SMWR, SMYG. Norway :—LA 1X, 4W. Austria :—Ö AA, HL, WA. Yugo - Slavia : — YS 7XX. French Morocco : — FM 8MA, 8RA, 8ST. Tripoli :—DA 1CW. South Africa :—O A3B, A6N. Belgian Congo :—CB F2. Arabia :—TJ CRJ. Japan :—J 3XP. Ships :—GX 6MU, NIDK, NTT, NULX, VOQ. Various :—ANF, F CIT, SAD, SPM.

(0-v-1) On 30 to 50 metres.

L. L. Parry.

Readers' Logs.

Weybridge.

New Zealand :—Z 1AO, 1AX, 1XA, 2AC, 2BG, 2BX, 2GC, 2XA, 3AI, 3AJ, 3AK, 3AR, 4AR, 4AC, 4AK, 4AM, 4AO, 4AQ, 4AS, 4AV. Australia :—VKP, A 2BB, 2CM, 2CS, 2BK, 2IJ, 2LK, 2LM 2NO, 2YI, 3BA, 3BD, 3BM, 3BQ, 3EF, 4AN, 4RB, 5BG, 6AG. 7CW. Canada :—C 1AK, 1AM, 1EB, 1ED, 1EX, 1BG, 2BE, 2CC, 3AA, 3KP, 8AR. Mexico :—M 1AR, 1N, 1K. Argentine :—R AA8, AC8, CB8, DB2, FF9, KA9. Brazil :—BZ 1AB, 1AC, 1AD, 1AG, 1AJ, 1AK, 1AO, 1AQ, 1AR, 1AU, 1AV, 1AW, 1AX, 1BD, 1BG, 1BI, 1IB, 1QA, 2AB, 2AJ, 2SP, 5AA, 5AB. Chile :—CH 2AR, 2LD, 9TC. Philippine Is. :—PI 1AU, 1CW, 1HR, NAJD, NEQG. South Africa :—O A3E, A4Z, A6N, 1SR, Misc. :—RA19, WNP, FI 8QQ, FI 8LBT, NF 30K, TJ CRJ, Fe 8FLO, Y 2AK, NUNX.

L. C. Snowden.

(0-v-1) On 28-50 metres.

Stroud Green, N.W.4.
(August 28th to September 8th.)

Belgium :—B 4AA, 2SSK, M8, Q1. Brazil :—BZ 1AD, 1AK, 1AW, 5AB, 5AD. Germany :—K 4GA, 4MFL, 4WM, L4. Holland :—PCRR, PCTT, N OGA. Sweden :—SMUF, SMUI, SAD, SGT. U.S.A. :—1ACI, 1AES, 1AVA, 2ANX, 2AVJ, 2BBW, 2BM, 2BSC, 2CJD, 2FO, 2GK, 3CDK, 3OQ. Australia :—A 2BB, 2BK, 2YI, 3LS, 5KN. New Zealand :—Z 1AK, 2AC, 2BG, 2BM, 3AF, 3AI, 4AA, 4AM. France :—F 8OQP, 8BW, 8OGS. Various : — OE AA, I 1AU, M 1K, PI IAU, PE 6ZK, Y 2AK, 1CD, HVA, LPI, HIK, GI 5GH.

H. C. Page.

(0-v-1) On 30-50 metres.

PIONEERS of WIRELESS

BY ELLISON HAWKS F.R.A.S

29.—Popoff, the Russian Pioneer.

IT is doubtful whether Branly realised that he was dealing with Hertzian waves when experimenting with his coherer. So short a time had elapsed between Hertz announcing his discovery of the electromagnetic waves and Branly's invention that it seems likely that the properties of the Hertzian waves were not fully recognised. Probably Branly was more concerned with demonstrating the alteration in the resistance of different metals when an electric spark occurred in the neighbourhood, and that he was more interested in measuring the reduction in resistance caused in various and numerous substances than in the application of the discovery to larger and practical issues.

However that may be, nothing further transpired until 1892, when Dawson Turner described Branly's experiments at the British Association meeting at Edinburgh. The following year Croft brought them to the notice of the London Physical Society, and Professor Minchin read a paper before the same society (in January, 1894) giving an account of his repetitions and modifications of Branly's experiments. This paper came to the notice of Sir Oliver Lodge, who had already done some work in the same direction, using, however, a Boltzmann gap or delicately adjusted cohering metal knobs.

Lodge's attention having been drawn to Branly's coherer, the discovery of which had previously escaped his notice, he "at once proceeded to try the Branly tube of filings, and found it far superior in manageability" to the apparatus he had previously been using. Lecturing in London and in Oxford, in 1894 he repeated all Hertz's experiments and demonstrated the efficiency of the Branly coherer.[1]

Alexander Stepanowitch Popoff.

In 1895 Popoff, a Russian physicist at Kronstadt, employed Branly's coherer in conjunction with a Morse printer. Connecting them to a lightning conductor, he caused distant lightning flashes to record themselves. Popoff's work is of such an interesting character that we must pause to consider it in further detail.

Alexander Stepanowitch Popoff was born in 1859 at Bogosloosky Zawod, in the Ural district. His father was a priest, and Alexander's scientific career commenced in 1877, when he entered the University of St. Petersburg. In 1895 he conceived the idea of using the Hertzian waves and Branly's coherer to study atmospheric electricity. He used steel filings and introduced an electric "tapper" that automatically restored the metallic dust in the coherer to a normal condition after the passage of an electric wave.

Popoff's circuit arrangement is very similar to that subsequently adopted by Marconi, and the similarity becomes more pronounced when we find him using a vertical aerial known in those days as an "exploring rod."

That Popoff was fully alive to the fact that greater issues were perhaps possible for his apparatus is shown by his remarks in a subsequent note (dated December, 1895) to a paper read (April, 1895) before the Physical Chemical Society of St. Petersburg. In this note he said: "I entertain the hope that when my apparatus is perfected it will be applicable to the transmission of signals to a distance by means of rapid electric vibrations—as soon as a sufficiently powerful generator of these vibrations is discovered."

It is perhaps of interest to remark in passing that although it has been claimed for Popoff that he followed his paper with a practical demonstration of Morse transmission before the Chemical Society of Russia, in the laboratory of the University of St. Petersburg, no confirmation of this is forthcoming.

In looking for "a sufficiently powerful generator" Popoff seems to have been working in the wrong direction. What was really wanted was a more sensitive detector, and this, as we shall shortly learn, was subsequently supplied by Marconi.

Popoff does not seem to have developed his apparatus any further, and apparently reverted to his original line of research, for we find him carrying out further experiments to ascertain the nature of thunderstorm discharges and the conductivity of the atmosphere. He published his conclusions in the Proceedings of the Physical Society of Russia in the following year (1896), and a summary of his paper appeared in the *Journal de Physique* for November, 1897.

No more was heard of his system of wireless communication until after Marconi's success in England. Then Popoff—probably using a more sensitive detector—succeeded (April, 1897) in transmitting signals over a distance of 1 kilometre. This distance he subsequently increased to 1½ kilometres, and finally to 5 kilometres.

[1] Sir Oliver Lodge's pioneer work will be dealt with in a special instalment.—E.H.

Pioneers of Wireless.—

which appears to have been the maximum distance over which he transmitted at any time. In all these transmissions he used vertical wires 18 metres in height.

Looking back at Popoff's work, we see that he certainly made some contribution to the science, but he was misled in looking for a more powerful generator, which, after all, could easily have been devised. What actually was wanted was a more sensitive detector than the form of Branly coherer he was using. As we shall shortly learn, this improvement was furnished by Marconi, in his magnetic detector, which was the one thing lacking to make Popoff's system practical.

NEXT INSTALMENT.

Augusto Righi and his Experiments with Hertzian Waves.

General Notes.

Mr. L. Bland-Flagg (G 2GO), 61, Burlington Road, W.2, was in two-way communication with Z 2AE, Mr. R. J. Patty, 109, Lowe Street, Gisborne, New Zealand, on July 25th for about 35 minutes in the early hours of the morning. G 2GO was working with an input of 17½ watts on a wavelength of 44 metres, and Z 2AE reported his signals as R5. A listener in Hobart, Tasmania, has informed Mr. Bland-Flagg that he heard this transmission at 2.55 p.m., Hobart mean-time (4.55 a.m. G.M.T.), and that the signal strength there was R4.

o o o o

Mr. E. Megaw (GI 6MU), Arden, Fortwilliam Drive, Belfast, has sent us a photograph of the apparatus used on his late experimental trip to Montreal on board s.s. "Lord Antrim" and the return journey to Belfast on s.s. "Carrigan Head." The tests proved very successful, regular communication being maintained with both sides of the Atlantic during the entire voyage. Mr. Megaw used the temporary call-sign GX 6MU, and was in constant touch with the well-known station GI 5NJ owned by Mr. F. R. Neill at Whitehead, Co. Antrim. The power used was about 20 watts on the outward and 30 watts on the homeward trip, and the wavelength about 41 metres.

In our issue of September 8th we published a list of some of the calls heard by 6MU on the outward voyage, and we are now able to give under "Calls Heard" a more complete list of the various stations heard by him during both voyages.

TRANSMITTERS' NOTES AND QUERIES.

o o o o

New Call-Signs and Stations Identified.

G 2ABL (Art. A.) R. Doble, Jr., 1, Pickwick Rd., Dulwich Village, S.E.21.

G 2AFG (Art. A.) H. C. Page, 40, Ferme Park Rd., Stroud Green, N.4.

G 2BWF (Art. A.) B. F. Phillips, Byng St., Landore, Swansea.

G 2BXA (Art. A.) A. S. Jennings, 87, John St., Nelson, Lancs.

G 5CD D. N. Corfield, 15, Linden Grove, Beeston, Notts. (Change of address.)

G 5LH F. Thompson, Jr., 48, Grosvenor Gdns., Jesmond, Newcastle-on-Tyne. (Change of address.)

G 5VN C. E. Horner, 487, Fulham Palace Rd., Fulham, S.W.6. Transmits on 150—200 metres.

G 6QH A. J. Baker, 23, Third Ave., Bush Hill Park, Enfield. (Change of address.)

G 6YI E. Whaley, 50, Clementson, Rd., Sheffield.

GI 2BX Municipal College of Technology, Belfast. (T. P. Allen, Operator.)

I 1DO G. P. Ilardi, Via Savoia 84, Rome, transmits on 33 metres.

K AYY Lieut. E. J. H. Moppett, Rhine Signal Coy., British Army of the Rhine (Wiesbaden), c/o G.P.O., London. Transmits on 43 metres.

U 2ARM Maurice Apstein, 2168, 77th St., Brooklyn, New York. (This corrects the QRA given on page 814 of our issue of June 16th).

U 4IT, U 4IR (Portable) W. K. and G. L. Stallings, 268, S. Church St., Spartanburg, South Carolina, will welcome reports from Great Britain.

o o o o

QRA's Wanted.

G 5LX, G 5RD, SGT, GBM, RPP, D 7IG, H 9XD, NOGA, N 0WC, U 2CNB, XMI, OCLP, HIK.

o o o o

Transmissions from Nauen.

Through the courtesy of Transradio A.G., Berlin, we are now able to give particulars of the transmissions from Nauen and Eilvese, which are distinguished by call-signs beginning with the letters "AG":—

AGA 15 metres. Valve transmitter, 10 kw. in aerial.

AGB 25.5 ,, Works with Rio de Janeiro, Buenos Aires, and Malabar.

(The station AGB is at present being re-constructed and will work with 20/50 kw. in aerial on 25 metres for traffic with North and South America and the East).

AGC 40.2 metres. Valve transmitter, 10 kw. in aerial. Similar transmissions to AGB and is also used for experimental work in radio-telegraphy and telephony.

AGK 20 metres. Valve transmitter, 2 kw. in aerial. Tests only.

AGN 4,900 ,, 25 kw. for European traffic.

AGO 5,600 ,, 10 kw. ,, ,, ,,

AGP 6,500 ,, For European traffic. ,,

AGS 13,000 ,, 400 kw. (Max.) for North American traffic.

AGW 18,060 ,, 400 kw. (Max.) for traffic with North and South America and the East, and for Press News and Time Signal relayed from POZ.

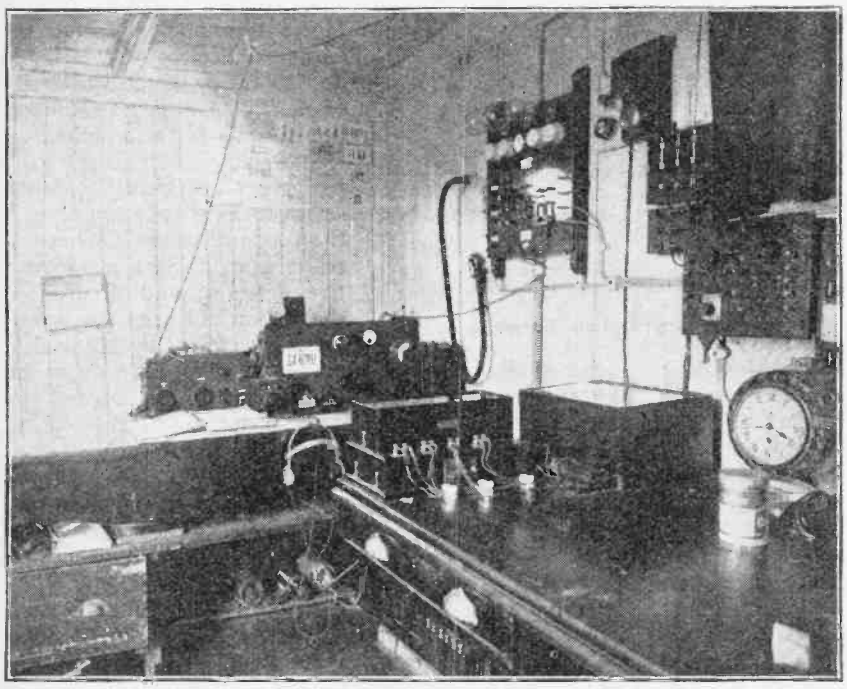
The call-signs AGQ, AGR, AGT and AGU are not at present in use, but are reserved for alternative wavelengths for the above stations.

AGX Eilvese, 14,600 metres. Goldschmidt high-frequency alternator about 100 kw. Traffic with North America and Egypt.

AGY Eilvese, 9,700 metres. Otherwise similar to AGX.

These last two stations are controlled from Nauen.

POZ 3,100 metres. Tuned spark transmitter 10 kw. is used for Time Signals only.



Apparatus used in station GX 6MU on s.s. "Lord Antrim" and "Carrigan Head" during trip from Belfast to Montreal and back.

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.

A SERVICE TO TRANSMITTING AMATEURS.

Sir,—Having some time on my hands, and being desirous of helping radio amateurs in any way that lies in my power, it has occurred to me that it might be of use to some transmitters to have more or less reliable information on the comparison of the strengths of their signals at a fixed receiving station, such comparison being made between the strength of the signal of each station individually in daylight, and the strength of the same signal (presumably using the same power and system) at night, the wavelength being 45 metres in each case.

I have a standard receiver, employing usually a detector and one low-frequency stage, in use at present, of fairly solid construction, so that chances of alteration of receiver conditions during the tests would be few.

As regards the practical details, any transmitter may call me (by my initials) at the following times during one or both of the daylight periods and again during the night period, and a full report will be sent to his address. The periods are: Wednesday, Thursday, and Friday, September 22nd, 23rd, and 24th: Morning, 11-11.30; afternoon, 3.30; night, 11.30 to midnight. Saturday, September 25th: Morning, none; afternoon, 3-4.30; night, 10.30 to midnight.

May I say that every transmitter whom I hear calling me will receive a report. J. C. WILSON.

53, Green Lane, Northwood, Middlesex.

SOME READERS' VIEWS ON OUR POLICY.

Sir,—I want to congratulate you on the ever-increasing interest in your paper. In this opinion all real wireless enthusiasts agree, both experimenters and members of the trade.

I have noticed that in the instance of sets and circuits given in your journal, a full description is given of windings of components. You do not simply say go to so-and-so and buy the parts advertised. May I, on behalf of experimenters in general, ask you to continue your honest policy and intensify it, by giving all windings such as H.F. transformers, chokes, etc.

You are at liberty to make any use you please of this letter over my name if desired, as I know I am only voicing the opinion of thousands of other readers of the wireless journal universally read and appreciated.

Belfast. THOS. H. TURPIN.

Sir,—We have to express our satisfaction in the policy of *The Wireless World* in connection with the components to be specified in the constructional articles of your publication, and we are quite sure that this will clear the air of a lot of suspicion which the public have regarding the wireless press and its advertisers. pp. S. A. LAMPLUGH, LTD.

Birmingham. W. T. WINKLES.

Sir,—We have read with much appreciation the Editorial in the current issue of *The Wireless World*.

As readers of fairly long standing, the article is to us unnecessary, and to an intelligent reader your policy has always been quite clear. On the other hand, your circulation, judging by the numerous copies one now sees in trains and public places, must be increasing rapidly, and deservedly so. In fact, we are of the opinion that *The Wireless World* has at last been recognised, rather belatedly, as the outstanding technical journal catering for the intelligent "experimental listener." It is presumably to your numerous new readers that you have particularly addressed the leader in question.

In conclusion, may we say that we shall always be pleased to use what little influence we have to promote an increasing circulation of *The Wireless World*, the best of all wireless papers.

F. J. BURTON.

Wandsworth Common, S.W.18.

A. J. PHILLIPS.

Muswell Hill, N.

Sir,—I hasten to express my keen appreciation of your full and frank reply to my letter of August 8th, and to thank you for your advice. I had just begun to wind the transformers, and will now follow the lead you have given me, and have no doubt the receiver will amply fulfil all you say of it—and, indeed, much more, judging by my previous experiences with your receivers.

May I take this opportunity of expressing on my own behalf, and I feel sure on behalf of many thousands of your "silent" readers, our appreciation of the straight policy you have the courage to declare and to follow?

And, for my own part, I have had endless amusement and interest after a busy day in making up component parts after your instructions.

Please make what use you think of this letter, and believe me, G. MACLEOD.

Clevedon, Somerset.

Sir,—The Editorial of the current issue (September 8th, 1926) meets with hearty endorsement from myself and others.

I was long ago convinced that *The Wireless World* could be relied on for unbiassed judgment.

Might I suggest that in tabulating components for a receiver the note might appear "alternative permissible," or "no deviation recommended" against the component. I know that you often permit alternatives, but a definite negative would often save much trouble. W. A. WATERFIELD.

Devon.

JAZZ v. CLASSICS.

Sir,—With reference to Mr. Hylton's letter recently printed in your columns, I must protest against his methods of reasoning. He evidently regards his own postbag as a Court of Final Appeal, coolly ignoring that of Sir Landon Ronald as of no account. It is staggering to find even one professionally interested making such an unblushing claim regarding "the amended poll."

Mr. Hylton describes all the 78 who did not definitely agree with him as "violently minded," from which it appears that anyone who ventures to differ musically from him at any time will be similarly classified. Such an utter lack of judicial fairness is sufficient to discount all opinions associated with it.

Your correspondent cannot explain away the admittedly progressive change in the B.B.C. postbag in favour of classical works at the expense of jazz over the broadcasting period.

Another point: If jazz is a wrong term, more so are the terms "syncopated music" and "symphonic syncopation" when arrogated exclusively to "modern dance music," which is the only proper term to apply. Every trained musician is

aware that the syncopation effects of dance music are the elementary and unsubtle ones which form the "children's hour" of the study of rhythmic resource. H. GILL.
Leeds.

Sir,—I was pleased to read Mr. Hylton's letter in a recent issue; his figures throw a different aspect on the case altogether, as we were lead to believe that only about 20 to 25 per cent. of the listeners were in favour of the jazz. I know the highbrows do not like it, but there is no doubt that dance music is much more popular than classics. In any case, whatever had been the verdict of the test, as a test it was a complete farce. For instance, "The Blue Danube Waltz" can hardly be called classical music; if it is, let us by all means have more of it. I am sure that if this piece had been replaced by, say, the overture "The Flying Dutchman," by Vardner or Scherzo from Sonata in A Flat, or some such piece as this with which the B.B.C. is constantly boring a large number of the listeners, Sir Landon Ronald's showing would have been much poorer despite the fact that he had much the best orchestra of 42 players against Jack Hylton's 14. Then again, look at the large choice he had, as classical music has been in existence hundreds of years against only the few years we have had jazz. Personally, I like the dance tunes best when some of the weird effects produced by jazz instruments are left out, and think dance music is heard at its best when played by a string orchestra like that at the Rialto Theatre. T.W.R.
Great Clacton.

TRICKS OF THE MICROPHONE.

Sir,—I have been much interested by the paragraph headed "Tricks of the Microphone" under "Broadcast Brevities" in the August 18th issue, particularly as concerns the reproduction of the drum and bass orchestral instruments. Also, being a regular reader of *The Wireless World*, I have, on many occasions, noticed similar remarks regarding the drum, which is undoubtedly very badly reproduced on the average loud-speaker.

Now I do not think that any suggestion such as substituting a pizzicato on a 'cello is a sound one and likely to really lead to improved reproduction, also I think I am right in maintaining that improvement is required in the receiver and loud-speaker and not, at present, in the transmitter, as I am convinced that the drums and other low notes are transmitted in very accurate proportion to the remainder of an orchestra.

I have constructed a loud-speaker according to my own ideas on the subject and I find that, in the reproduction of a full orchestra on this instrument, the drums are very faithfully reproduced indeed as are all other bass instruments; in fact a full or symphony orchestra, as transmitted by 2LO at any rate, is very accurately balanced indeed, from one end of the musical scale to the other, and this when the loud-speaker is operated by either a really good transformer or resistance capacity amplifier without any form of tone control whatever. Therefore I feel very sure that no really useful purpose is to be served by faking the orchestration itself.

With regard to the organ, I find that here also the reproduction of the pedal notes is much more accurate than the average listener supposes. I should imagine that it is the most difficult instrument of all to transmit and reproduce accurately, but even as things are at present I find the pedals are sufficiently well reproduced to vibrate the floor of a room quite perceptably at quite moderate volume. B. A. BUTT.
London, S.W.13.

[We were recently afforded an opportunity of hearing Mr. Butt's loud-speaker and can fully endorse his remarks regarding the distinctive tone colour of the pizzicato strings and percussion instruments as transmitted by the B.B.C.—ED.]

SIDE BANDS.

Sir,—Judging by many recent statements bearing on the matter, it seems to be an accepted fact that "side frequencies" exist in modulated carrier wave telephony. That is to say, they have an objective physical existence. Let me quote.

The Wireless World, Aug. 4th, 1926, p. 165.

"Hitherto we have considered a modulated carrier wave merely as a high-frequency oscillation, of constant frequency, whose amplitude was varied at audio-frequency in accordance with the wave shapes representing the speech or music; but *actually* a modulated oscillation consists of three or more high-frequency oscillations of different frequencies."

I have emphasised the "actually" because I consider it definitely misleading. Side frequencies have no *actual* physical existence at all.

The only proof of their existence that I have ever seen depends on analogy with the beat tones in sound. I believe the analogy is a true parallel, and as these beat tones in sound have no actual objective physical existence one could conclude that the beat tones in ether waves have no existence.

I would advocate a reversion to the original manner of speech, in which the "decrement" of tuned circuits would be referred to, instead of "cutting off the side bands."

Speaking of "side bands" as if they had an actual existence has led even competent technicians (in the B.B.C. and elsewhere) into error.
Dublin. D. McATEER.

THE LOW POWER TESTS.

Sir,—Further to the correspondence which has appeared in your journal, I wish to associate myself most wholeheartedly with the efforts to conduct a series of low QRP tests during the coming winter.

I am fully convinced that great usefulness will accrue from these tests, and feel confident that the days of enormous power are ending. From tests made recently I am sure that it is possible to maintain *reliable* telegraphic communication up to 300 miles with no greater power than 3 watts. It is already established that far greater distances can be worked on even less power, but I think the 100 miles per watt is a good safety value.

It seems to me that if the tests are to prove anything more than we already know, they should be conclusive—and the only way to make them so will be to schedule each station to work nightly during the tests with one or more stations situated at distances of, say, roughly 300, 500, 1,000 and 2,000 miles. The method usually employed of calling a test and chancing what turns up is not much use during tests of this description. Schedules must be adopted and co-operation amongst the foreign amateurs sought if the results are going to be worth anything.

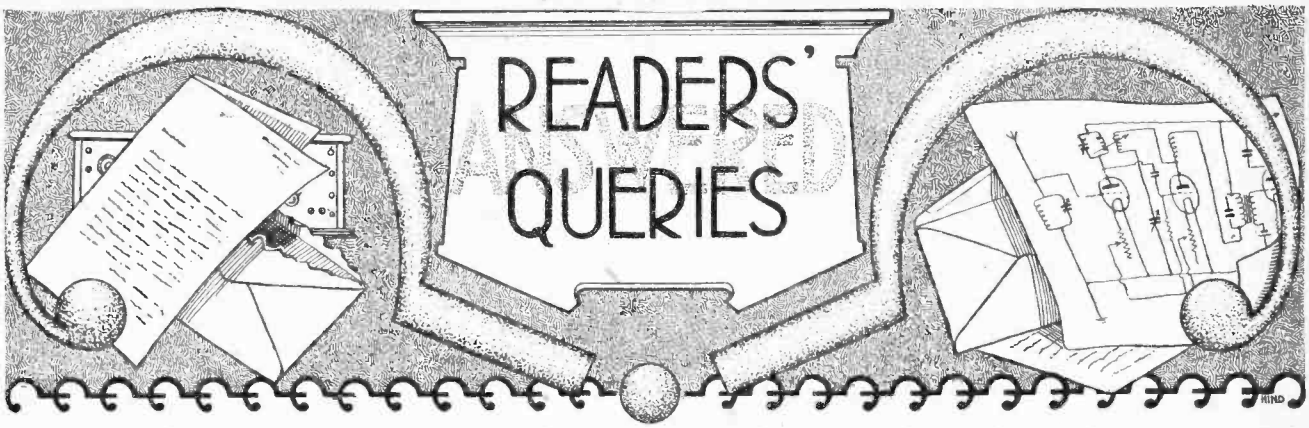
With best wishes for the success of the test and my thanks for allowing the use of your valued journal for the passing of comment. JOHN CLARRICOATS
107, Friern Road, London, N.11. G6CL, Member T. and R. Section R.S.G.B.).

Sir,—With reference to the many letters published in recent issues of *The Wireless World* on low power short-wave tests, I should like, as an Italian amateur, to tell you I agree entirely with the suggestion of arranging QRP international tests. I am very much interested in this matter, and, as I am desirous of taking part, I send you all my support.
Rome. G. P. ILARDI (i1DO)
(Radio Manager of *Corriere Latino*).

WHERE IS THAT STATION?

Sir,—With reference to the letter of BM/BB5J in the September 1st issue, I would like to say that I have a similar difficulty in identifying short-wave telephony amateurs. I would like to suggest to amateurs who have indistinct call signs that they supplement names for their call sign letters more. During the past two months I have sent QSL's to three amateurs, who have written back saying they had not transmitted for many months. In each case the call sign has had an indistinct letter in, *e.g.*, "C." "T." or "P."

I am sure that many listeners would be glad if these amateurs would be more careful in making their call signs clear.
Birmingham. L. L. PARRY.



"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 Simple Three-valve Circuit.

I am intending to build the two-stage power amplifier described in your March 31st issue, with certain modifications as follows. A simple regenerative detector is to be incorporated in the instrument, and no volume control or jack switching is desired. I shall be glad, therefore, if you can give me this modified circuit. *G. H. C.*

We give in Fig. 1 the modified circuit which you require. The aerial and reaction coils can consist of two ordinary plug-in type coils mounted in a two-way coil holder, or one of the many regenerative tuners now upon the market may be used. The anode resistance could be preferably of the wire wound type to ensure freedom from crackling noises, whilst the 0.1 mfd. coupling condenser should have a mica dielectric, since it has to withstand the voltage of the H.T. battery. There is no necessity to use a separate rheostat for each of the L.F. valves and a common instrument is used. In nearly all cases it will be found that in order to obtain smooth reaction effects, it is necessary to shunt the anode resistance with a small fixed condenser, but this should not be made larger than is absolutely necessary to fulfil its function, and in general the value given on the diagram will be about correct.

○○○○

S.L.C., S.L.W., or S.L.F. ?

I have read with interest the article on "Frequency and Wavelength" in your August 4th issue, and am wondering whether there is any method of converting my existing S.L.W. condensers to the S.L.F. type, as I do not wish to go to the expense of purchasing new condensers. *B. H.*

It would be impossible, of course, to convert your existing condensers without changing the whole design of them, but several manufacturers now sell special geared tuning dials which when used with a S.L.W. type condenser have the effect of giving a movement to the plates which is not of constant ratio with respect to the movements of the knob. The result is that the S.L.W. condenser is caused to give an S.L.F. effect. Dials are also supplied for giving an S.L.W. or S.L.F. effect to the older type of S.L.C. condensers, and care should be taken to order the type for converting S.L.W. to S.L.F. It should be pointed out that the dials must not be used in conjunction with an S.L.F. condenser for vernier control purposes, as the result of this combination would be to give an eccentric movement to the plates which would give neither an S.L.C., S.L.W., or S.L.F. effect.

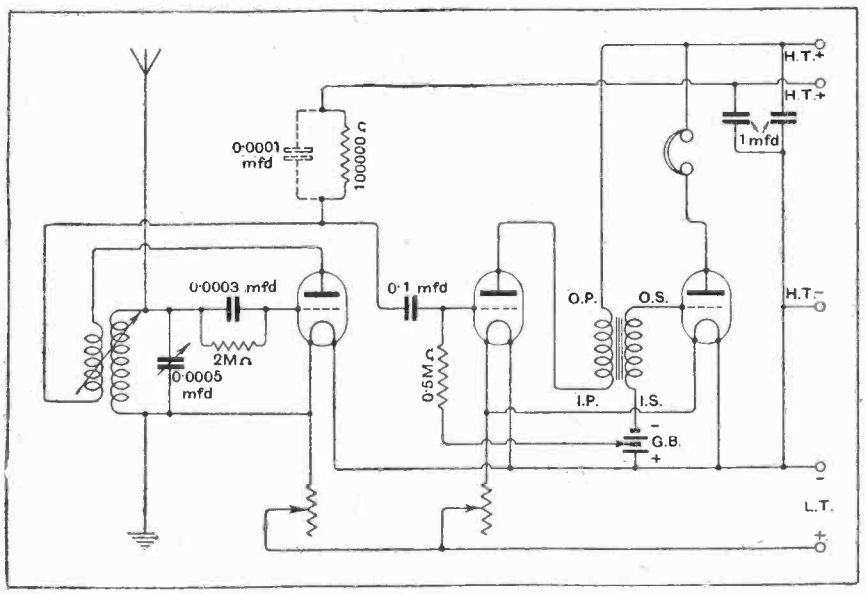


Fig. 1.—A three-valve circuit giving good quality.

○○○○

Condensers in Series or Parallel.

I have a large number of fixed condensers of all types on hand, which I am constantly using in trying out experimental circuits. Often, however, I find that I have not the exact capacity specified for some particular circuit. Is it possible for me to obtain any desired capacity by connecting a number of different condensers in series or parallel? *K. D. R.*

It is quite possible to do as you suggest. The capacity given by any number of condensers connected in parallel, for instance, is equal to the sum of the individual capacities. It will be obvious from the above that the resultant capacity will always be larger than that of the largest condenser in the combination. In the case of condensers connected in series, the resultant capacity is equal to the reciprocal of the sum of the reciprocals of the individual capacities. This will be recognised as being the same rule as that given for determining the resultant resistance of a number of individual resistances connected *in parallel*, and it will be seen that the resultant capacity resistance as the case may be will always be less than that of the smallest capacity in the series. An

enormous additional number of capacity values may be obtained by connecting up several condensers in a series-parallel combination. The method of working out the resultant capacity, however, is perfectly straightforward. Supposing, for instance, we connected two 0.0001 mfd. condensers in series, and shunted an additional two 0.0001 mfd. condensers (also in series with each other) in parallel with the first pair. First it is necessary to work out the capacity of each series pair. This is obviously 0.00005 mfd. each. We have now, therefore, a simple arrangement of two 0.00005 mfd. condensers in parallel with each other, and the effectual capacity of four 0.0001 mfd. condensers connected in this way, therefore, is 0.0001 mfd., the capacity of any one of them.

o o o o

Choice of Valves.

I frequently see it stated with regard to receivers described in journals that for best results it is necessary to use valves of low impedance or high impedance in certain positions. Can you give me any definite idea of how to ascertain the impedance of a valve, and does it depend on filament characteristics? *F.V.N.*

In nearly all cases when purchasing a valve a pamphlet will be found in the box in which the maker definitely states the impedance of a valve. If a low impedance valve is specified in any particular circuit, a valve having an impedance of from 5,000 to 10,000 ohms should be used, whilst if a medium-impedance valve is specified, a valve having an impedance between 15,000 and 30,000 ohms should be used, and if a high-impedance valve is required, a valve of 30,000 to 50,000 ohms impedance is called for. In general, a high-impedance valve is used if in its anode circuit is connected a tuned anode coil, a resistance, or a choke, whilst a low-impedance valve is used if the valve is followed by an L.F. transformer, a loud-speaker, and in many cases by an H.F. transformer in a modern neutralised receiver, such, for instance, as the long-range three-valve receiver described in our May 26th issue. In some cases, however, such as in the "Everyman's Four-valve Receiver," described in our July 28th issue, a high-impedance valve must be used in front of the H.F. transformer. For rectification, a general-purpose or medium-impedance valve is usually specified, although in anode rectifiers it is preferable to use a high-impedance valve.

It is immaterial whether the valves are of the 2-, 4- or 6-volt type, provided that the impedance specified is obtained. In many cases, however, valves of certain impedance are marketed with certain filament voltages. Thus, all the 3-volt 0.06 ampere type valves are of medium or high impedance, and if a low impedance valve were specified it would be impossible to use a 3-volt 0.06 ampere type of valve. It would, however, be possible to use either a 2-, 4- or 6-volt valve, the Mullard P.M.2, P.M.4 and P.M.6 valves being typical examples.

In some cases it is necessary to use valves of extra high impedance or of extra low impedance. In general, such valves can be said to be of more than 50,000 ohms or of less than 5,000 ohms respectively. An extra high impedance valve, for instance, is often specified as an anode rectifier when a very high anode resistance of ½ to 1 megohm is used in its plate circuit. A good example of this is the Cosmos S.P.18 "Blue Spot" valve, which has an impedance of 70,000 ohms, or the Mullard P.M.5A, which has an impedance of 120,000 ohms. On the other hand, in cases where extremely great volume is expected from a receiver, such, for instance, as a receiver with several stages of L.F. operating from the local station, a valve of very low impedance is called for. A good example of this is the Marconi and Osram D.E.5A valve, which has an impedance of 4,000 ohms, and the L.S.5A valve by similar makers, which has an impedance of 2,750 ohms.

Everyman's Four-valve Receiver.

In the editorial columns of your August 25th issue, I notice a reference to the "Everyman's Four valve Receiver," from which receiver it appears most excellent results have been obtained by your readers. I am a new reader and I shall be glad, therefore, if you can tell me if I can obtain working drawings and full instructions for building and operating this receiver, also if it is absolutely necessary that I adhere to the author's specifications in the matter of valves, etc. *T.E.S.*

This four-valve receiver relies for its extreme sensitivity on getting the utmost efficiency from a single stage of H.F., and, moreover, since there are only two tuning controls, the receiver is exceptionally simple to tune. It is perfectly stable over its entire wavelength range, and cannot cause annoyance by oscillating. The quality obtained is excellent, partly owing to the design of the low-frequency portion of the receiver, and partly due to the use of anode bend rectification.

It is most important, however, that the author's specifications be followed carefully if good results are to be obtained. For instance, a high resistance of ½ megohm in value is used in the plate circuit of the detector valve, which has important bearing on the efficient functioning of the valve as an anode rectifier.

The ordinary method of grid rectification must not be used, otherwise all the care bestowed on the design and construction of a highly efficient H.F. transformer will be set at naught.

Another point which cannot be too strongly emphasised is that it is not permissible to substitute any old transformer in place of the actual L.F. transformer used in the last stage. The valve used in front of this transformer has an impedance between 20,000 and 30,000 ohms, and, therefore, a very high impedance is necessary in its anode circuit if frequency distortion is to be avoided. The actual transformer used has a primary inductance of 80 henries, and it would be extremely unsound policy, therefore, to substitute an instrument having only a 20-henry primary, which is the case with a very large number of transformers that are upon the market.

The choice of valves is another important consideration. It must be remembered that the H.F. transformer is specially designed to suit the particular valve specified, since this particular valve and transformer combination were found to be the most efficient. The use of a different type of valve would mean that either sensitivity or selectivity would suffer very severely according to the characteristics of the particular valve used. The detector valve used was chosen for its efficiency as an anode rectifier, and it would not be permissible to substitute any type valve indiscriminately in this position. For instance, if the same valve were used in this position as was used in the H.F. stage, results would not be so good. It is also necessary to follow the author's advice in the matter of using a high impedance valve of the characteristics specified in the first L.F. stage, and a low impedance valve, of course, in the last L.F. stage.

Full constructional details, together with theoretical and practical wiring diagrams and working drawings, were published in the issues of this journal for July 28th and August 4th, and these should be studied carefully and the specifications adhered to if first-class results are desired. If the instructions are carefully followed, however, it is possible for the absolute novice to build a highly efficient four-valve receiver which will give him no trouble whatsoever. An additional article dealing with the use of valves and components other than those originally specified appeared in the September 8th issue. These three back numbers may be obtained, post free, by forwarding fifteenpence to the publishers of this journal at Dorset House, Tudor Street, London, E.C.4.

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(14th Year of Publication)

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REMOTE CONTROL.

THE subject of remote control by wireless (or adopting the new name "Telearchics" introduced by the author of a recent article in *The Wireless World*) has received comparatively little attention hitherto, and yet it is, probably, one of the most fascinating of the applications of wireless.

It is true that there have been quite a number of workers (both in America and in this country) who have devised interesting methods of wireless control, but most of these efforts have been made with early types of wireless apparatus and have not employed the most up-to-date developments which have added to the sensitivity of receiving apparatus, nor has advantage been taken of the great possibilities which the use of short waves suggest.

In the present issue interesting photographs are given of a wireless-controlled boat which has been "hatched out" in the Experimental Laboratory of *The Wireless World*. The boat serves to illustrate very forcibly the enormous possibilities which lie ahead awaiting development. This model boat is by no means a complicated piece of apparatus, and yet to watch it carrying out afar off the instructions of the little short-wave transmitter used in conjunction with it, one would almost think that the boat itself had a brain.

In commending the subject of remote control to the study of our readers, we know that we are introducing them to hours of fascinating study with the certainty of results which can almost be described as spectacular.

In the present issue only an outline is given of the principles of the radio-controlled model boat, but this will be followed in subsequent numbers with full details for construction.

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NEW PRICE THREEPENCE.

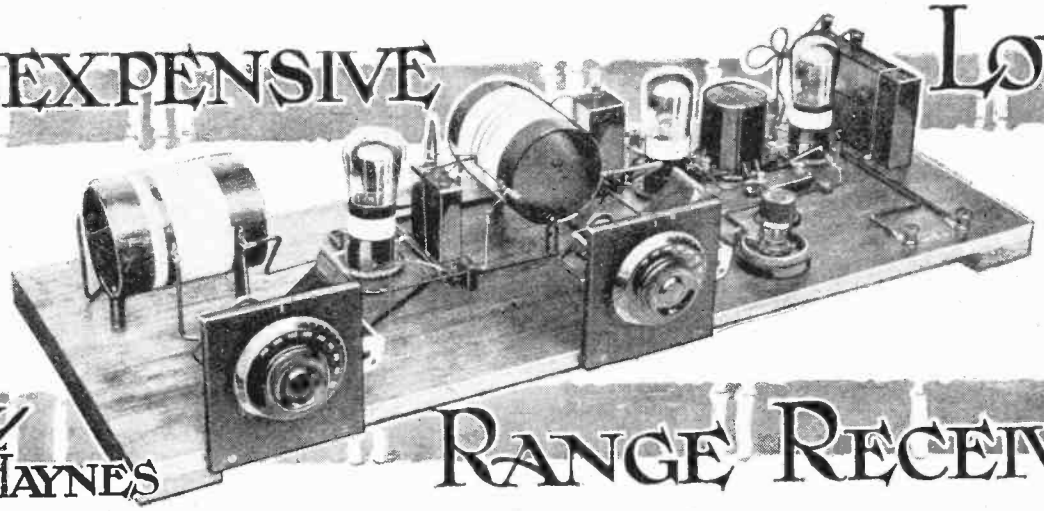
THE issue of October 6th will mark a new stage in the progressive development of *The Wireless World*, for with that issue the price, which has hitherto been fourpence per copy, will be reduced to threepence, with a corresponding reduction in the annual subscription rate.

This change has been made possible owing to the increasing popularity of *The Wireless World*, and it is felt that this reduction in price will enable the regular reader to share in the prosperity of the journal, whilst at the same time it should bring the paper within the reach of many more readers.

In making this announcement we wish it to be clearly understood that the reduction in price will entail no change either in the character of the contents or in the size of the paper. This is, perhaps, an opportune moment to express our indebtedness to our readers for the large part which they themselves have played in assisting us both by their suggestions and by their recommendation of *The Wireless World* to their friends. It is gratifying to note how frequently a new reader writes to us explaining that he has been introduced to *The Wireless World* through a friend. Perhaps our readers scarcely realise how much they can do to extend the popularity of *The Wireless World* by such personal recommendation.

CONTENTS.

INEXPENSIVE LONG RANGE RECEIVER



by F. H. HAYNES

Three-valve Stabilised Set costing less than £2 10 0.

FOR every instance where a receiving set is made up regardless of cost there must be at least a hundred where expense is the first consideration.

Complete Set for £2 10s.

Many designs involve an expenditure of from £20 to £40, and it must be admitted that one rarely has an opportunity of seeing such sets finished and installed, for the simple reason that they are too costly to build. There is, however, a very welcome endeavour on the part of the manufacturer to bring down the price of parts, and this fact augurs well for the man whose means are limited.

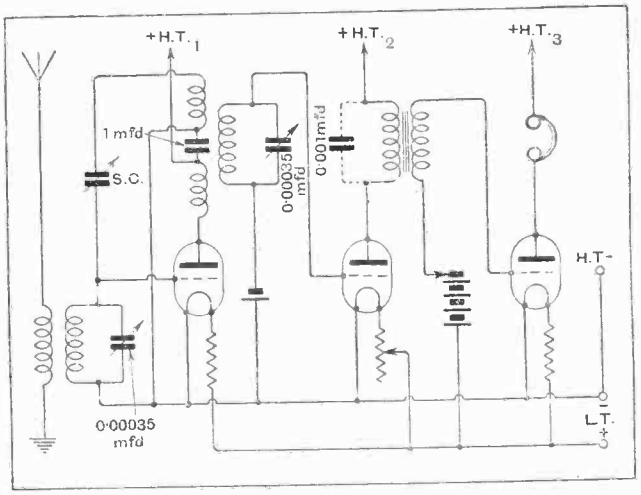
With low cost as the primary aim it was decided to make up a long-range receiver with a price limitation of £2 10s., using only reliable components.

Another important consideration in the design of any set is that of easy construction. This need has been evidenced in the sets shown in connection with two recent amateur receiver construction competitions. Amateurs in general have not elaborate workshop facilities, and the design of the average set should not, therefore, rival in elaboration receivers of commercial manufacture. It hardly seems consistent to make use of components where the manufacturer has gone to great trouble to avoid accurate setting out by the introduction, say, of one hole fixing, when the set to be made up necessitates the careful use of square and dividers and involves tapped holes for fixing.

Easy Construction.

For simplicity, the baseboard form of construction has been adopted as meeting the requirements and permitting of a good layout of the components with easy wiring.

The most useful set is undoubtedly an arrangement of three valves, with an efficient high-frequency amplifying stage, valve detector and note magnifier. Such a set will, if necessary, operate a loud-speaker from the local station and will give good reception on telephones from stations all over Europe. It can be designed to be reasonably selective and quite stable in its operation, and in many respects equal in its performance to the most expensive of three-valve receivers.

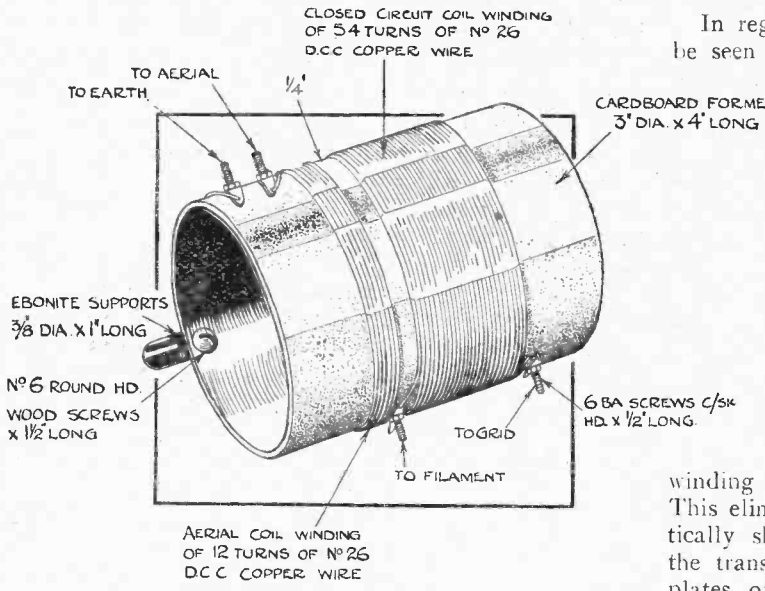


THREE-VALVE RECEIVER WITH STABILISED H.F. STAGE. It will be seen that the neutralising winding is arranged so that in the event of the stabilising condenser becoming short-circuited the H.T. positive lead does not become connected to the L.T. battery. The condenser which bridges the primary of the L.F. intervalve transformer actually connects between the plate of the valve and the filament circuit.

An input oscillation transformer is used between the aerial and the input to the first valve, the damping in the tuned grid circuit being kept to a minimum by not too tightly coupling with the aerial and negatively biassing the grid of the valve to prevent the flow of grid current through the secondary coil. Both the primary and secondary windings of the input transformer are wound with No. 26 D.C.C. without appreciable loss of efficiency in view of the damping which is certain to exist in the aerial circuit inductances. The extent of coupling between the two windings might, with advantage, be vari-

Inexpensive Long-range Receiver—

able, so that the maximum signal transference could be obtained without creating undue damping in the closed circuit by aerial resistance. Amateur aerials,



THE AERIAL COUPLER. Details for making up the aerial and closed circuit inductances. The positions for the connecting screws are chosen to simplify the running of connecting leads to the terminals and other components. The earth lead connects to the end of the coil nearest the secondary winding.

however, are so similar in physical dimensions that adjustable coupling may be dispensed with, the windings given having been found to be the best by careful test. Variable coupling would, however, prohibit the calibration of the aerial tuning condenser, as also would any arrangement of controlling the coupling by varying the number of primary turns.

The inductance formers, which are quite inexpensive, are made of thin shellacked cardboard, and possess good insulating properties. The formers for the aerial and intervalve couplers are identical, and are made from strips of thin white card, 4in. in width by 19in. in length. Card that will withstand bending without cracking must be selected.

Home-made Coil Former.

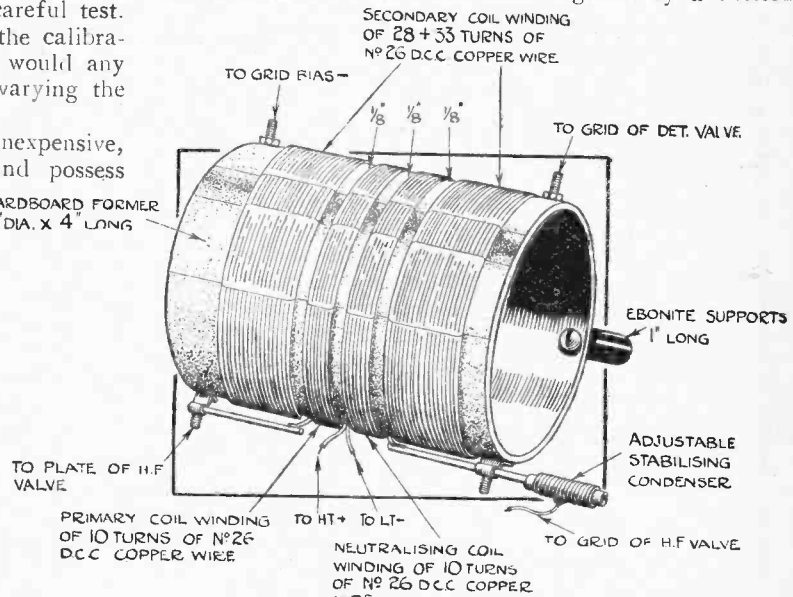
The easiest way of making the cylinders is to find an object roughly 3in. in diameter, and by treating the edges with varnish, taking care that it does not reach the interior of the cylinder, wrap the cardboard tightly round and bind in position. When thoroughly dry, liberal treatment inside and out with shellac varnish will produce two light and exceedingly rigid formers. Care should be taken to see that the cardboard is quite free from moisture before varnishing, and the cylinders can be gently dried out after varnishing in a warm oven, though they should be watched to see that they do not go out of shape, and although the centre piece should be removed it is advisable to leave the outside binding intact. When thoroughly hard, holes should be drilled to pass the 6 B.A. screws which bolt on the connecting tags as well as for the holding down screws.

The H.F. Intervalve Coupling.

In regard to the H.F. intervalve transformer, it will be seen that the winding is arranged as four sections, the outside pair forming the secondary, and the inside pair the primary and neutralising winding. This form of construction is adopted first in an endeavour to make the coils symmetrical as regards the primary and neutralising turns, and, secondly, to give maximum magnetic coupling between primary and secondary with a minimum of capacity. Between each of the sections a gap, ⅛in. in width, is left so that the capacity between primary and secondary turns is exceedingly low, whilst the gap between the centre sections is merely to maintain good insulation.

It will be noticed from the circuit diagram that the earth potential end of the neutralising winding connects directly to the H.T. battery leads. This eliminates the danger so often experienced of practically short-circuiting the high-tension battery through the transformer primary if a contact occurs across the plates of the neutralising condenser, and when the neutralising winding is a continuation of the primary. It becomes important, however, to connect the H.T. bridging condenser in the position shown, close up to the coil to avoid stray coupling.

The two secondary sections are, of course, wound in the same direction and connected together by a twisted



THE H.F. INTERVALVE TRANSFORMER. Details for winding intervalve coupling and constructing the stabilising condenser.

and soldered connection inside the former. Quite small holes should be pierced for passing the wire through, taking care that even the insulation on the wire does not come into contact with the two centre sections. The ends of the secondary winding are terminated on small double-

Inexpensive Long-range Receiver.—

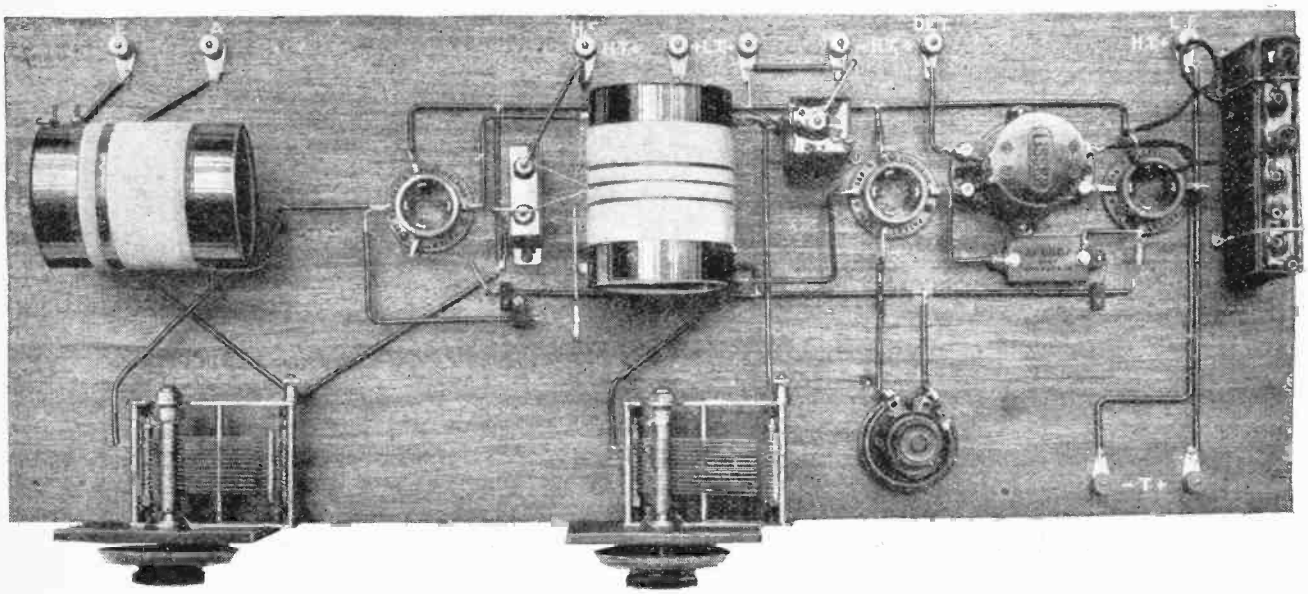
ended tags cut from thin tin plate. Four pairs of holes are made through the former for terminating the two centre sections which are identical in turns and direction of winding.

Tubular Stabilising Condenser.

To avoid the cost of an elaborate neutralising condenser, one of simple construction is adopted consisting of a closely-wound spiral of No. 20 S.W.G. tinned wire with the turns soldered together and about ⅜in. in length. Alternatively a small tube can be made from thin copper foil or even tin plate. It should fit tightly over a piece of insulating sleeving which in turn must slide on a piece midway between them together with the small metal box of the bridging condenser. It is interesting to note that the resistance of an unscreened coil is appreciably lower than one which is covered by a metal box, and unless the screen is spaced at a good distance from the coil an appreciable increase in resistance will result.

Assembly.

A piece of suitable wood for the baseboard will probably be to hand, though should it be necessary to purchase a board for the purpose, the wood should be finished planed. There will probably be little difference in the price between mahogany and American white wood. The board when finished measures 11in. × 28in. and is ½in.



PLAN VIEW OF THE FINISHED SET. The arrangement of the components and the paths taken by the connecting leads can be followed from this illustration.

of No. 16 wire. The area of overlap produced is equal to a plate ¼in. to ½in. The piece of 16 gauge wire is supported by a tag.

The positions of the other tags should be exactly copied from the illustration so that they may be conveniently placed for the wiring. This completes the construction of the coils, and four 1in. stems cut from ebonite tube ⅜in. in diameter or four wooden spacers give the necessary lift above the baseboard.

Owing to cost and difficulties of construction no form of screening now so commonly met with in high-frequency amplifiers has been provided. Screening by the use of metal shields is for the purpose of preventing pick-up on the coils themselves and essentially for assisting in giving improved stabilisation by eliminating magnetic coupling between the coils. In a single stage H.F. amplifier a screen is required to prevent magnetic coupling, but it can with safety be dispensed with when the coils are liberally spaced apart and arranged with their fields at right angles. Care is necessary, however, to see that the grid and plate leads of the H.F. valve do not intermix and that they pass directly away out of the fields of the coils. The centres of the coils in this instance are nearly a foot apart and a valve is placed in thickness. It is stiffened across the ends with 2in. × ½in. battens. The board should be rubbed down with glass-paper and varnished on both sides. The first step in assembly should be the fixing of the ten terminals in position, a small tag cut from tin plate being inserted under each.

With the aid of the scale drawing all components can be screwed in position, using round-headed brass screws. It will be noticed that the centres of the two H.F. transformers, the H.T. bridging condenser and the three valves are all in line, while the spindles of the variable condensers are exactly central with the coils. This process of alignment adds greatly to the appearance of the set while simplifying the wiring.

The Lissen transformer, although selected essentially in view of its low price, has its terminals near the base which is a very necessary feature in order to keep the wiring near the baseboard. In this instance it is placed between the detector and L.F. valve holders so that its tags join up directly to the plate and grid socket.

The easiest way of supporting the Ormond condensers is by means of small panels of ¼in. ebonite, which should be of sufficient size to accommodate 4in. slow-motion dials which may subsequently be fitted. Thin wooden

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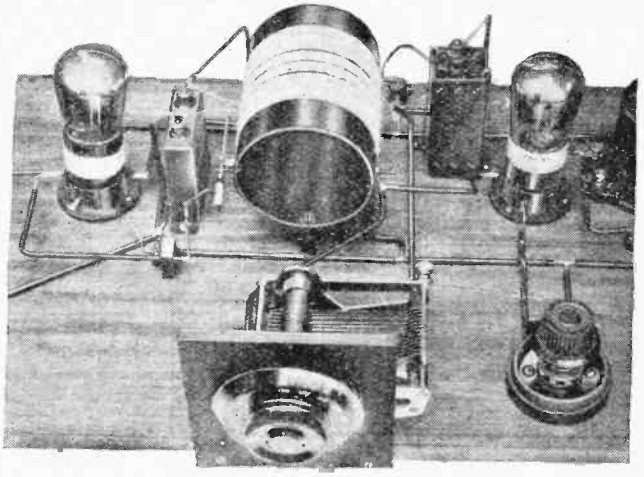
panels with the grain arranged vertically could be used as an alternative.

Wood as an Insulator.

Reference might be made here to the absence of ebonite for insulation. Dry wood is practically as good an insulator as many specimens of ebonite, but it must not be overlooked that the insulation on any instrument is as good as its weakest point, and the insulation resistance provided between the aerial and earth terminals is no less than that across the cotton covering on the turns of wire to which the terminals are connected. When tested, however, with a megger the insulation proved to be infinity.

The question of insulating the battery terminals is of little account. A leakage path of one or two megohms between them will not bring about a rapid discharge of the batteries, which is the only consideration, whilst the telephone terminals which are, of course, battery connected are undoubtedly far better insulated in the wood than the telephone receivers themselves.



THE H.F. STAGE. A close up view showing the layout of the apparatus associated with the H.F. amplifier.

All components must be in position before commencing the wiring, and nothing is gained by way of easy access by omitting any of the parts. The grid biassing cells are held down by loops of No. 16 wire. All leads are of No. 16 tinned copper enclosed in yellow sleeving. The wire is straightened by stretching and covered with the sleeving before being bent to shape, and care must be taken not to "nick" the wire when trimming the sleeving. A razor blade can be used for this purpose.

All filament and battery leads are kept down in contact with the baseboard, while the connections to the grid side of the condensers are raised to clear the rest of the wiring. The L.T. positive lead will require fixing down to the baseboard at its ends in order to hold the small spirals of filament resistance wire in position, and small ebonite cleats or staples made from pins will serve this purpose. An ebonite support screwed down to the base is needed to carry the lead which connects by a flexible wire to the sleeve of the neutralising condenser.

Selection of Valves.

For testing the finished set P.M.1. H.F. valves were used in the H.F. and detector stages, the intervalve H.F. transformer being arranged to suit valves of this type. This valve has an average impedance of 28,000 ohms with an amplification of 13.5 and requires a negative grid bias of about 0.5 volt when the anode potential is 50 volts. This bias is obtained by connecting the return lead from the tuned closed circuit to the negative side of the filament battery, and on weak signals is ample to prevent grid current passing through the coil and causing damping, as is evidenced by the particularly sharp tuning of the aerial circuit when in a non-oscillating condition.

A similar valve is used as the detector, and as the grid voltage swing is now appreciable anode rectification may be employed instead of using a leaky grid condenser, at the same time avoiding the damping effect of grid current. A single grid cell of 1½ volts is normally sufficient to prevent the grid becoming positive, and it is necessary to carefully regulate the H.T. tapping in order to obtain anode rectification. The potential will be about 35 volts but, being critical, the value is quite easy to find and it should be accurately adjusted when listening to weak signals.

A high-impedance valve with a sharp bend in its characteristic is required as an anode bend detector, and the reader can, therefore, if he so desires, substitute resistance coupling in front of the L.F. stage without an appreciable loss of signal strength and without additional cost. The transformer used, however, has a liberal primary winding, the requisite H.T. potential for the detector valve being far better defined than when a resistance is connected in series with the anode circuit.

The P.M.1. L.F. is used in the L.F. stage and is suitable for use with high-resistance telephones or loud-speaker, and when used on a potential of 60 volts requires biassing to the extent of only 1.5 volts.

Fixed filament resistances are used on the first and third valves consisting of 9in. of No. 28 S.W.G. Eureka wire. A variable filament resistance is fitted to the detector valve to provide additional control although a fixed resistance may be used.

Range of Reception.

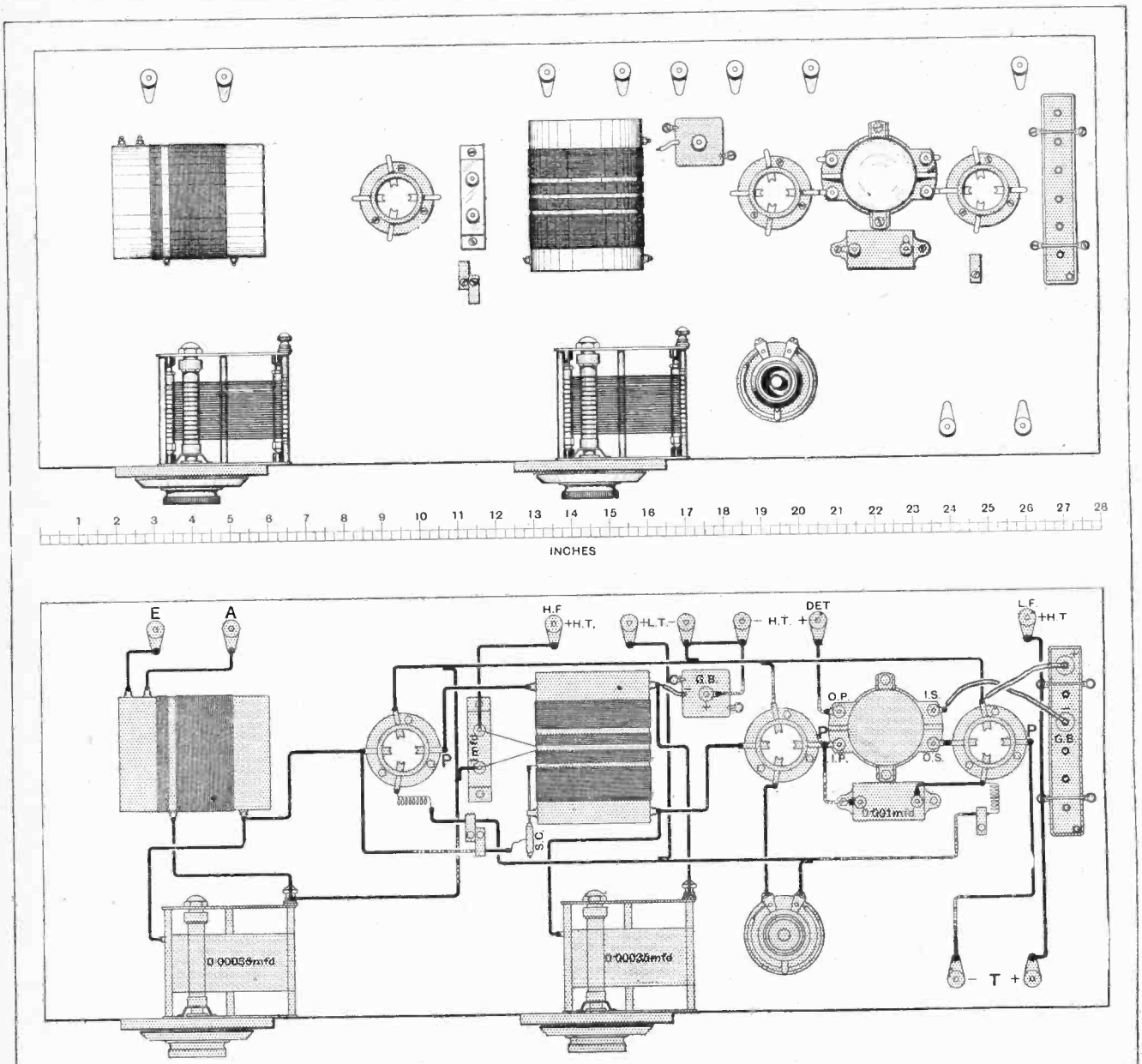
With the neutralising condenser out of action the set will be found to self-oscillate when the tuning condensers are almost at similar settings and near their zero. At the maximum setting of the neutralising condenser self-oscillation can be produced at almost any position when the condensers are in step, and a well-defined adjustment will easily be found where a distant signal is practically the only evidence that the two circuits are tuning together. So many stations can be tuned in, however, that by starting with the condensers adjusted for the local station they can be moved in either direction stepping by almost single degrees from station to station.

Between 10° on the condenser scale which tunes the H.F. intervalve coupling and its maximum setting of 180° a wavelength range of 220 to 525 metres is covered. Although the use of condensers giving straight line frequency tuning are in general to be recommended, it is interesting to observe the very small differences in the

LIST OF PARTS.

Baseboard in planed mahogany, 28in. × 12in. × ½in.		2	0	*9 Volt grid battery, Hellesen (A. H. Hunt, Ltd., H.A.H. Works, Tunstall Road, Croydon)*	2 0
Sheet of thin white card			6	*Condenser, 0·001 mfd., unmounted or mounted as shown, 2s. 6d. (Efesca)*	10
4 oz. No. 26 D.C.C.		1	0	*3 Yards Sleeving*	9
T.C.C. condenser, 0·5 mfd.		3	4	*Screws, ebonite, etc.*	1 0
3 Valve holders (Excelsior Motor Co., Ltd., King's Road, Tyseley, Birmingham)		3	0	*6 ohm. Rheostat. Optional. (Ashlay Wireless Telephone Co. (1925), Ltd., Finch Place, Falkland Street, London Road, Liverpool)*	2 9
2 Variable condensers, 0·00035 mfd. (Ormond)	1	3	0		
1 Intervalve transformer (Lissen)		8	6		
1½ volt cell (Siemens, type T)		1	2		
10 Terminals		1	3		

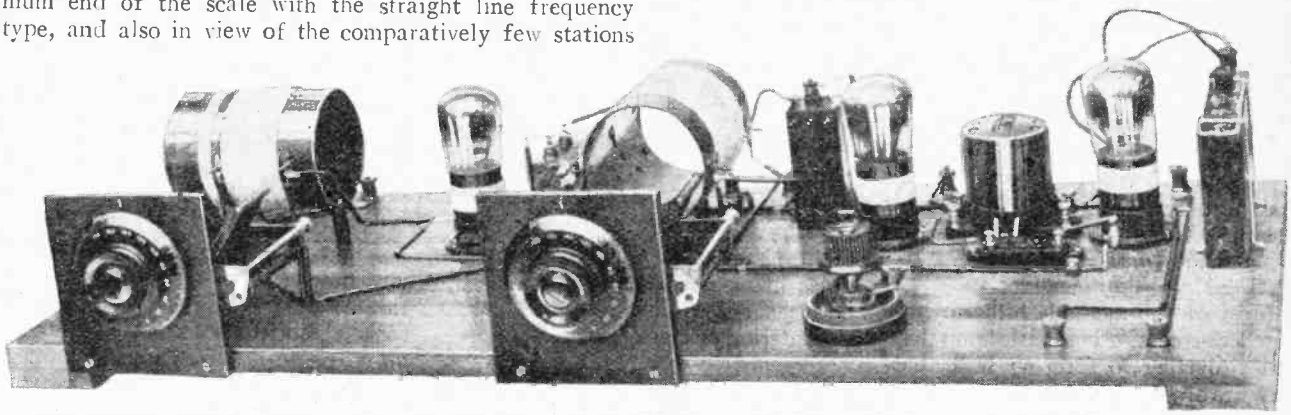
Total cost - £2 8s. 4d.



THE LAYOUT OF COMPONENTS AND PRACTICAL WIRING. The upper drawing shows the relative positions of the components, the exact locations being found by applying the scale. In carrying out the wiring all filament leads should be in contact with the baseboard, while those leads which form part of the tuned circuits and connected to the grids and plates of the valves are raised from the board.

Inexpensive Long-range Receiver.—

scale settings which are obtained when tuning to the principal European broadcasting stations. It would almost seem that it might be an advantage to make use of condensers giving the ordinary square law tuning, partly owing to the critical adjustment required near the maximum end of the scale with the straight line frequency type, and also in view of the comparatively few stations operating on wavelengths below 250 metres. The fitting of slow-motion dials will undoubtedly facilitate the process of tuning, though all the stations included in the following table were tuned in, and many others not identified using the dials with which the condensers were fitted when supplied.



THE FINISHED SET. Ample space is available for making subsequent modifications, while the condensers are accommodated on panels of sufficient size to provide for the fitting of geared dials.

Stations Received at Good Strength on Telephone Receivers.

Berlin (Witzleben)	170°	Frankfort	162.5°	Rome	150.5°	Bournemouth	139°
Aberdeen	168°	*German station*	159°	*German station*	150°	Oslo	137°
Munich	166°	Belfast	155.5°	Newcastle	145°	London	133°
Swansea	165°	Berne	152°	Madrid (Iberica)	142°	Barcelona	118°
Birmingham	164°	Toulouse	151°	Hamburg	142°	Toulouse	92°

Tuning condenser 0.00035 mfd. S.L.F. 180-degree scale.

An Exhibition at Southport.

Plans are nearing completion in connection with the wireless exhibition to be held at Southport on October 28th, 29th and 30th, under the auspices of the Southport and District Radio Society. In addition to a display by local traders, visitors will have an opportunity of inspecting an exhibition of sets constructed by members of the Society. Two attractive competitions will be open to residents in the Southport district.

Enquiries should be addressed to the Exhibition Secretary: Mr. S. Irving, 53, Hampton Rd., Southport.

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Radio Experimental Society of Manchester.

The following meetings of the society will be held during October:—

Oct. 1st.—Special meeting and discussion on various topics by the secretary.

Oct. 15th.—Experimental evening.

Oct. 29th.—Lecture at the Manchester Athenæum by one of the B.B.C. staff (the name of the lecturer and the subject will be announced later).

The society transmits every Tuesday on 200 metres, its call-sign being G 2FZ. Reports of signal strength and modulation will be welcomed.

Hon. Sec., J. Levy, 19, Lansdowne Road, West Didsbury, Manchester.

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Barnet and District Radio Society.

Keenness was the predominating feature of the society's opening meeting of the autumn session held in the club room on Thursday evening, September 16th.

NEWS FROM THE CLUBS.

Capt. L. A. Bratt (G 5XO), the new president, was in the chair, and there was an enthusiastic gathering of members. While the indoor meetings have been suspended during the holiday season, the committee has been busy and has purchased a fine array of new components and instruments for the use of the members. Various suggestions for the activities of the society during the winter months were put forward, and an attractive programme of events is being arranged.

The hon. sec., Mr. J. Nokes, Sunnyside, Stapylton Road, Barnet, will be pleased to supply full particulars of the society to anyone interested.

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Stretford and District Radio Society.

An attractive programme for October has been arranged by this enterprising society, which, although it has only been in existence for a little over a year, has already a membership exceeding 60.

A visit to the transmitting station at 2ZY has been arranged for October 9th. The annual general meeting will be held at the Café Imperial on October 14th. The following week the chairman, Mr. J. Hartley (G 6JH) will demonstrate "Various Sets for Various Members."

A lecture and demonstration by the Igranic Electric Co., Ltd., has been arranged for October 28th at the Stretford Town Hall, and the month's work will conclude with a dance at the Conservative Club, King Street, on October 30th.

Tuition in Morse code, reception and transmission is given at the society's headquarters every Monday evening.

Hon. Sec., W. Hardingham, 21, Burleigh Road, Stretford, Manchester.

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Southport and District Radio Society.

The season opened with the ordinary business meeting on September 27th, and a varied programme has been arranged for the month of October, including a lecture by R. B. S. Munn, of the B.B.C., on "Why we listen to Broadcasting," and a social evening on October 14th at Boots' Café.

Hon. Sec., T. Godfrey Storry, 67, Virginia Street, Southport.

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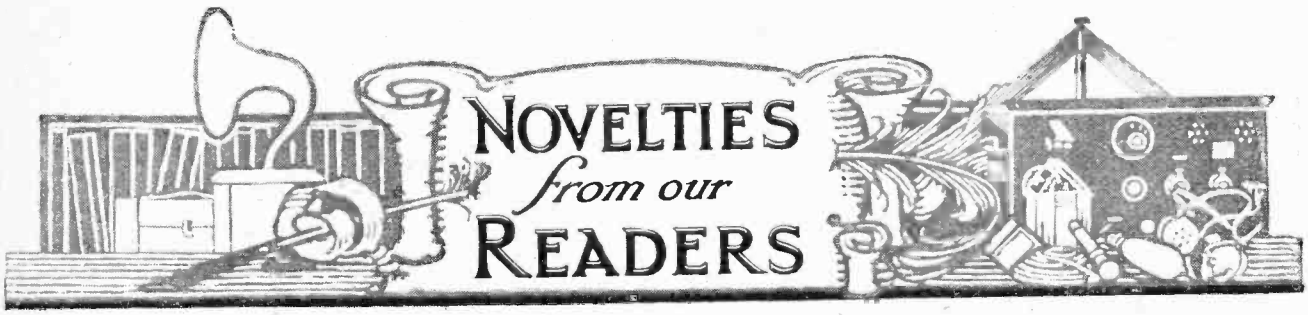
Preston and District Radio Research Society.

Among the items of interest in the October meetings of this society are a lecture and demonstration on "Saxon Sets," by G. Makin, and lectures on "Sources of Electrical Supply to Wireless Sets," by W. E. Bamber; "Microphones and Amplifiers used by the B.B.C.," by S. I. Holt (G 5FW); and "Broadcasting in Great Britain," by Mr. Pearson, the station director of 6LV.

Hon. Sec., John B. Cookson, 14, Lune Street, Preston.



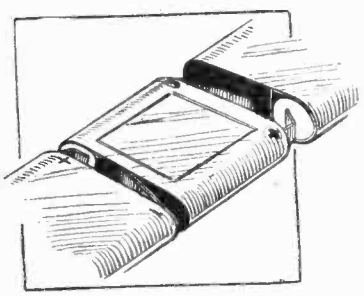
A Section Devoted to New Ideas and Practical Devices.

FLASH-LAMP BATTERY CONNECTIONS.

Most of the methods hitherto proposed for connecting flash-lamp batteries together to form an H.T. battery involve the use of a soldering iron or the addition of connecting clips. These expedients are unnecessary if the scheme shown in the diagram is followed.

The cardboard base of the battery is cut away at the end corresponding to the long (negative) brass contact strip. This exposes the bottom of the zinc container of the end cell, and since the long brass contact strip is soldered to this container we may just as well pick up contact with the base as with the strip at the top.

In applying this principle to the assembly of H.T. units the batteries are placed end to end with the short



End-to-end connections for flash-lamp H.T. batteries.

(positive) contact strips pressed against the exposed base of the preceding cell. It is suggested that special trays be constructed from 3-ply wood for assembling groups of cells which may then be connected in series in the normal way.—T.C.S.

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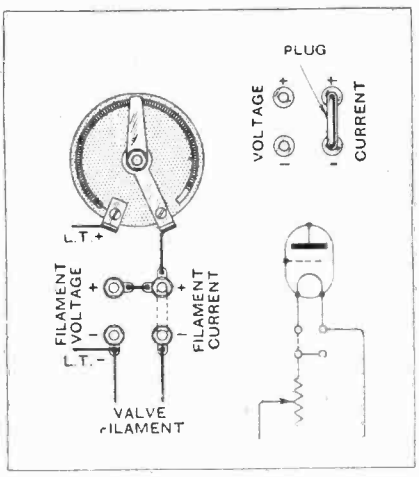
TESTING FILAMENT VOLTAGE AND CURRENT.

The diagram shows a simple arrangement of four sockets on the front panel of a receiver which enables filament current and voltage to be measured without having access to the interior of the receiver.



Arrangement of sockets for testing filament voltage and current.

A group of four sockets is associated with each valve in the receiver and is mounted on the panel just below the filament rheostat. The system of connection is clearly shown in the diagram which also gives the equivalent theoretical circuit.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A dull emitter receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review" Dorset House, Tudor Street, London, E.C.4, and marked "Ideas."

Filament voltage can be tested at any time without interrupting reception by plugging into the appropriate sockets, but the set must be switched off momentarily when testing filament current in order that the "current" socket shorting plug may be removed and an ammeter substituted. Reception may then be continued with the ammeter in circuit.—F.B.

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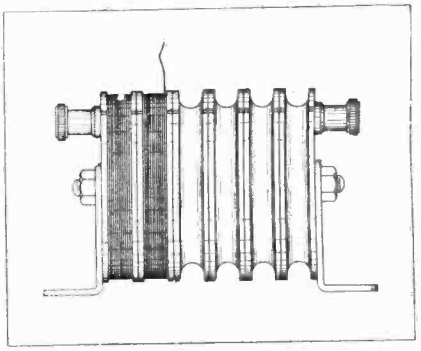
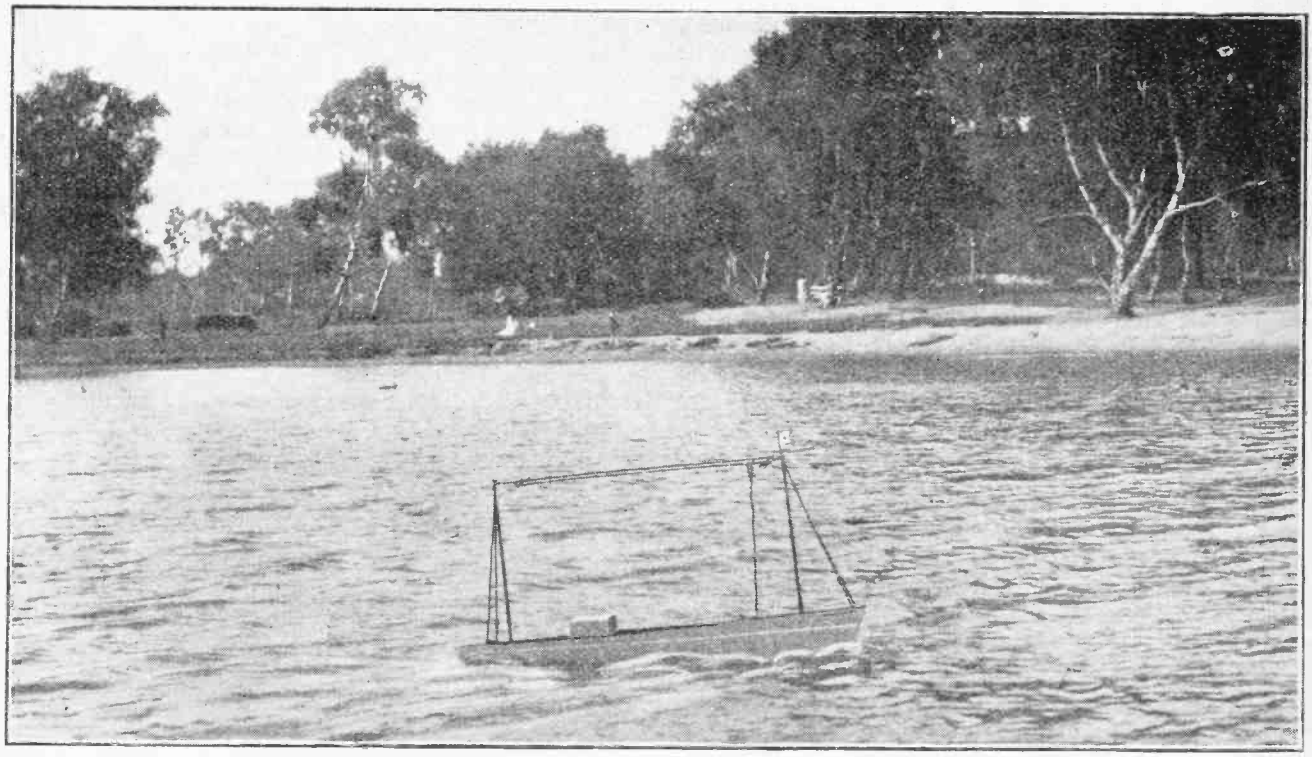
H.F. CHOKE.

A very good former for a high-frequency choke may be made by bolting together six old filament rheostat bases. These bases will at once be recognised by old experimenters, who will no doubt find many in their scrap box. They are made of moulded ebonite, and the semi-circular groove round the edge was originally intended to carry the self-supporting spiral resistance element.



Former for H.F. choke built up from filament rheostat bases.

The mounting of the former is clearly indicated in the diagram. Saw-cuts are made in the edges of the formers for the purpose of connecting the sections, each of which may consist of 150 turns of No. 36 D.S.C. copper wire.—P. H. P.



The model boat *Radio Ship Telearch I* with which the author carried out preliminary experiments.

TELEARCHICS.

Practical Experiments in Remote Wireless Control.

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

"R.S. Telearch I" is the outcome of a long series of experiments undertaken with a view to providing a practical demonstration of the science of Telearchics. The idea at the back of the writer's mind when first considering the practical side of Telearchics was to design some piece of machinery which would involve the use of several controls and yet be relatively simply operated. It was also desired to be able, if required, to change the method of control without alteration of any of the machinery itself, simply by changing that part of the mechanism which dealt with the actual form of wave control used—in short, if it was required to change over from radio to light control, for example, it should be necessary only to remove the radio receiver and insert a light receiver, the rest of the apparatus being unchanged.

Further limitations, which were thought desirable from the point of view of others constructing the practical "Telearch" sets, were that components already on the British market should be used wherever possible, with as little alteration as possible—and only those who have designed and made out-of-the-usual sets will fully realise what a limitation these particular points can be.

Another point, which is almost a necessity, is that—in the case of radio control—the power used at the transmitter end shall not exceed the usual ten watts allowed in this country and, further, that only one wavelength be used for all the controls.

In view of all these considerations, then, the writer decided that a model boat was the best subject to start with for radio control, as relatively little power is required for its propulsion, and a good "earth" connection may be made to the water both at the transmitter and at the receiver ends. The method of propulsion which immediately suggested itself was by means of an electric motor, since the steering would almost certainly have to be done electrically.

Method of Control.

The method of control used, though seemingly crude, is one which works very successfully in practice—and which may be called the impulse or step-by-step method. Before discussing the actual method, let us see what we have to control.

First, there is the steering, which involves a minimum of three positions of the rudder, namely, centre, left, and right.

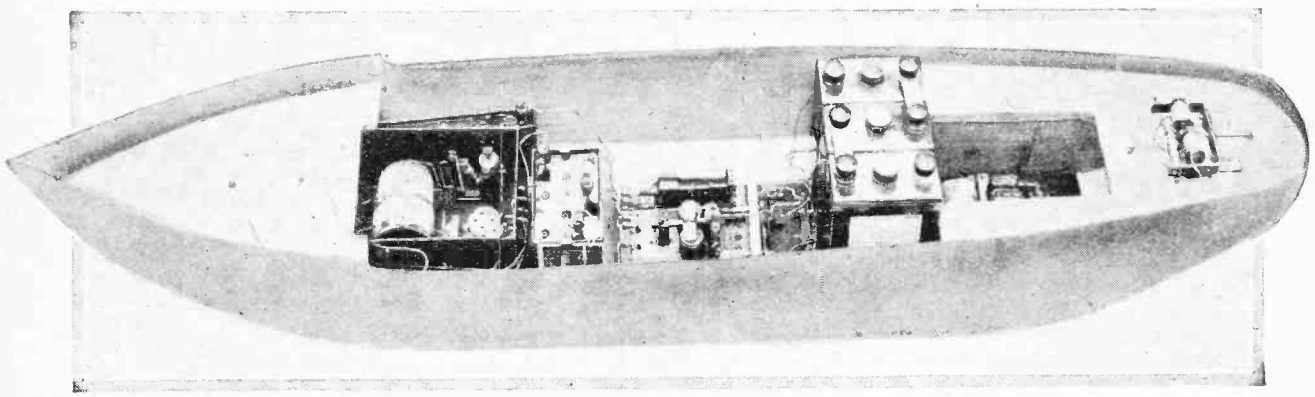
Next, there is the motor, for which it is desirable to have stop, half-speed, and full-speed positions—making in all six controls.

Telearchics.—

The step-by-step method, about to be briefly described, was the first one that occurred to the writer, as it is somewhat similar to that used in automatic telephone systems, in which he has always been interested, and although a very simple form is used it gives every satisfaction in practice.

Impulse Control.

In brief, the method consists in transmitting a definite number of impulses, one number corresponding to one control; for example, one impulse might correspond to steering left and five impulses to stopping the motor, and so on. The way in which the number of impulses received is translated into which control is required is comparatively simple, and it is a method which was not



An interior view of the working model; the deck has been removed to show the arrangement of the apparatus required to be carried aboard.

described in the writer's first article on Telearchics. Briefly, each impulse has the effect of passing a momentary current round the coils of an electro-magnet which thereupon attracts a piece of soft iron carrying a pawl. This pawl engages in a ratchet wheel when the iron is attracted and moves the wheel one tooth on. Thus, suppose there were ten teeth on the wheel, ten impulses would give a complete revolution, five impulses a half revolution of this wheel, and so on. If a drum carrying projections is mounted on the axis of the wheel, and if these projections are arranged to push contact strips together at various stationary positions of the wheel, then it will be seen that, according to the number of impulses received, *i.e.*, according to the position of the wheel, so the particular contacts closed by the drum will be altered.

The Rotary Relay.

If at the transmitter end a similar ratchet wheel is used to send the impulses, then the relative rotative positions of the two wheels will always be the same, *i.e.*, if the transmitter wheel is turned, say, $2\frac{1}{2}$ revolutions, the receiver wheel will also make $2\frac{1}{2}$ revolutions—no more and now fewer, provided that the number of the impulses per second is not too great for the operating magnet of the receiver wheel to follow.

A convenient name for the magnet-ratchet wheel arrangement is that of *Rotary Relay*.

In the boat the rotary relay has eight positions—as a Gamage relay was used, and this has an eight-toothed wheel.

The next problem is how are the six separate controls to be best fitted into an eight-position switch, but this will not be entered into here, and all that will be said is that only *four* separate contacts are used—two for the motor and two for the steering. The rotary relay may be considered as a simple electric brain, as it translates received impressions into messages to stimulate the various organs of the mechanism, namely, the motor and the rudder in the case of the boat.

Essential Parts.

The essential parts of the "works" (see photograph) of Telearch I are, therefore (*a*) the radio receiver or electric "ear"; (*b*) the rotary relay and its operating relay, or "electric brain"; and (*c*) the motor and steering gear, or "electric muscles and tail," so that it will be seen that the boat may be likened to an electric fish.

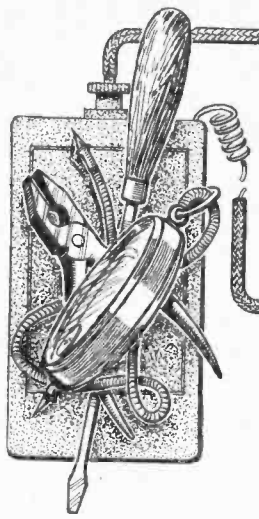
The hull of the boat, though perhaps not a thing of beauty to the critical eye, is easy to make, and is quite suitable for carrying the apparatus without fear of sinking; and, moreover, gives a fair turn of speed with the motor installed; and, although model boat designers would make a much better-looking craft (to the nautical eye), it would probably have to be much bigger to accommodate the apparatus and harder to build, and certainly not so good for the job in hand.

Dimensions of the Model.

The photograph of the boat in the water gives some idea of its general appearance when under control, and the photograph showing the deck removed will indicate the nature and quantity of the "works."

Telearch I is 4ft. long, and has a beam of nine inches, and draws about $3-3\frac{1}{2}$ inches of water, so that it is suitable for quite shallow ponds. The maximum power used so far for control is about one watt (96 volts and 11 milliamps), and control up to 100 feet (maximum distance available) was easily obtained with this power.

As this article has been written just to introduce the subject of a radio controlled boat for the reader to construct, no further details will be given here as they will be dealt with in full in separate articles.



PRACTICAL HINTS & TIPS

A Section Mainly for the New Reader.

MIXING VALVES.

Amateurs may occasionally wish to use one or more six-volt valves in combination with those having two- or four-volt filaments, for which their sets were primarily designed. The simplest way of doing so is to increase the voltage of the filament battery, at the same time making sure that the filament rheostats have a sufficient excess resistance to drop the surplus voltage. This, however, is an extremely inefficient procedure, as under certain conditions more energy may be dissipated in the form of heat than usefully employed in heating the filaments.

Generally speaking, one or other of the methods shown in Fig. 1 will meet the case fairly well; the first (*a*) is likely to be the more convenient of the two. It will be seen that two valves are fed from a single cell, while the filament of the third, which is assumed to be of the six-volt type, is supplied from an entirely separate three-cell battery, with its negative pole connected to the common lead. This arrangement generally necessitates a minimum of alteration to an existing set. It will be as well to choose a battery having as nearly as possible the same working life between charges as that supplying the two-volt valves; thus, if these latter take a total current of 0.6 amp., and are fed by a 40-ampere hour cell, the batteries for the last valve, assuming it to take 0.25 ampere, should have a capacity of 20 ampere-hours—a size obtainable commercially. If this precaution is taken, it is possible to ensure that both batteries are ready for recharging at the same time.

If the high-voltage valve takes only a small current, it may be permissible to heat its filament by means of a battery of dry cells, particularly when it is used experimentally or intermittently.

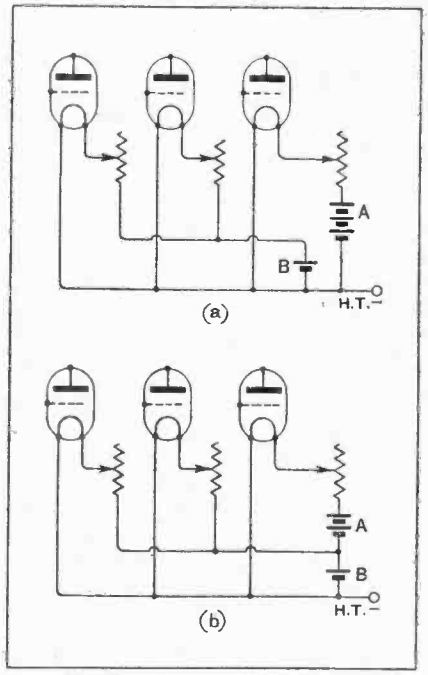


Fig. 1.—Combining 2- and 6-volt valves. (b) represents the normal battery and (a) the the extra cells.

The arrangement shown in Fig. 1 (*b*) has the advantage, from the point of view of economy in initial expenditure, that the extra battery need only have two cells, as it is connected in series with the single cell. Its capacity should, again, be chosen with a view to both batteries having an equal working life, remembering that the single cell supplies current to the six-volt valve as well as to the others. Thus, if the first two valves consume 0.3 amp. each and the third 0.25 amp., the total current taken from the two-volt cell will be 0.85 amp., and from the four-volt battery 0.25 amp.

The need for this mixing of valves is most likely to arise when the user of those of the two-volt class wishes to add a six-volt power valve capable of dealing with larger voltage swings than can any of the former rating at present on the market. It seems likely that in the near future large power valves with two-volt filaments will become available, and the need for using separate batteries will no longer exist.

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TESTS FOR OVERLOADING.

The simplest and best-known method of deciding whether observed distortion is due to overloading of the L.F. valve or valves is to watch the needle of a milliammeter connected in series with the anode. If the needle moves sharply with each deeply modulated passage, it can safely be assumed that the valve is being overloaded, or that its grid and plate voltages have been incorrectly chosen.

A word of warning may be given in connection with this test, as misleading results are likely to be obtained when "atmospherics" are bad, particularly when a sensitive set is being used at some distance from the transmitting station. The voltages set up by these discharges are often considerably in excess of those due to the signals, and when they are taking place at short intervals the needle may be in a more or less continuous state of oscillation, although the valve may actually be

working well within its capabilities as far as normal signal voltages are concerned.

Atmospherics usually give rise to sounds of a very low audible frequency, which (perhaps fortunately) are not reproduced at full strength by the majority of loud-speakers. It is only when making observations in the manner suggested that the magnitude of the voltages which they set up is fully realised by the amateur.

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REACTION CONTROL.

For use in a receiver where reaction is controlled by partial de-neutralisation, it is of advantage to choose a balancing condenser which permits of easy and quick adjustment. A component which requires several complete turns of the controlling knob for variation from minimum to maximum is hardly likely to be the most suitable, particularly if it is not provided with a dial, although it may be well adapted for its more usual purpose. If there is no external indication of the proportion of the total capacity actually in circuit, an operator is working more or less in the dark, and the risk of causing interference by allowing the set to oscillate is considerably increased.

In the conventional balanced circuit, both sides of the condenser are at high oscillating potential with respect to earth. Thus, to prevent hand-capacity effects, an extension handle may be regarded as more or less essential, when frequent adjustments are likely to be necessary.

It will be almost needless to say that when the neutralising condenser is to be used as the main reaction control, it should be mounted in an accessible position on the panel, and not on the baseboard.

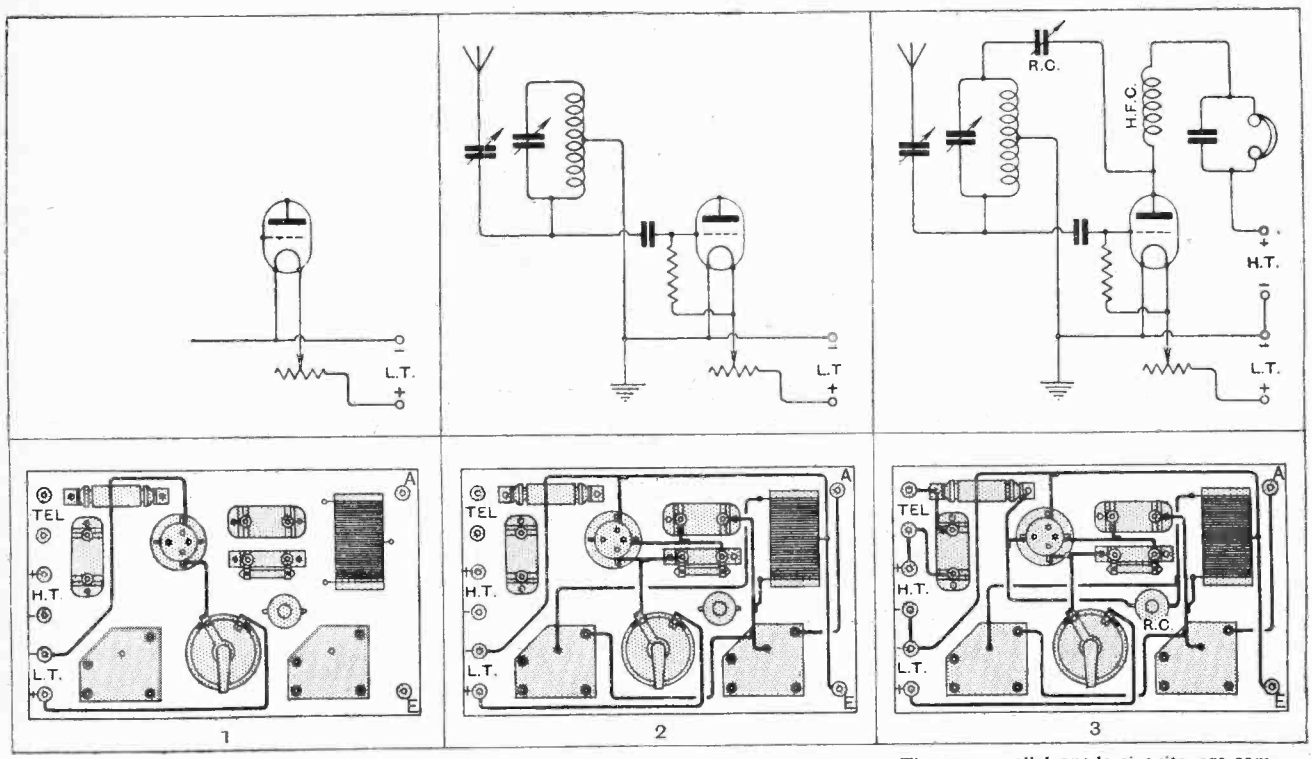
The above remarks hardly apply to certain receivers using highly efficient transformers, with lightly damped circuits. In such cases it is generally possible to set the neutralising condenser slightly "off balance," and to obtain a good measure of regeneration over the whole of the tuning range.

DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 45.—A "Hartley" Detector Circuit.

In this series of diagrams it is hoped to make clear the steps to be taken in converting theory into practice in the construction of various typical wireless receivers. Below is shown a popular modification of the well-known transmitting circuit which works well as a receiver on the broadcast and short wavelengths. The condenser in series with the aerial operates rather as a variable coupling than as a tuning device. A low-capacity "vernier" condenser gives a smooth control of reaction. Centre-tapped coils are used; they may be interchangeable.



The L.T. battery circuit is completed in the usual manner, through the valve filament and a rheostat, which is inserted in the positive lead.

Grid and aerial circuits are connected up. It will be noticed that only half of the total inductance is across the grid-filament circuit.

The two parallel anode circuits are completed; the first through choke and phones and the second through the reaction condenser and part of the coil.

CURRENT TOPICS

News of the Week — in Brief Review

NEW STATION FOR TANGANYIKA.

The Government of Tanganyika intend to erect a station at Dar-es-Salaam during the current financial year.

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SUNDAY EVENING WIRELESS.

The religious community in Wales is apparently starting a "brighter Sunday" movement. At Wrexham the local Sunday school is organising wireless "smokers" on Sunday evenings. A wireless concert and lectures will be given, smoking will be permitted, and light refreshments will be provided.

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BROADCASTING IN YUGO-SLAVIA.

The broadcasting station at Zagreb in Yugo-Slavia, to which we alluded under "Broadcast Brevities" in our issue of September 8th, has been in operation since May 15th on a wavelength of 350 metres with 0.350 kW. aerial power and transmits daily from 2030 to 2230.

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A FRENCH EXHIBITION.

The next exhibition of French wireless apparatus will be held at Paris in the Salon de l'Automobile in the Grand Palais des Champs-Elysées from October 23rd to 31st. This will be the third of these exhibitions and the development of the industry, in spite of the present uncertainty prevailing with regard to the broadcasting question in France, is shown by the increasing number of exhibitors each year. In 1924 there were 90 exhibitors, last year the number had increased to 110, and this year we understand that 196 different wireless firms have applied for space.

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THE PIRATES' EXCUSES.

Prosecutions for installing and using wireless sets without a licence are now of almost daily occurrence, and it is interesting to notice the varied excuses offered by the defendants.

The usual explanation offered is that the accused did not know that any licence was necessary until the set was working satisfactorily, but perhaps the most original is that of a native of Cricklewood whose wife had presented him with twins and who pleaded that this domestic turmoil had put the matter of the licence completely out of his head. The stony-hearted magistrate, nevertheless, fined him.

A SATISFACTORY GUARANTEE.

Confidence in the efficiency of all apparatus that has once been Government property is, perhaps, justifiable but may lead to curious errors. According to our esteemed contemporary the *Sporting Times*, the purchaser of a certain loud-speaker reassured his wife who questioned its qualities and value by stating that it must be a good one as it was largely used by the Government.

"How do you know?" asked she, and he replied, "Well! There is stamped on it '2,000 O.H.M.S.'"

ARMY WIRELESS. The reception of field messages during the recent "war" round Aldershot. It will be seen that the aerial used is of the collapsible frame type mounted on a gun limber.

DIRECTION FINDERS ON SHIPS.

According to the "Journal of Commerce" there are now over 200 ships of the British Merchant Service fitted with direction-finding apparatus of the moving-frame aerial or similar type by means of which they can pick up their own bearings to any coast stations, but, on the other hand, the secretary of the Mercantile Marine Service Association, in a letter to *The Times*, deplores the comparatively small number of regular D/F stations along the coast of Great Britain.

THE CONFLICT OF WAVELENGTHS.

The wavelength question is not confined solely to Europe and the United States. Apparently the epidemic of interference has reached the Antipodes, as we learn from Australia and New Zealand that it is already suggested that co-operation with regard to wavelengths should be secured between the Australian and New Zealand authorities, in order that a comprehensive policy may be adopted.

The listener in New Zealand often prefers to tune in to Australian stations and it is probable that this feeling may be reciprocated by listeners in Australia. Interference between the carrier waves of New Zealand and Australian stations is quite possible unless co-operation between the two countries ensures its elimination.

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WIRELESS DEBATES.

Meetings of the Institute of Wireless Technology will take place on October 6th and November 10th. The first will be held at the Engineers Club, Coventry Street, W, at 7.0 p.m. and will take the form of a debate on the subject "that it is impossible to obtain absolute purity of tone with a valve detector." Mr. Y. W. P. Evans will support the motion and Dr. F. T. Fawcett will lead the opposition. Full particulars may be obtained from the hon. assistant secretary, Mr. Harrie J. King, 71, Kingsway, W.C.2.

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BROADCASTING IN RUSSIA.

"One of the most interesting sights in Moscow," says a correspondent of the *Daily Herald*, "is the free wireless concerts which are given in various parts of the city. In some cases enormous loud-speakers are fixed to standards, as they are in front of the Moscow Soviet headquarters to the Tverskaya. In others they are attached to the walls of buildings. But however placed they invariably give an excellent transmission. The speeches are frequently discussed between apparent strangers."

From this we infer that the Russian temperament does not clamour for "fewer talks and more jazz," or, possibly, the citizen bears in mind the far-off villagers whose main source of information is by means of wireless; or, again, perhaps he is content with the fare served out by those in authority and does not consider any improvement necessary.

THE RAWSON-MacMILLAN SUB-ARCTIC EXPEDITION.

The full report of the expedition to Labrador is not yet available at the time of writing, but it is understood that much valuable information has been gained regarding the relationship between radio, the aurora borealis, the barometer and mirages. It was discovered that there was a definite relationship between the fading of wireless signals and the aurora, radio appearing to be most affected when the aurora was strongest in the opposite direction from the approaching signals.

Transmission was practically unaffected when this aurora band travelled perpendicularly to the axis. Sometimes a lagging of about a minute appeared between the shift in the aurora displays and the fading.

It will be remembered that the expedition sailed last June in two vessels, "Sachem III" and "Bowdoin" to study Norse relics in the sub-arctic region as well as scientific phenomena, and it is interesting to note that the special 20 and 40 metres transmitter installed on the "Sachem III" was able to keep in touch with many British and American stations during the whole voyage. During the previous MacMillan expeditions, above the arctic circle, the party was out of touch with the world for many considerable periods.

THE T. & R. SECTION OF THE R.S.G.B.

The first Convention of the Transmitter and Relay section was held at the Institute of Electrical Engineers on Friday and Saturday, September 17th and 18th.

On Friday evening an informal lecture was given by Mr. H. L. Kirke of the B.B.C. on "Master Oscillators," which was preceded by a tea kindly given by Mr. E. J. Simmonds (G 2OD) and followed by a general discussion.

Saturday's proceedings were opened at 11.0 a.m. by an address given by the chairman, Dr. W. H. Eccles, in which he emphasised the part played by the amateur transmitter in the advancement of wireless. The Constitution of the T. and R. Section and the General Rules were discussed and passed with certain amendments.

Among the foreign and provincial representatives were Mr. F. D. Bell (Z 4AA), Mr. W. R. Burne (GW 15B), Mr. B. Walsh (GI 2IT), Mr. J. Wyllie (G 5YG), Mr. S. R. Wright (G 2DR), and Mr. L. J. Hughes (KY 1VP).

A luncheon was given by the hon. secretary at the Hotel Cecil to 21 delegates.

Messages of encouragement were received from Holland and Australia.

In the course of the afternoon the hon. organiser, Mr. J. A. J. Cooper, reported on the progress of the "T. and R. Bulletin," and a discussion on Low Power Tests was opened by Mr. G. A. Exeter. Capt. H. J. B. Hampton made various suggestions for the better co-operation between provincial and London members. Mr. C. A. Jamblin reported on the work undertaken by the QSL and QRA section and after a discussion, "How to secure Ideal Conditions for British Experimenters" the proceedings were brought to an end by the closing remarks of the hon. secretary, Mr. Gerald Marcuse.

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THE CONTRIBUTION OF SCIENCE TO HUMAN LIFE.

A series of short lectures is to be given on Sunday afternoons, beginning on October 3rd, at the Guildhouse, Eccleston Square, S.W.1, by various well-known authorities, on different aspects of the influence of scientific discoveries on the ordinary life of the human race. Space does not permit of our giving a full list of these interesting talks, but we would specially draw attention to the lecture by Dr. W. S. Eccles on "The Influence of Wireless on Modern Life" which he will give on November 7th.

Full particulars can be obtained from the hon. secretary, Mr. L. Hammick, 2, Rosslyn Mansions, Goldhurst Terrace, N.W.6. The lectures are free to all and no tickets are required.

FIRST BRITISH RADIO CONVENTION. The amateur experimenters who gathered together under the auspices of the Radio Society of Great Britain to discuss methods of progress and co-operation.

WIRELESS CONVENTION IN AUSTRALIA.

The third annual Federal Convention of the Wireless Institute of Australia is being held in Sydney, where the delegates were expected to arrive on September 17th. The entertainments committee has made elaborate preparations for the social side of the Convention, including the annual dinner of the New South Wales Division. Visits will be made to many of the amateur stations which are now becoming so well known to British transmitters. On the technical side it is understood that a number of important tests have been organised to extend over a period of three weeks.

AN ENTHUSIASTIC LISTENER.

A few weeks ago we recorded the boast of an American transmitter that his station had not missed transmitting for a single night during the last five years. Incidentally, we have since been informed that there are several operators at that particular station, so that the achievement is not so wonderful as it at first appeared. We now hear of a listener, Mr. W. C. Bramwell, of Teddington, who has not missed listening every day for the last six months, making a total of 476 hours. Mr. Bramwell, who has passed his eighty-second birthday, should certainly be an authority on the comparative merits of broadcast programmes.

FRAME AERIAL CRYSTAL RECEPTION.

Re-radiation from Local Resonant Aerials.

By W. H. F. GRIFFITHS.

WHEN a large and efficient aerial is tuned to resonance with the local broadcasting station the oscillatory current flowing in it is sufficient to induce very considerable E.M.F.s in all near-by conductors. It is only necessary to bring into resonance, in some way, coils, frame aerials, gas-pipe systems, electric bell wiring, or any other insulated or partially insulated systems of conductors which happen to be situated in the vicinity of the resonant aerial, to obtain from them such resonant potentials as will produce quite reasonable signal strengths with crystal detectors only.

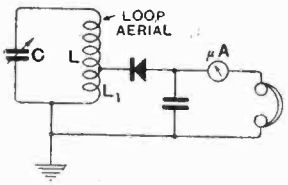


Fig. 1.—Experimental crystal receiver used in these tests.

Some time ago, in an article in this journal by the present author,[1] it was shown that the signal strength obtained from small aerials was augmented enormously by tuning a large near-by aerial to the same transmission, and it is the object of the present article to show that this method of signal strength augmentation is by no means confined to ordinary aerials.

In the experiments to be described, the re-radiated energy was obtained from a fairly large twin aerial of the "T" type, 70ft. long and 30ft. high. The first experiment was carried out with a small frame aerial of 600 μH total inductance, tuned by a very small variable air condenser of about 80 micro-microfarads maximum capacity, and having its low potential end earthed to a gas-pipe system (a water-pipe system provided the earth connection for the large aerial). The circuit of this frame aerial crystal receiver is given in Fig. 1, the tapped portion L_1 of the loop being reduced to an optimum value of about 40 μH, as the crystal employed was of low-resistance galena.

The frame aerial receiver, complete, was set up just

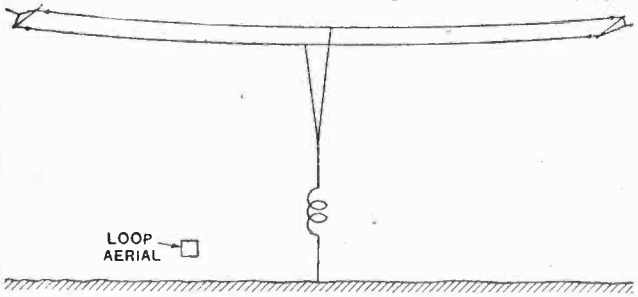


Fig. 2.—Relative positions of the tuned "T" aerial and frame aerial receiver.

off the ground (about 4ft.) near the large aerial, in the position indicated in the scale drawing of Fig. 2, and when tuned to resonance with 2LO the local broadcasting station 10 miles distant, with the large aerial open-circuited, gave a rectified telephone current of only 0.05 μA, a signal strength much too weak to produce intelligible speech in the most sensitive telephone receivers. When the large aerial was also tuned to resonance with the incoming signal wave (365 metres), however, the signal strength was greatly increased and a resonance curve of rectified telephone current plotted against variable condenser readings about resonance was obtained. This curve (B) is given in Fig. 3, and it

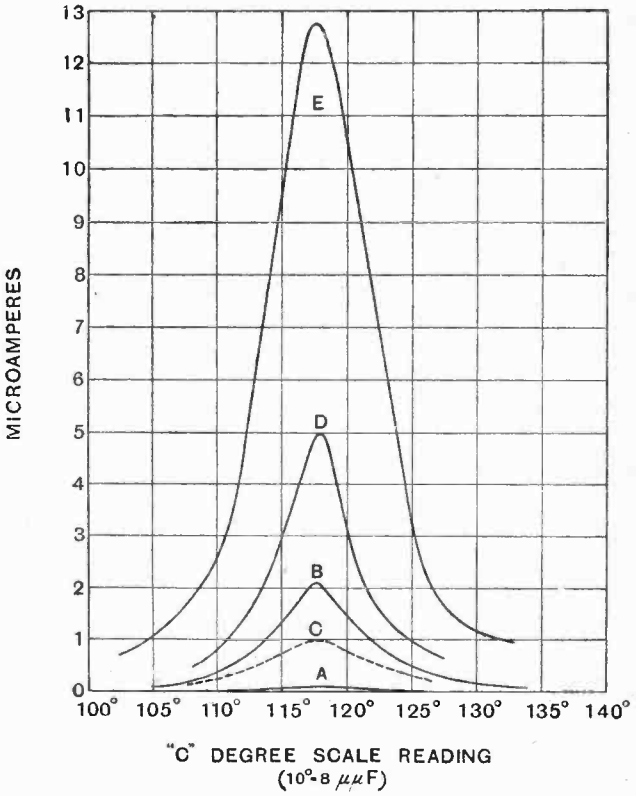


Fig 3.—Resonance curves for the frame aerial-crystal circuit of Fig. 1; A, without assistance from elevated aerial; B, elevated aerial tuned to resonance; C, elevated aerial tuned to resonance and loaded with crystal rectifier; D and E, reacting (non-oscillating) valve connected to A.T.I. of re-radiating aerial.

must be noted that the large aerial was tuned exactly to resonance with the incoming signal wave during the whole of the experiment. It should be noted, also, that no load, either crystal or valve, was taken from the re-radiating aerial, which was merely tuned by a variable inductance. The current circulating in the aerial was therefore not limited by anything except its own effective resistance as augmented by that of the variable inductance by which it was tuned. Had a crystal been tapped across the variable inductance, the consequent loading would have been such that the current flowing in

[1] "Interference from Adjacent Aerials" (*The Wireless World*, June 3rd and 10th, 1925).

Frame Aerial Crystal Reception.—

the re-radiating aerial would have been considerably reduced, resulting in a smaller degree of signal strength augmentation in the frame aerial receiver somewhat as shown by curve C (Fig. 3).

If now the oscillatory current in the re-radiating aerial could be increased by some means, one would expect to obtain a still further increase in signal strength from the frame aerial receiver. In order to obtain this result, a single thermionic valve was connected across the aerial tuning inductance and made to retroact into the aerial circuit, and so, in effect, reduce its losses to a certain extent. The increased current thus obtained in this aerial produced in the frame aerial receiver the rectified telephone current indicated by curve D of Fig. 3, a maximum value of 5 microamperes being now obtained at resonance. This curve, and all others of this article with the exception of curve C, have been carefully plotted from actual experimental results.

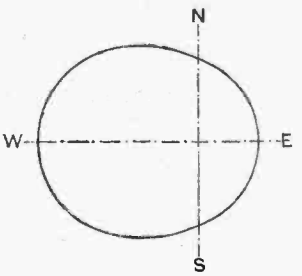


Fig. 4.—Polar diagram obtained by rotating the frame aerial through 360°. The re-radiating aerial runs east and west.

Intensifying Reaction.

As the degree of reaction on the large aerial was increased, the signal strength was correspondingly increased until, while the former was still some way from a condition of self-maintained oscillation, the rectified current was tremendously increased, as shown by curve E. These results were all obtained with the plane of the loop aerial parallel with the horizontal wires of the re-radiating aerial, and in order to ascertain to what extent the loop aerial receiver was assisted by its earth connection, the loop was oriented about its vertical axis to obtain a polar diagram of signal strength in all directions. The polar diagram obtained is given in Fig. 4, the rectified telephone current being 12.8 μA when the loop was pointing west (the direction of the large aerial), and 7.0 μA when rotated through 90° to a north-south direction. This diagram shows that the directional properties of the loop aerial had been impaired by the earth connection, and so the latter was dispensed with in order to obtain results with a pure loop aerial.

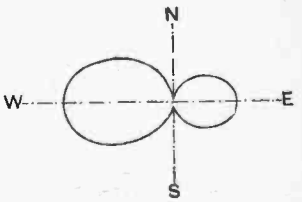


Fig. 6.—Polar curve obtained without earth connection.

Without an earth connection of any kind, and with the plane of the loop parallel with the large aerial, a very considerable signal strength was obtained (3.5 μA) and the tuning curve of rectified telephone current, F of Fig. 5, was plotted for this condition, curve E of Fig. 3 being repeated in this figure for purposes of comparison, since they both refer to the same condition of reacting aerial. The loop was again oriented and the polar diagram of rectified telephone current given in Fig. 6 obtained. From this diagram it will be seen that the unearthed loop aerial exhibited quite normal directional properties, the rectified current being reduced from 3.4 μA to 0.15 μA when it was rotated through 90 degrees from west to north-south.

The above results were all obtained with the loop aerial in the same position well away from the foot of the aerial down-lead, but when moved near to the latter the reacting valve of the aerial had to be switched off, so great was the rectified current obtained. When the frame aerial was within 3ft. or so of the down-lead, a rectified current of about 19 μA was obtained with the re-radiating aerial merely tuned (with no load or reaction). In this position the signal strength obtained was very nearly as great as that obtained from a crystal detector circuit connected to the large aerial itself, and any change in effective resistance of the latter, due to the tuning of other near-by aerials or conductors, was indicated very clearly by the value of rectified current obtained from the

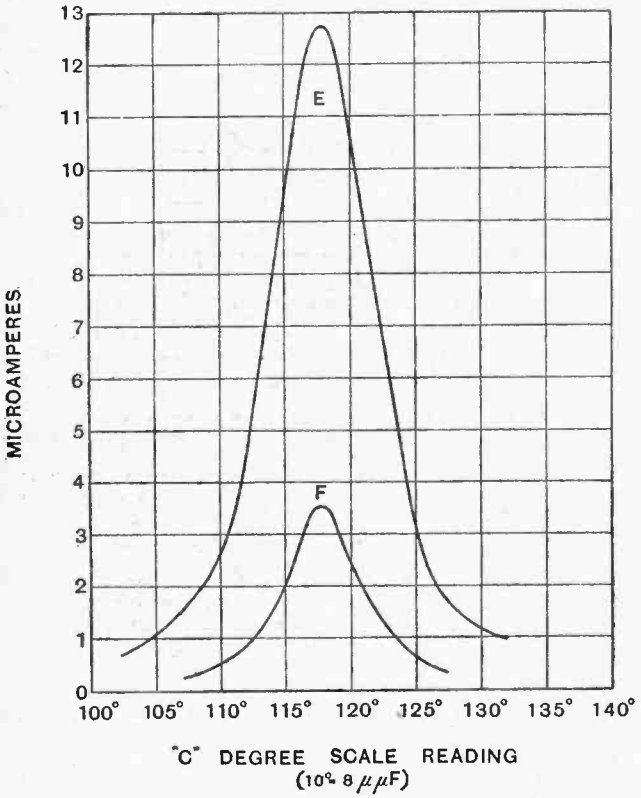


Fig. 5.—Resonance curve F without earth connection, obtained under the same conditions as curve E of Fig. 3, which is reproduced on the same scale for comparison.

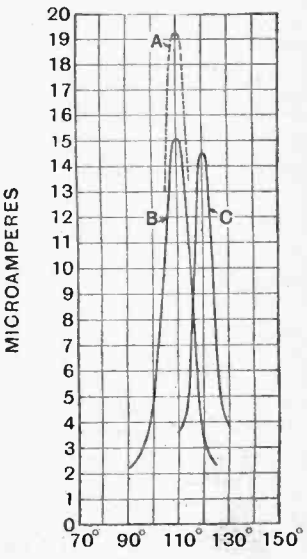


Fig. 7.

Frame Aerial Crystal Reception.—

loop circuit. As an example of this, a reduction of telephone current from 19 μA to 15 μA was the result of quite a miniature aerial about 25ft. away from the main re-radiating aerial being tuned to resonance with the incoming signal wave. Curves A and B of Fig. 7 show this effect. The frame was, in this case, merely acting as an ordinary secondary circuit very loosely coupled to the primary circuit down-lead. Both of these signal strength curves, A and B, were obtained with a wire counterpoise attached to the low potential end of the loop aerial, and when this was removed and the loop retuned to resonance, the rectified current was again reduced by about the same amount as shown by curve C of Fig. 7.

Effects with Other Conductors.

It may be of interest, perhaps, to record here a few examples of the effects of tuning various conductors in the vicinity of the re-radiating aerial whilst the latter was strongly reacted into. By clipping on to various parts of a house gas system, rectified currents of from 2 to 6 microamperes were obtained, the variations seeming to indicate that some sections of piping were less perfectly insulated from earth than others. A horizontal iron gutter, from which a vertical iron pipe led, was used as an aerial, and 5 to 6 microamperes of rectified telephone current obtained from it. In these cases the signal strength fell to zero when the large aerial was open-circuited or detuned from resonance.

Conclusion.

In conclusion it should be noted that results of far greater importance would have been obtained had the experiments been carried out at a point much nearer to the transmitting station. That is to say, that, although a reacting valve had to be employed in order to obtain an aerial current of sufficient value to make the re-radiation phenomena well marked, the same effects could have been obtained without a valve had the large aerial current been produced by the much greater radiation field strength available at positions less remote from the transmission source instead of an aerial resistance reducing device.

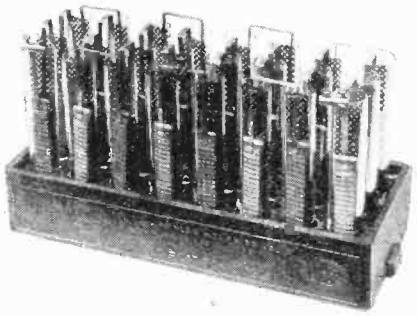
MANUFACTURERS' NEW APPARATUS.

A Review of the Latest Products on the Market.

NICKEL STEEL STORAGE BATTERY.

The introduction of a steel plate battery for H.T. supply by Batteries, Ltd., of Redditch, will undoubtedly develop. The battery is constructed on the lines of the well-known Edison nickel steel alkaline cell which has proved so successful in a number of applications where skilled and constant attention are not available.

The disadvantage of using cells of this type is that on discharge the voltage slowly falls, whereas with the lead-plate battery the voltage remains practically constant during discharge. As regards H.T. supply, this is perhaps no serious disadvantage, while the cell undoubtedly



Nickel iron alkaline H.T. Battery unit, consisting of 18 cells giving a potential of 30 volts.

possesses many points of merit. First of all the avoidance of acid electrolyte is of importance, while the cells are practically fool-proof and require no more attention than the occasional addition of distilled water. As compared with the lead battery no deterioration will occur if left unattended.

The steel plates cannot buckle, and the steel containers used for the larger cells cannot crack, while the battery can be short-circuited or even charged in the reverse direction without damage. The charging rate for a given ampere-hour capacity is higher than the lead battery, but its important property is long life in spite of indifferent treatment without an equivalent effect of the sulphating which occurs in the case of the acid battery.

Glass tubular containers are used supported in a pitch-filled, moulded tray, and the separators are of perforated ebonite. A battery of eighteen cells gives a potential of 30 volts, and each plate measures about 5in. $\times \frac{1}{2}$in., giving a total capacity of 1 ampere-hour.

o o o o

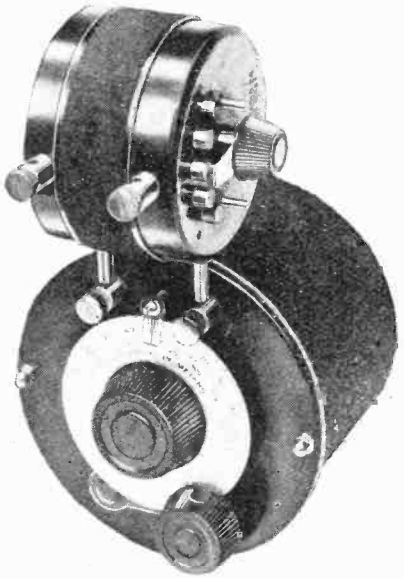
G.R.C. WAVEMETER AND FILTER.

A simple tuned closed circuit consisting of parallel inductance and variable condenser without auxiliary apparatus can be used with reasonable accuracy as an absorption wavemeter or may be connected in the aerial circuit to serve as a very effective rejector.

Such an instrument is included in the range of products of the General Radio Company, handled in this country by Claude Lyons, 76, Old Hall Street, Liverpool.

The instrument consists essentially of a well-built variable condenser fitted with slow-motion-geared dial and a silvered scale calibrated in a hundred divisions and also directly in metres over a wave-band of 200 to 600. It is interesting to observe that this wave range is covered without making use of the condenser settings at the minimum and maximum positions, undoubtedly a good feature. The condenser is enclosed in a metal screening box having an attractive japanned crystalline finish.

The inductance, which is wound on a Bakelite former, can be detached from the condenser to permit of the separate use of either component. It consists of a double winding, one of which becomes parallel connected across the condenser to serve as the wavemeter, whilst the other coil, which is tightly coupled to the wavemeter coil, is provided with four tappings



The General Radio Company's rejector circuit and wavemeter calibrated over a wave range of 200 to 600 metres on a direct reading wavelength scale.

and connected to a pair of terminals. It is intended that the tapped winding shall be connected in series between the aerial lead and aerial terminal of the receiving

set to permit of the use of the instrument as an interference eliminator when tuned approximately to the wavelength of the interfering signal. In this respect it gives a good performance, whilst to determine the wavelength of a particular station it is only necessary to adjust the condenser to the point where the signals from that station vanish and reading off the wavelength directly on the scale.

This instrument, being of robust and reliable construction and moderate in price, should prove a useful accessory to almost any broadcast receiver.

The manufacturers state that the wavemeter scales are individually calibrated to an accuracy of 1%, though, of course, it would not be possible to take readings down to such narrow limits of accuracy, though the scale can be read sufficiently closely for all practical purposes. Used as a filter, of course, the parallel capacity connected to the filter circuit winding will slightly influence the settings of the condenser to produce a given wavelength.

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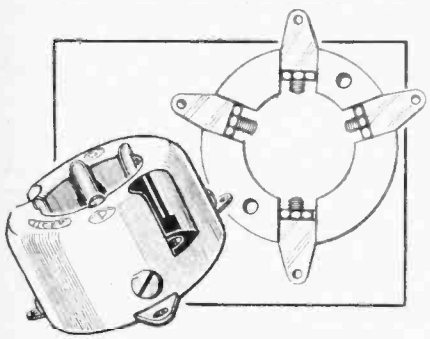
NEW ATHOL VALVE HOLDER.

The wireless products of the Athol Engineering Company, Seymour Road, Crumpsall, Manchester, are invariably unique in that porcelain is used as the insulating material. Porcelain is undoubtedly good as an insulator, and its dielectric properties render it particularly suitable for giving separation to conductors carrying



The contacts of the "Tiger" valve holder are supported around a porcelain ring so as to give a long leakage path and limit the stray capacities to a minimum.

radio-frequency currents. The principal drawback is the difficulty of producing clean mouldings accurate to dimensions, and it is in this direction that Athol porcelain products excel.

The contacts on the new "Tiger" valve holder are built up round a porcelain ring so that a mimimum of capacity with long leakage path is obtained. The connecting tags are tinned, which is preferable to the nickel-plated tags so often found on valve holders, and as they project from the lower rim of the valve holder the connecting leads will lie in contact with the face of the baseboard, which should be the aim as far as possible in baseboard wiring.

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SIEMENS SUPER-RADIO BATTERY.

A high-tension dry cell battery capable of a maximum economic discharge rate of 20 milliamperes has recently been produced by Siemens Bros., and is suitable for use with multi-valve sets.

It consists of 36 cells of extra large size giving a nominal E.M.F. of 50 volts.

The new 50-volt Siemens battery is made up with large type cells to withstand a heavy discharge rate and the cells are assembled so that the battery occupies very little table space.

Although somewhat bulky, it is designed to occupy minimum table space, as the cells are assembled to give the overall dimensions of $8\frac{3}{4} \times 5\frac{3}{8} \times 9\frac{1}{2}$in. high. An important feature is that the individual cells are exceptionally well insulated one from another and are solidly embedded in paraffin wax, which is probably the only satisfactory method of completely insulating the cells of a H.T. dry battery.

The battery is fitted with nickelled spring clip terminals and intermediate tappings are provided at 25 and 36 volts, together with two connecting tags for attaching to the flexible leads. It is offered at a low price so that the cost of upkeep compares favourably with other forms of H.T. current supply on the market.

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BRITKAM EBONITE.

The Britannia Rubber and Kamptulicon Co., Ltd., 7, Newgate Street, London, E.C.1, are now manufacturing a range of ebonite panels $\frac{1}{4}$in. in thickness and of the following standard sizes :—6×8in., 8×10in., 8×12in., 10×12in., 10×14in., 10×18in., 7×30in., 9×30in., and 9×36in.

Apart from securing panels with clean finished edges, one has the advantage of knowing that the ebonite is undoubtedly reliable as compared with obtaining a rough cut panel without knowledge of its manufacture. This is a very important point in view of the considerable latitude which exists in the making up of ebonite and the inability of the purchaser to form any idea of its electrical properties. The range of sizes is perhaps not the most convenient. The smaller panels seem to be too square and the narrow ones are for the majority of sets a little too long, though Britkam ebonite panels can be supplied cut to any size and thickness to suit the user's requirements.

Book Review.

"Accumulator Charging, Maintenance and Repair," by W. S. Ibbetson, B.Sc., A.M.I.E.E., M.I. Mar.E., pp. 115, with 33 illustrations and diagrams. Published by Sir Isaac Pitman and Sons, Ltd., price 3s. 6d. nett.

A concise and comprehensive handbook dealing primarily with the practical side of accumulator charging and maintenance.

The opening chapters deal with the electrical calculations necessary in working out rheostat and lamp resistances, cost of charging, etc. The theory of the accumulator is confined to a brief chapter, which is followed by three chapters on the charging of batteries from D.C. mains. All the essential points to be watched during the charging and discharging of the cells are given proper emphasis, and many useful hints of a minor character, such as the best method of emptying acid carboys, first aid in the case of acid burns, etc., are given.

A brief chapter deals with the methods of charging from A.C. mains, but does not give any indication of the relative merits of the various methods.

Then follows a most useful chapter on the diseases to which the accumulator cell is heir, each ailment being systematically treated under the three headings : Indication, Cause and Treatment.

For the benefit of service station attendants a chapter is devoted to accumulator repairs, and the book concludes with some brief notes on the nickel-iron cell.

A thoroughly sound and practical handbook which we have no hesitation in recommending.

Catalogues Received.

[*In most cases the publications referred to in this list can be obtained on application to the firms concerned.*]

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Metrovick Supplies Limited, (Trafford Park, Manchester.). Envelope Folder No. 4117/3, giving prices and particulars of Cosmos Radio Valves.

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B. Phillipson, (124, City Road, London, E.C.). Wholesale and export price list of wireless supplies, components and ebonite parts.

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A. H. Clarkson, Ltd., (119, Fleet St., E.C.4.). List No. 9, dealing with Triumph Receivers and Components.

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Rothermel Radio Corporation of Gt. Britain Ltd., (24-26, Maddox Street, Regent Street, London, W.1.). 1926-7 supplement to general radio catalogue, giving prices and particulars of American accessories and components.

WIRELESS CIRCUITS in Theory and Practice.

22.—Magnetic Circuits of Choke Coils and Transformers.

By S. O. PEARSON, B.Sc., A.M.I.E.E.

WHEN designing a choking coil or transformer for operation in the plate circuit of a three-electrode valve, the problem is not so simple as in the case where the coil or transformer is to be run in an ordinary plain alternating current circuit. The first difficulty arises out of the fact that when a choke or transformer primary winding is connected in the plate circuit of the valve, that winding carries not only the alternating component of the plate current but the steady D.C. component as well. The result is that the magnetic flux produced through the core never reverses in direction under actual conditions of operation, but merely varies between two limits in the same direction. Theoretically, as far as the choke or transformer is concerned, the D.C. component has no effect whatever, but where an iron magnetic circuit is employed the D.C. component may have very serious effects indeed, owing to the permeability, or "magnetic conductivity," of the iron falling off as the magnetic flux density is increased above a certain value.

The inductance of a choking coil or primary winding of an intervalve transformer depends upon the number of turns in the coil, the dimensions of the iron magnetic circuit, the length of the air gap in the magnetic circuit (if any), and the magnetic permeability of the iron. It is this last item which presents the most difficulty, because it is a variable quantity, depending upon the number of lines per square centimetre or flux density through the iron.

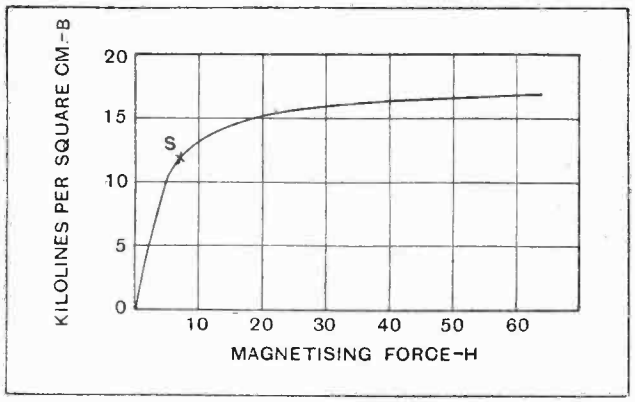

Fig. 1.—Magnetisation curve for steel alloy stampings

Expressed simply, the permeability of a specimen of iron is the number of times that the iron is more conductive to magnetic lines of force than air. For instance, if a long coil carrying a certain current produces a magnetic field strength of, say, 5 lines per square centimetre in air at the centre, it will be found that on passing an iron rod into the coil or solenoid the magnetic flux density would be many times greater than the original field strength in the air. Suppose that on measurement (quite easily effected in the laboratory) the flux density in the iron is found to be 4,500 lines per square inch. Then the permeability of this specimen is $\frac{4,500}{5} = 900$ *when the density is* 4,500 *lines per square inch.* The field strength produced by the coil in the air is called the *magnetising force* of the coil, and is usually denoted by H. The magnetising force is proportional to the number of ampere turns on the coil, and inversely proportional to the mean length of the magnetic circuit. The resulting magnetic density produced in the iron when brought under the influence of the coil is usually denoted by B. Denoting the permeability of the iron by μ we have:—

$$\text{Permeability, } \mu = \frac{B}{H}.$$

It is due to the fact that this ratio is not a constant that special precautions have to be taken when designing a choking coil or transformer for operation in low-frequency amplifying circuits.

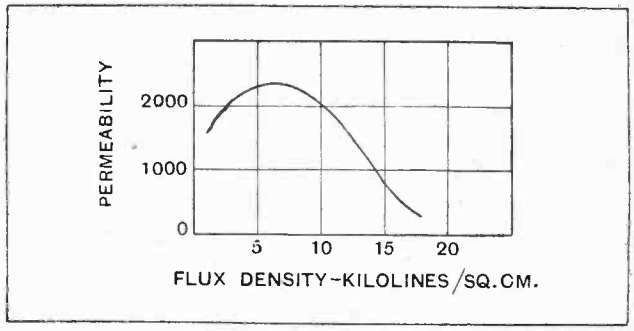

Fig. 2.—Permeability curve for steel alloy stampings.

There are on the market various alloys of silicon steel, such as "Stalloy," which have high permeability and low eddy current and hysteresis losses. In Fig. 1 is given the magnetic curve or B/H curve for steel alloy stampings. It will be noticed that as the magnetising force H is increased from zero up to about 8, the resulting flux density in the iron increases very rapidly, but that as H is increased above this value the flux density B does not increase to any appreciable extent. The point marked S, where the knee occurs in the curve, is called the saturation point of the iron, and the iron is said to be saturated when magnetised beyond the density represented by the saturation point. It is extremely important, when designing choking coils and transformers, to make quite sure that the iron will not become saturated. From the curve of Fig. 1 we can derive another curve showing the relation between the flux density of the iron and the permeability $\frac{B}{H}$. This has been done, and is shown in

Fig. 2. It shows that the permeability is greatest for densities between 2,500 and 10,000 lines per square centimetre, and is fairly constant over this range, having a value of over 2,000. If we were designing a choking coil the core of which was to be made of this particular iron we should try to arrange it so that the mean working density is about 6,000 lines per square centimetre.

Simple Law of Magnetic Circuit.

Before we can design a choking coil to have a given effective inductance when operated in conjunction with a particular valve, we must know the relationship between the inductance and the dimensions of the coil, and the properties of the iron. In addition, we must know the normal plate current which will flow through the choking coil continuously. Fortunately there is a very simple law of the magnetic circuit which can be applied in exactly the same way as we apply Ohm's law to the electric circuit. Ohm's law of the electric circuit states that :—

$$\text{Current} = \frac{\text{Electromotive force}}{\text{Resistance}}$$

$$\text{or } I = \frac{\text{E.M.F.}}{R} \text{ amperes.}$$

The equivalent law for the magnetic circuit states that

$$\text{Magnetic flux} = \frac{\text{Magnemotive force}}{\text{Reluctance}}.$$

Denoting the magnetic flux by ϕ, the magnemotive force by M.M.F., and the reluctance by R, we have

$$\phi = \frac{\text{M.M.F.}}{R} \text{ lines} \quad \ldots\ldots\ldots\ldots \quad (1)$$

Now the magnemotive force (M.M.F.) is the driving force which the coil exerts on the magnetic circuit, and is equal to $0.4\pi \times$ (No. of ampere-turns) $= 0.4\pi NI$, where N = number of turns and I = current in amperes. The reluctance R is the opposition which the magnetic circuit offers to the passage of the lines of force and will obviously be directly proportional to the length of the magnetic path, and inversely proportional to both the permeability and the area of cross-section of the magnetic path. For the present we shall assume that the whole magnetic circuit is composed of iron laminations, no airgap being included. Such an arrangement is shown in Fig. 3. Let the mean length of the magnetic path, as indicated by the dotted line, be l cms. and let the effective cross-sectional area of the iron core be A sq. cms. Then if μ is the permeability of the iron at the mean flux density B which has been previously decided upon (6,000 lines per sq. cm. in the above example) the reluctance is given by

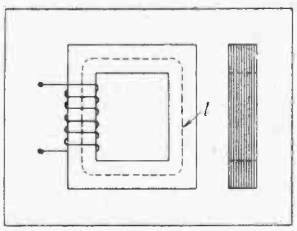

Fig. 3. — Simple magnetic circuit without airgaps.

$$R = \frac{1}{\mu} \cdot \frac{l}{A}$$

[compare this with $R = \rho \frac{l}{a}$ given for the electric circuit in Part 1, page 82, January 20th, 1926].

Substituting for M.M.F. and R in equation (1) above we get

$$\phi = \frac{0.4\pi NI}{l/\mu A} = \frac{0.4\pi NI\mu A}{l} \text{ lines.}$$

In Part 2 it was shown that the inductance was equal to the number of line linkages or flux turns per ampere divided by 10^8, *i.e.*, $L = \frac{\phi N}{I} \times 10^{-8}$ henries. Thus from our last equation we get

$$L = \frac{0.4\pi N^2 \mu A}{l \times 10^8} \text{ henries} \quad \ldots\ldots\ldots\ldots \quad (2)$$

When an alternating current is passed through an iron-cored choking coil is proportional to the permeability of the iron, and this, in turn, depends on the current through the coil. Thus the inductance is not a constant quantity where iron is employed in the core, but depends upon the current through the coil. This fact does not seem to be sufficiently well recognised, and many a purchaser buys a choking coil marked, say, 30 henries, and he therefore thinks that this is the effective inductance under all conditions.

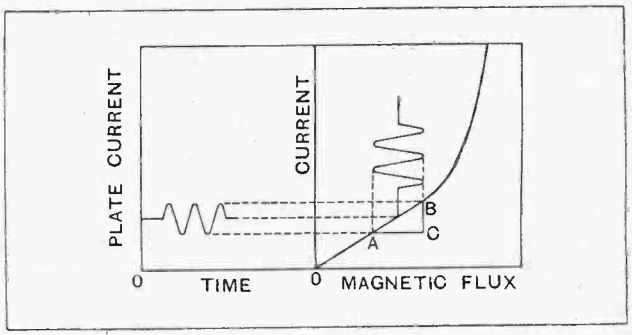

Fig. 4.—Variation of magnetic flux under normal conditions due to alternating component of anode current.

When an alternating current is passed through an iron-cored choking coil the effective inductance depends upon the maximum value or amplitude of the current in either direction. The effective inductance begins to fall off rapidly when the current is increased beyond the value required to magnetise the iron beyond the saturation point. When the choking coil is connected in the plate circuit of a valve the conditions are changed altogether, because we have both an alternating and a direct current flowing through the coil simultaneously, in other words a unidirectional current with a periodic variation. What we require is to know the effective inductance of the choke as it affects the alternating component of the plate current, and this is best shown by means of the diagram shown in Fig. 4. Suppose that the plate current contains a pure alternating component the amplitude of which is moderately small compared with the mean value of the plate current. The left-hand side of the diagram shows how the plate current varies with time. The curve on the right-hand side shows how the magnetic flux in the core varies with the current in the coil. The shape of the curve is exactly the same as that of the magnetisation curve given in Fig. 1, but here the current is plotted vertically and the magnetic flux horizontally.

By projection across from one diagram to the other we can see exactly how the alternating component of the

plate current will vary the magnetic flux in the core. It varies backwards and forwards between the points A and B on the magnetisation curve. On drawing the right-angled triangle ABC we see at once that the magnetic flux variation is equal to AC when the plate current variation is equal to BC. Now the effective inductance of the coil as regards the alternating component of the current is equal to :—

$$\frac{\text{Change of flux-turns}}{\text{Change of current}} \times 10^{-8} \text{ henries.}$$

But AC is proportional to change of flux turns and BC = change of current. Thus the effective inductance is proportional to the ratio $\frac{AC}{BC}$ and therefore the steeper the flux-current curve the lower will be the effective inductance and *vice versa*.

The conditions shown by the curves of Fig. 4 are the correct ones, the iron being worked below the saturation point and on the straight portion of the magnetisation curve. Note that the flux variation occurs over a part of the curve which is practically straight and therefore the effective inductance will be constant for all amplitudes of current variation within reasonable limits.

Ill Effects of Magnetic Saturation.

Suppose now that we take the same choking coil and connect it in the plate circuit of a valve which takes a much higher plate current, assuming that the amplitude of the alternating component is the same as before. These conditions are indicated in Fig. 5. It will be seen that the iron is now magnetically saturated by the D.C. component of the plate current and that the alternating

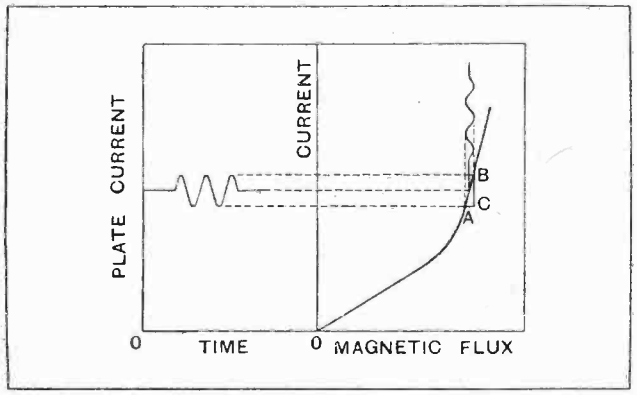

Fig. 5.—Diagram showing diminution of flux variations due to saturation of iron core

component of the plate current causes only a very small variation in the magnetic flux. The result is that the effective inductance has been reduced many times and the amplification, especially of the lower notes, would be very much reduced. If under the normal conditions of Fig. 4 the effective inductance is 30 henries, then under the bad conditions of Fig. 5 the effective inductance would be only 5.4 henries.

The reader will realise that it is very easy to make a mistake of this sort and introduce conditions leading to inefficiency without knowing it. One is quite likely to replace an existing valve for one of higher power and which naturally takes a higher plate current. It may be that the choke has been designed to stand a moderately large steady current without saturation setting in, in which case no ill effects would be introduced by the interchange of valves. Saturation may also be caused by using an excessively high anode voltage and increasing the current in this way. It does not matter how far below the saturation point in the magnetisation curve the iron is operated, and therefore when acquiring a choking coil or transformer the purchaser should endeavour to find out at what current magnetic saturation occurs and to choose coils or transformers capable of carrying the plate current of the highest-powered valve likely to be used.

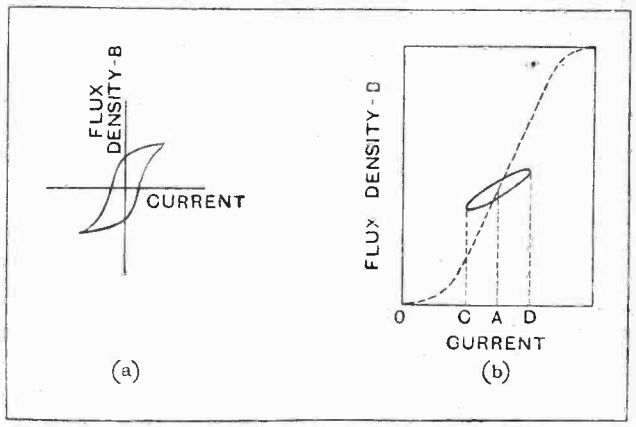

Fig. 6.—Complete hysteresis loop (a) and subsidiary loop (b) obtained under conditions of operating in a choke coil or transformer.

It was pointed out in a previous instalment that the inductance of a choking coil or transformer in the plate circuit of a valve had the effect of almost completely suppressing the alternating component of the plate current and setting up an alternating potential difference across the ends of the winding. Since this is the case we see that the amplitude of the alternating component is quite small compared with the steady D.C. component and thus choking coils and transformers may be operated with mean plate currents almost up to that at which saturation occurs without any appreciable loss of efficiency.

The Use of an Airgap.

By introducing a small airgap into the magnetic circuit the reluctance is greatly increased, with the result that it requires a very much greater magnetising current to saturate the iron. This advantage is offset however by the great reduction which takes place in the inductance. For instance, in a choking coil of which the iron magnetic circuit has a length of 40 cms. an airgap of 0.04 cm. would reduce the inductance by half, assuming the permeability of the iron at the working density to be 1,000. The reluctance of an airgap is μ times that of the same length of iron path, where μ is the permeability of the iron, and is sometimes as high as 2,000. Thus for transformer cores and choking coil cores with butt joints it is necessary to see that the latter are clamped tightly together.

Losses in Iron Cores.

There are two sources of energy loss in an iron core carrying an alternating flux, or a magnetic flux with an

Wireless Circuits in Theory and Practice.—

alternating component. The first of these is known as the eddy current loss and is due to the fact that the alternating magnetic flux induces electromotive forces in the iron itself and these E.M.F.s drive circulating or eddying currents through the iron and produce heat. As explained in the last section, the iron is laminated in layers parallel to the lines of force in order to break up the continuity of the paths taken by these eddy currents. The other source of loss is that known as hysteresis loss, and is due to a peculiarity of the iron itself. When the flux in an iron magnetic circuit is produced by an alternating current the curve obtained by plotting the values of the flux density B against all the successive values of the current throughout one complete cycle, is a closed loop somewhat like that shown in Fig. 6 (a). This is known as the "hysteresis loop" and the area enclosed by the loop is proportional to the energy lost per cycle. In the case we have under consideration, however, the magnetic flux is not a purely alternating one but merely a pulsating one, and the loop obtained will be more like that shown at Fig. 6 (b). Since the alternating component of the plate is very small under normal operating conditions the loop will be very small and the energy loss due to hysteresis is generally small compared with with other losses. In the diagram, OA = mean plate current, and AC or AD = amplitude of alternating component.

TRANSMITTERS' NOTES AND QUERIES

General Notes.

In our issue of August 11th we made a brief mention of the part played by the New Zealand Station Z 4AA in helping to render assistance to the schooner "Morrissey" (VOQ) when that vessel was in difficulties on the rocks off the coast of Newfoundland, and we stated that the New Zealand station was at that time being operated by the owner's sister. We understand that Mr. F. D. Bell (Z 4AA) is on a visit to England and that during his absence Miss Bell operates his station, and is in regular communication with her brother on Sundays *via* G 2SZ or G 2NM.

Mr. J. C. Harrison (G 5XY), Ightenhill, near Burnley, asks us to state that TJ CRJ wishes it to be known that he will reply to all communications as soon as he gets his cards forwarded. G 5XY also records a somewhat interesting "four-cornered talk" with G 5NJ, 5TD, and 5XY, on about 45 metres.

Mr. Gian Piero Ilardi (I 1DO), the Radio manager of "Corriere Latino," Via Savoia 84, Rome, is conducting low-power tests on a wavelength of about 33 metres. He is transmitting every night from 2100 to 2145 G.M.T., and will welcome QSL cards giving detailed reports of reception of his signals.

Mr. G. L. Brownson (G 2BOW), tells us that on June 13th he received A 7LA, Mr. L. A. Hope, 210, George Street, Launceston, Tasmania, at his station in Hale, Cheshire. Mr. Hope was using only 12 watts in conjunction with a UV 201A valve, transmitting on a wavelength of 34 metres; his aerial was only 10ft. high. G 2BOW states that the signal strength was about R4.

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International Amateur Radio Union.

We have received from Mr. F. A. Mayer (G 2LZ), the British secretary of the I.A.R.U., the following communication :—

"Another expedition using 40 and 80 metres is depending on amateurs for handling contact messages and news despatches to outside world. The Field Museum Chicago Daily News Expedition to Abyssinia will be on the air early in October, probably signing WCDN. Co-operation of I.A.R.U. members in African, European and Mediterranean countries is requested in handling traffic for Chicago Daily News Offices, 25, Piazza Mignanelli, Rome, Italy, or 10, Boulevard des Capucines, Place de Opera, Paris, France, or direct to Chicago, Ill., U.S.A. Most traffic will be sent in early evening hours. Further details will follow in I.A.R.U. broadcasts and bulletins. Please tell every foreign amateur you work about WCDN requesting co-operation."

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QRA'S Wanted.

BN SK2, G 1F, A 4BD, A 7RS, Z 2DY, BZ SQ1X, BZ 9QA, G 6YA.

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New Call-signs Allotted and Stations Identified.

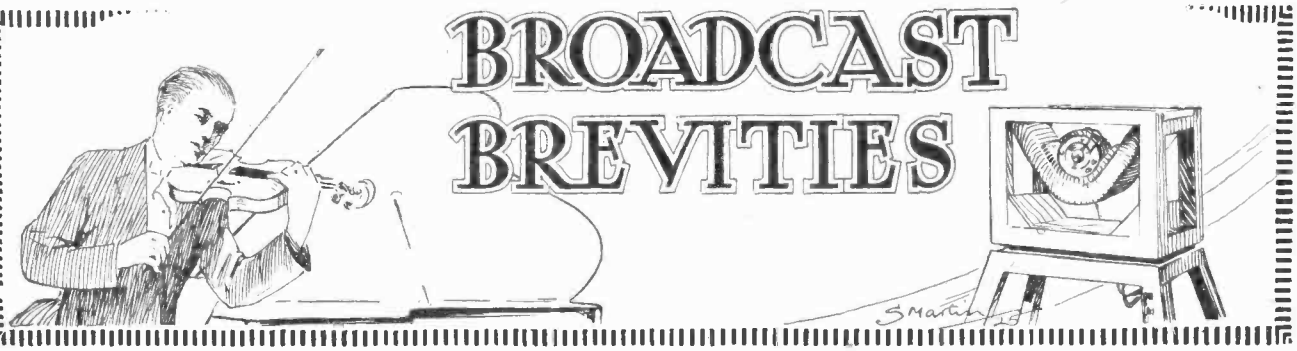
G 2BWO	(Art. A.) J. H. Blakeley, 5, Hazel Grove, Forest Gate, Blackpool.
G 6QC	E. T. Pethers, 3, Couley Street, East Greenwich, S.E.10, transmits on 150–200 metres.
G 6TP	Lord Egerton of Tatton, Tatton Park, Knutsford.
JM 3AB	C. W. Randall, Amber Rubber Estate, Johore, Malaya, transmits on 20 metres. (The prefix JM indicates Johore Malaya.)
Z 4AA	F. D. Bell, Palmerston South, Otago, New Zealand. (Correcting error in our issue of March 31, when this station was inadvertently printed as Z 1AA.)
FC 8EM	E. Fourevet, 514, Sicawei Road, Shanghai.
FC 8FLO	J. Michelet, o/c Radio Croiseur Francais, Shanghai.
FC 8GG	G. Galletti, 618, Avenue Joffre, Shanghai.

International Prefixes and Intermediates.

Fresh intermediate prefixes appear to be coming into use almost daily, and as many are of a temporary nature and not yet officially or semi-officially recognised, it is often a difficult matter to determine the locality of some stations from their prefixes.

We give below a list compiled from information received from various sources which we believe comprises all those now in use :—

A	Australia.
AI	Tripoli.
AU	Alaska.
B	Belgium.
BA	Albania.
BE, BER	Bermuda.
BO	Bolivia.
BR	Roumania.
BZ	Brazil.
C	Canada.
CB	Belgian Congo.
CH	Chile.
CHN	China.
CO	Colombia.
CR	Costa Rica.
CS	Czecho-Slovakia.
CZ	Canal Zone, Panama.
D	Denmark.
DA	Dutch Africa.
DY	Uruguay.
E	Spain.
EG	Egypt.
EI	East Indies.
F	France.
FA	Algeria.
FC	French China.
FI	French Indo-China.
FM	French Morocco.
G	Great Britain.
GI	Northern Ireland.
GW	Irish Free State.
H	Switzerland.
HU	Hawaiian Islands.
I	Italy.
IC	Iceland.
IC	Indo-China.
J	Japan.
JM	Johore Malaya
K	Germany.
KCZ	Latvia.
KY	Kenya Colony.
L	Luxembourg.
LA	Norway.
M	Mexico.
M	Mosul.
MF	Morocco (see FM).
N	Holland.
NP	Samoa.
O	South Africa.
Ö	Austria.
P	Portugal and Madeira (Stations in Madeira have Fig. 3 as distinguishing number).
PE	Palestine.
PI	Philippine Islands.
PR	Porto Rico.
PT	Panama.
Q	Cuba.
R	Argentina.
R	Russia.
S	Finland.
SM	Sweden (incorporated in call-sign e.g., SMUK).
SR	Salvador.
SS	Straits Settlements.
T	Poland.
T	Turkey.
TE	Esthonia.
TJ	Trans-Jordania.
TL	Lithuania.
TUN	Tunis.
U	United States.
W	Hungary.
Y	Uruguay.
Y	India.
YS	Yugo-Slavia.
Z	New Zealand.



News from All Quarters: By Our Special Correspondent.

Military Tattoo Again.

The immense popularity of the Military Tattoo which was broadcast from Wembley and the ingenious replica given later from the Studio has encouraged the B.B.C. to broadcast another Studio representation of this thrilling pageant on October 9th.

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Albert Hall Concerts.

The series of twelve national concerts to be given in the Albert Hall by an orchestra of 150 performers and a chorus of 250 voices, which is being organised by the B.B.C., is being anxiously awaited by all musical listeners.

The particulars of the first five concerts (all on Thursdays, except that on November 9th) are given below :—

	Conductor.	Artist.
Sept. 30.—	Sir Hamilton Harty.	Maria Olczewska.
Oct. 21.—	Albert Coates.	Frederic Lamond.
Nov. 9.—	Richard Strauss.	
Nov. 25.—	Sir Edward Elgar, O.M.	Albert Sammons.
Dec. 16.—	Otto Klemperer.	Frida Leider.

All the concerts will commence at 8 p.m. For the remaining seven concerts, of which particulars will be duly announced, the following eminent conductors have been engaged :—Percy Pitt, Sir Landon Ronald, Bernardino Molinari, Erich Kleiber, Arthur Honegger, Hermann Scherchen.

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A Brighton Night.

A programme on similar lines to that given from Brighton recently will be broadcast from Eastbourne on Friday, September 24th. It will commence at 8 p.m. with a brief history of Eastbourne by the Mayor, Councillor Charles J. Knight. This will be followed by a musical programme from the Floral Hall, Devonshire Park; the "Pier Revels of 1926" from the Pier; the Grand Hotel Orchestra from the Grand Hotel; and dance music from Devonshire Park Pavilion.

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Civic Celebrations at Manchester.

Civic Week at Manchester is to be held between October 3rd and 9th, during which period Manchester station will co-operate with the Manchester city authorities in the productions to be staged. On Sunday, October 3rd, an all-star symphony concert will be given in the Hippodrome by the Augmented Station Orchestra, conducted by Mr. T. H. Morrison, with solos by Mr. Norman Allin and Mr. Arthur Catterall.

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Milton Hall Concert.

On Monday, October 4th, a concert by past and present students of the Royal Manchester College of Music will be relayed from Milton Hall at 7.30 p.m.

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Operatic Gems.

Gems from the operas will be broadcast by the Manchester Beecham Operatic Chorus, relayed from the Milton Hall, Manchester, on Saturday, October 9th. Massed bands and civic celebrations will also be transmitted during the week.

NIGHT LIGHTS. An unusual picture of the new "Radio Tower" of the Berlin Broadcasting Station. A restaurant has been built 200 feet up the 430 feet mast, which is served by a lift that travels up to an observation gallery at the top.

Centenary Commemoration.

The seventh centenary of St. Francis of Assisi will be commemorated on Sunday afternoon, October 3rd, when a play entitled "St. Francis d'Assisi," by Mr. G. J. Vaughan Emmett, will be broadcast from 2LO and other stations.

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One Act Play.

"Augustus in Search of a Father" is the title of a play in one act which is to be broadcast from 2LO on October 6th. The author, Mr. Harold Chapin, was killed during the war. This play made its first appearance in 1910 in a triple bill with two G.B.S. plays, "The Man of Destiny" and "How He Lied to Her Husband." The cast will include Ashton Pearse, Fred Grove and Alan Howland.

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The Guards Band.

A concert by the band of H.M. Grenadier Guards will be relayed from Battersea Town Hall on Tuesday afternoon, September 28th. The programme will consist of Roger Quilter's "Children's Overture," "Land of Hope and Glory" (Elgar), "Storm at Sea" and "Solvieg's Song" by Grieg, and Holst's "Suite in E Flat for Military Band."

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Festival Service.

A hymn festival service will be broadcast on Sunday, October 3rd. This will be relayed from Chester Cathedral to 2LO and 5XX from 8 to 8.55 p.m. The service will be conducted by Sir H. Walford Davies, and the address will be given by the Rt. Rev. Dr. Henry Luke Paget, Bishop of Chester.

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"If I Were King."

Probably the most envied individuals at the present time are those to whom the B.B.C. is giving a free hand (within limitations) in compiling the ideal programme. Every listener is secretly convinced that if he were given the same opportunity he could arrange the perfect programme that would give complete satisfaction to everyone. It seems such a simple matter, but no one except those who have attempted the task can appreciate the many difficulties that have to be surmounted.

"The listener is an intractable being," says a writer in *La Radiophonie pour tous*. "He wants only what he likes; for the tastes of his neighbours he cares nothing. Programmes should be arranged for him alone, for his taste, for his exclusive pleasure. This is but human nature. If he were a station director he would do exactly the same as all other station directors in the world and would receive three thousand six hundred letters every week—or even more! But don't tell him so, old chap, he wouldn't believe you!"

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No B.B.C. Ban Against Women.

The B.B.C. denies the existence of a ban against women announcers. Statements that women are constitutionally unfitted for announcing are not in accord with either the policy or the experience of the company. Women take an active part in microphone work, and it is likely that they will do more and more in the future. There is no question of any discrimination against women even although in the present stage of technical development it is recognised that a man's voice is appreciably more suited to the microphone than that of a woman.

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A "Revival" Meeting in Scotland.

A two-day conference will be held in Glasgow on October 12th and 13th which, it is expected, will revive—if, indeed, any such revival is necessary—the general interest shown in Scotland for broadcasting.

The conference will conclude with a public meeting at which the Secretary of State for Scotland will take the chair. The general subject for discussion will be the effect of broadcasting on the Scottish national life, and among the speakers will be Lord Charlemont, the Minister of Education for Northern Ireland, who will emphasise the educational value of broadcasting, and Sir H. Walford Davies, who will speak from the musician's point of view on the influence of broadcasting on the artistic life of the nation. Deputations from educational authorities from all parts of Scotland will be present, and it is hoped that the Secretary for Scotland will himself take part. Demonstrations will be given of new educational installations.

A meeting at which the subject of "Religion and Broadcasting" will form the topic of discussion will be presided over by the Moderator of the Free Churches. The B.B.C. is arranging to broadcast all the chief speeches.

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Cupid and the Loud-speaker.

The approaching marriage of Madame Tetrazzini and Signor Pietro Vernati is, says the *Sunday News*, attributable to broadcasting. It was at a wireless concert in Rome that Signor Vernati first heard the voice of the great Queen of Song. Up to that time he had not been greatly interested in either music or musicians, but the voice appealed to him so strongly and haunted him so persistently that he could not rest content until he had made the singer's acquaintance. The sequel is the engagement just announced.

This opens up another vista of broadcasting possibilities, but we fear that the result may not, in every case, be as happy as this romance. We have often formed our impression of a speaker by his voice as heard on the telephone or loud-speaker, but when we have afterwards met him our preconceived ideas have proved sadly at fault.

FUTURE FEATURES.

Sunday, October 3rd.

LONDON.—Seventh centenary of St. Francis of Assisi.
MANCHESTER.—Red Rose Concert.
NEWCASTLE.—Service relayed from Newcastle Cathedral.

Monday, October 4th.

LONDON.—Cedric Sharpe, 'cello recital.
CARDIFF.—Concert by Eisteddfod winners.

Tuesday, October 5th.

LONDON.—B.B.C. Chamber Concert.
GLASGOW.—Popular Overtures.

Wednesday, October 6th.

LONDON.—Sir Oliver Lodge: "Atoms and Worlds." Beethoven, interpreted by Maurice Cole.
BIRMINGHAM.—Concert by Repertory Chorus and Orchestra.
BELFAST.—Radio Players in "The Lone Man."
NOTTINGHAM.—"Round the Main Stations."

Thursday, October 7th.

LONDON.—Geoffrey Goodheart Sextette.
CARDIFF.—Wagner Programme.
MANCHESTER.—"The Jeffersons," a comedy.
NEWCASTLE.—"John Gilpin" Ballad for Chorus and Orchestra.
GLASGOW.—Callenders Cable Works Band.
ABERDEEN.—Scottish Programme.

Friday, October 8th.

LONDON.—William Primrose, solo violin, with string orchestra.
BIRMINGHAM.—"The Golden Buddha."
BOURNEMOUTH.—Act III of "The Mastersingers" relayed from Glasgow.
EDINBURGH.—Concert in aid of Royal Edinburgh Hospital.
BELFAST.—"Folk Dance to Fox Trot."

Saturday, October 9th.

LONDON.—Radio Tattoo and Tournament. The Westminster Singers.
BIRMINGHAM.—Wireless Exhibition Programme.
MANCHESTER.—Gems from Opera.
ABERDEEN.—Verdi and Saint-Saëns. Birthday Programme by Station Orchestra and Choir.

Bi-lingual Programmes.

A correspondent to the *South Wales News* says that the Executive of the Gorsedd of Bards is asking the B.B.C. to consider the possibility of Welsh broadcasting during the coming winter. It was considered unfair that Welsh listeners should be forced to listen to English dialect programmes while they are denied the possibility of Welsh programmes of a high musical standard.

A somewhat similar controversy is, we understand, taking place in South Africa, where a large proportion of the population desires more Dutch and less English in the programme from Cape Town and Johannesburg.

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Controversial Matters.

England is not the only country in which careful watch is kept by those in authority on the broadcasting of speeches and news that may give offence to any political party or occasion controversy.

The Minister of the Interior in Germany has, we understand, appointed a representative from his own Ministry and two members of the Prussian Diet to act as a Political Committee of Supervision on all political items, news, and lectures in the broadcasting programmes.

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A Standardised Accent.

Anxiety is felt—and perhaps with reason—by the wireless correspondent of the *Evening News*, that the standardised pronunciation adopted by the B.B.C. announcers may eventually exterminate all country dialects.

"The development of the railway system," he says, "has changed that (a real country accent) a good deal, and after a hundred years of railways you have to travel a considerable distance before you can find a broad dialect." His suggestion that old countrymen from the most remote districts should be invited to broadcast some of their memories is worthy of consideration as an antidote.

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"Ravag."

The broadcasting station in Vienna will celebrate its third anniversary on October 1st, when a special programme is being given. This station, which has been run by private enterprise, has become a recognised and important feature in the daily life of the Austrian, who, during the late period of depression and poverty, was no longer able to attend theatres and concerts, as in his days of prosperity.

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Theosophy by Wireless.

The Theosophical Society in Australia has established a high-powered broadcasting station at Sydney, says the *Indian News Service*, which was opened on the 24th of August by the Minister of Education for New South Wales. Mr. G. S. Arundale (F.T.S. and a colleague of Mrs. Annie Besant) said at the opening of the station that it would be one of the most powerful stations in the world, and that it would soon be able to broadcast to India, America and Africa. Its motto is to be "Brotherhood."

PIONEERS of WIRELESS

BY ELLISON HAWKS F.R.A.S

30.—Augusto Righi's Experiments with the Hertzian Waves.

FOR some time the discoveries of Hertz had been the subject of experiment in many laboratories in different parts of the world, and soon further additions to our knowledge were made. Hertz's waves, for instance, were many metres in length, and it does not seem that he ever worked with waves of less than 30 centimetres. It was not long before shorter waves were produced and also improved methods of propagating and detecting the waves.

Some of the most important developments at this time were made by Augusto Righi, Professor of Physics at Bologna University. Righi, who was a native of Bologna, was born on August 27th, 1850, and died on June 8th, 1920. He was a scientist of some distinction and, as we shall see later, aroused a great interest in the Hertzian waves in one of his young pupils—Marconi. Soon after Hertz had announced the discovery of the electro-magnetic waves Righi commenced to investigate them, paying particular attention to their optical properties. In 1897 he embodied his results in a treatise, not yet published in English, entitled "*Optice Elettrica.*"

Augusto Righi.

Centimetre Wavelengths.

By using exciters with very small spheres, Righi was able to propagate waves of 2.5 centimetres. He found that the smaller the spheres, the shorter are the waves. By using minute spheres of platinum, Prof. Chunder Boze, of Calcutta, was able to produce waves of only 6 mm., and thus if we carried the matter to its extreme, and imagined the ultimate atom to be used, we should get waves the length of which correspond approximately to light waves.

Righi also effected a considerable improvement in Hertz's "exciter," by replacing the hollow spheres with solid metal balls, which enabled the waves to be transmitted to nearly double the distance.

Hertz had found that the spheres quickly oxidised, and their roughened surfaces caused the action to become irregular. This necessitated that the spheres should be frequently cleaned and their surfaces polished. To overcome this difficulty E. Sarasin and L. de la Rive, of Geneva, immersed the spheres in olive oil. The sparks were then found to be greatly strengthened but the oil was found to carbonise quickly. Righi further improved on this suggestion by placing the metal balls in an ebonite frame and filling the spark-gap with vaseline-oil, thickened by the addition of ordinary vaseline and contained in a parchment envelope filling the spark-gap.

Righi found that this "liquid cushion" seemed to have a heightening effect on the electric potential, and also that it had a regularising effect making the production of the waves more uniform. He also found oxidisation very materially reduced, and even after working for a long time, when the vaseline had become black and the surfaces of the balls was covered with a deposit of carbonised vaseline, the apparatus continued to perform satisfactorily.

Before the Hertzian waves could be turned to practical use for wireless communication, however, and before any system of wireless telegraphy could become commercially possible, it was evident that some more delicate apparatus than Hertz's somewhat crude resonator spark gap was necessary for the detection of the waves in space. As we have seen, such an apparatus was subsequently forthcoming, and in its final form was given to the world by Edward Branly, of France, whose pioneer work in this connection has already been fully dealt with.

At the time Righi was at work on the subject, however, the coherer principle had not been developed. Little was known of its action beyond the fact that in 1850 Guitard had noticed that when dusty air was electrified from a point, the dust particles tended to cohere into strings or flakes—a long-forgotten observation that seems to have been re-discovered in 1866 by S. A. Varley, who made the first practical application of the principle of cohesion by embodying it in the construction of his lightning protector for telegraphic apparatus.

Other forms of detectors—based on physiological, chemical, electrical and mechanical principles—were at this time under experiment, when Righi introduced what he considered to be an improved form of detector. Hertz's "rectifier" had consisted of simply a wire bent in the form of a circle, cut in one place and the ends terminating in small metal knobs, between which the sparks appeared. Righi's detector consisted of bands of

Pioneers of Wireless.—

quicksilver, as used for mirrors, rendered discontinuous by cross-lines lightly traced with a diamond.

Righi died in 1920 and thus lived not only to see the full development resulting from his pioneer work, but also to witness the complete triumph of his one-time pupil, G Marconi—a triumph that must have been a continual source of pleasure and pride to the one whose enthusiasm for Hertz and his work had undoubtedly directed the young man's attention to the subject in which he met with such conspicuous success.

Righi resembled Hertz, and other modest workers, in his dislike of publicity. "Righi's friends," wrote his friend Augustus Trowbridge, "appear to have been jealous lest he should fail to receive proper credit for his part in making wireless communication possible. But not so Righi himself—he cared little for popular applause, and actually enjoyed a fuller measure of it in his own country than ordinarily falls to the lot of a pure scientist."

NEXT INSTALMENT.

Oliver Heaviside: Originator of the "Heaviside Layer" Theory.

Extracts from Readers' Logs.

Acocks Green, Birmingham.

(June-July.)

Australia :—A 2BK, 2LK, 2LM, 2TM, 2YI, 3BD, 3EF, 3EN, 3OT, 3KB, 3WM, 2BB, 4RB, 4AN, 4CM, 5KN. Tasmania :—A 7CW, 7HL. N. Zealand :—Z 1AO, 2AC, 2AE, 2XA, 4AA, 4AC, 4AM. Argentine :—R AA1, AF1, CB8, DB2, FA3, FC6, FF9, HA2. Chile :—CH 2AS, 2AH, 2LD, 3AT, NAD. Uruguay :—1CD, 1CG. Russia :—R A19. Arabia :—TJ-CRJ. Mexico :—M 1AA, A1, 1J, 9A, XDA. Austria :—Ö WA. U.S.A. :—U 6XBR, 9ADK, 9AOD, 9AVJ, 9AAW, 9BOJ, 9BTR, 9BPB, 9CU, 9CUC, 9CPQ, 9CEJ, 9CXC, 9CWN, 9CYE, 9DAY, 9DQU, 9EP, 9EJI, 9EKE, 9EGH, 9NK, 9NV, 9PU, 9QR, 9ZT, NEM, NISS, NITC, WXF. Portugal :—P 1AE, 1AW. Madeira :—P 30R. Fr. Morocco :—MF 8MA. Norway :—LA 1E, 1H, 1X. Unknown :—STTYC, 7GP, XJ, NIDK, VKP, KEGK, WGY.

(0-v-1) On 30 to 40 metres.

F. J. Taylor.

London, N.10.

(August 8th to 23rd.)

Alaska :—U 7EO, 7HV, WXP. Argentine :—R AA8, CB8, DB2, FC6, FG6, GA2, HA2, MA1. Australia :—A 2AJ, 2BQ, 2CM, 2DS, 3BQ, 3KB, 6AG, 7CW, 7HL. Brazil :—BZ 1AA, 1AB, 1AF, 1AK, 1AO, 1AW, 1BB, 2AM, 5AA, 5AB, 6QA, SQ1, SQ2. British Guiana :—BG 1AE, 1JT. Canada :—C 1BQ, 1DD, 1ED, 2AX, 2BE, 2BN, 3AA, 3XI, 5BA. Ceylon :—4IET, 4IT. Chile :—CH 1EG, 99TC, CHAK, CLAA. Cuba :—Q 2BY, 2MK. Hawaii :—HU 6DCF, 6NL. India :—Y HBK, 2JL. Indo China :—FI 8QQ, IC 1B. Japan :—J 1AA, 1KK, 1PP. Java :—EI PK1, ANE, ANDIR. Mexico :—M 1A, BX, 2X, 3M, 9A, 1AA. New Zealand :—Z 1AP, 1AX, 2AC, 2BK, 2BL, 2XA, 2XB, 3AA, 3AK, 3AL, 4AA, 4AC, 4AM, 4BW. Porto Rico :—PR 4JE, 4UR, 4SA. Philippine Islands :—PI 3AA, 8CD. South Africa :—O A4Z, A6A, 1SR, 5SR. Uruguay :—Y 1AA, 1AB, 1AE, 1AM. U.S.A. :—U 1AAC, 1AAO, 1AAY, 1AA, 1ABW, 1ADM, 1AEP, 1AFF, DB2, DE3, FC6. Uruguay :—Y 1CD, 1CG, 2AK. Chile :—CH, 2AB, 2AH, 2AR, 2AS, 2LD. Mexico :—M IAA, 1J, 1K, 1N, 5C, 9A, JH, YY. Canada :—C 1ED, 2BE, 8RG, 9CD. Brazil :—BZ 1AE, 1AF, 1AI, 1AJ, 1AK, 1AO, 1AQ, 1AR, 1AU, 1AW, 1AX, 1BD, 1BE, 1BH, 1BG, 1BI, 2AA, 2AB, 2AF, 2AG, 2AJ, 2AR, 2AU, 5AA, 5AB, 1QA, 1C, SNI, PTQ, PTR, PTM. U.S.A. :—U 5WI, 6CTO, 6TS, 9AC, 9BAZ, 9EDT, 9BDQ, 9BFB, 9BHE, 9BPL, 9BPB, 9BVR, 9CYE, 9CZW, 9DT, 9EDB, 9EJG, 9EJQ, 9ELB, 9KG, 9KVR, 9SA, 9NV, 9WI, 9ZA, 9ZE. Shanghai :—FC 8FLO. Dominica :—HIK. Peru :—OAF. Miscellaneous :—O A6N, PI 1AU, CZ FR5, TJ CRJ, TJ 6XC, T PACh, T PAV, T PAX, KGBB, WNT, VOQ, AQE, WXF. (All on 30 to 50 metres.) U.S.A. :—U 1CMX, 2BQH, 9ZF. Denmark :—D 7ZG. Finland :—S 2CO. Various :—WIK, WLL.

(0-v-1 Reinartz) On 20 metres.

B. and F. Smith.

Saltley, Birmingham.

(July 1st to 27th and August 17th to September 6th.)

Australia :—A 2BB, 2BK, 2CS, 2LK, 2LM, 2TM, 2YI, 3AK, 3BD, 3EN, 3KB, 3WM, 3XO, 4AN, 4CM, 4RB, 5KN, 7AA, 7CS, 7CW, 7HL, 7LA. New Zealand :—Z 1AJ, 1AO, 2AC, 2AE, 2BG, 2GC, 2XA, 3AI, 3AJ, 3AM, 3AR, 4AA, 4AC, 4AM, 4AO. Argentine :—R AA1, BG8, CB8, BA1, 1AGM, 1AID, 1AKM, 1AMD, 1AMG, 1ARC, 1ASF, 1AWE, 1AW, 1AXA, 1AXX, 1BAL, 1BDI, 1BHM, 1BLG, 1BMS, 1BXH, 1BZ, 1CAW, 1CCZ, 1CIB, 1CKP, 1CME, 1CMX, 1CN, 1CSB, 1GP, 1MV, 1QM, 1RA, 1SW, 1XV, 1YB, 1YC, 1YD, 1ZD, 1ZK, 2AAH, 2AAI, 2ABK, 2AGP, 2AGQ, 2AGT, 2AHK, 2AL, 2ANR, 2ANX, 2ASE, 2ATQ, 2AWQ, 2AXU, 2AYJ, 2BAL, 2BGI, 2BNZ, 2BUR, 2BXJ, 2CHK, 2CMZ, 2CRB, 2CXL, 2CYQ, 2CYX, 2FZ, 2GP, 2GQ, 2GV, 2GX, 2HA, 2JL, 2KG, 2KH, 2LR, 2MT, 2NZ, 2OW, 2PX, 2QA, 2RV, 2TS, 2XAC, 3AML, 3BHV, 3DD, 3SN, 3TE, 3UY, 3ZO, 4KJ, 5ADZ, 5AX, 5DL, 5JD, 5QG, 5YB, 6AJM, 6BAU, 6BXR, 6CAP, 6DAA, 6NO, 6OI, 7DF, 7FR, 7PU, 8AF, 8AKS, 8ALY, 8APM, 8BBE, 8CXI, 8DQK, 8EQ, 8GX, 8PL, 8ZE, 9AAW, 9ALH, 9ATQ, 9AZN, 9BAZ, 9BDQ, 9BDT, 9BHB, 9BHZ, 9BQE, 9BQI, 9BZE, 9CEJ, 9CGQ, 9EAN, 9EAR, 9EAZ, 9EEH, 9EFH, 9QQ, 9RK, 9ZT. Miscellaneous :— VOQ, NEJD, NISM, KEGK, KEFT, KGKK, KFZH, LPZ, TUK, BO 1AH, HIK.

(0-v-1) On 8 to 45 metres. J. Hum.

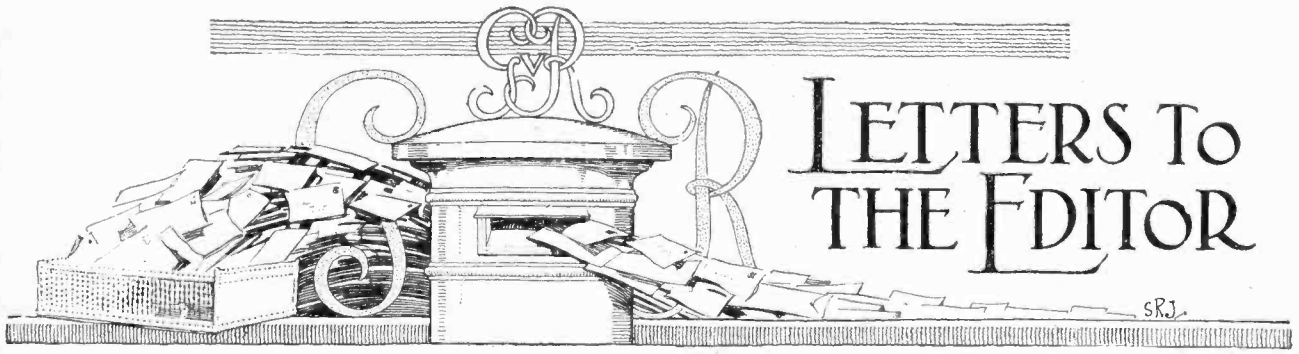
Upper Norwood, S.E.19.

(July 29th-August 19th.)

France :—F 8EZ, 8FBH, 8FFH, 8GM, 8HFD, 8HLL, 8IMR, 8JQ, 8JYZ, 8LMH, 8LZ, 8NA, 8NOX, 8PRD, 8RBP, 8TBY, 8VVD, 8ZD. Belgium :—B A1, B1, B7, 4BS, D7, G5, H5, H6, K2, K44, L66, M8, O2, S2, S4, W1, Y8, 4ZZ, Z2, Z4. Holland :—N OAG, OAM, OCT, OFP, OGA, OGG, PCK4, 2PZ, OPM, OPX, OVN, OWC. Italy :—I 1AU, 1BA, 1CH, 1CU, 1DA, 1DJ, 1FC, 1GM, 1MT. Germany :—K 12, 4PG, P6, 4WL. Sweden :—SMUK, SMVH, SMYG. Finland :—S 2ND, 2NL. Spain :—EAR26, EAR28. U.S.A. :—U 1BQT, 1CCZ, 1DI, 1MV, 2CCL, 2XBB, 3BVA, 3BZ, 3NR, 4AG, 4IT, 4IZ, 2XAF, W1Z. Brazil :—BZ, 1AK, 1AR, 1AW, 1BD, 1QA, 5AB, 6QA. Argentine :—R BA1. Porto Rico :—PR 4JA. Morocco :—FM 8ST. Java :—ANF. Various :—Ö HL. P 1AK, D 7XU, AGC.

A. F. Griffith.

(0-v-1, Reinartz) On 20-60 metres.



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.

MARCONI ROYALTIES.

Sir,—Some time ago I read your interesting article on Marconi patents, for the use of which royalties are payable. Since then I have heard various discussions on the matter, and find the ideas of my friends so much at variance with each other that I would like you to give me a ruling on the following points.

There is the firm who advertise a set for home construction, offering for sale full details in blue print form, and afterwards state that if the components are bought from them they will drill panel free of charge. If a complete set of parts is obtained at the one time (*i.e.*, with valves and batteries), must the royalty of 12s. 6d. per valve be paid? If so, to avoid paying this, what components must be omitted to make the list incomplete? Then again, does the seller pay a licence for issuing this drawing?

D. W.

Edinburgh. September 1st, 1926.

BROADCASTING AND GOVERNMENT CONTROL.

Sir,—I am a civil servant and very near the retiring age, and should know something about Government management. I think it is a thousand pities that broadcasting is to be a Government departmental affair. The great defect of Government management is lack of flexibility and the necessity of practically cast-iron regulations; matters run in grooves, and personal initiative is rather of the nature of a crime officially. I am perfectly certain that we should get better service from a free institution untrammelled by red tape, and also that the employees of that institution would be much freer and happier than as Government servants. My opinion of Government service is such that I hope none of my children will be civil service pawns. Cast-iron rules are inseparable from Government control, and they do not make for real efficiency: the regulations, however absurd the result of their enforcement, must be observed. For instance, in a certain department a rule was in force that no linoleum should be laid before the public counter; a room had to be covered which included such a counter, and after covering behind the counter there was plenty of "lino" left to cover the small standing space in front, and the office head asked the man responsible to use the left over lino for this purpose, but, no, it could not be done, it was a breach of the regulations, and would mean the ruin of his official career if he did so, and the spare lino was thrown instead on the rubbish heap. This is quite true, and similar things are of common occurrence and even more serious in their nature. The instructions are constantly changing, and the unfortunate civil servant has to worry more about keeping posted than he has about getting on with his work as he would do if he had personal initiative and could use his common sense; but common sense against the regulations means loss of promotion or worse. We shall certainly lose by the Government control of broadcasting.

September 9th, 1926. BEHIND THE SCENES.

WAVEMETER CALIBRATION.

Sir,—In the issue dated August 25th you described an accurate method of calibrating a wavemeter by use of a tuning-fork ("Calibration Waves from the N.P.L."). Unfortunately, the use of a tuning-fork for such measurements is not customary to most amateurs, but the same degree of accuracy may be obtained by using the double beat method. The same apparatus as by the tuning-fork method is to be used: an oscillating receiver and the heterodyne wavemeter. The measurements are made as follow:—

In order to get a rough value of the wavemeter setting the heterodyne is at first set to zero beat tone with the receiver not oscillating. The receiver is then brought to oscillation and tuned so that the beat tone between the transmitting station and the receiver has a favourable pitch. If now the heterodyne wavemeter is switched on a new beat tone will be added, and this forms beats with the already existing note. The wavemeter can now be very slowly tuned until this second beat tone is heard as strength variations of the ordinary beat tone with a very low period, one or two per second or still lower. The setting of the wavemeter is then exact to a very high degree of accuracy. The whole manipulation can be carried out much more easily and quickly than would be inferred from the above description.

Lund, Sweden. G. ALB. NILSSON.

September 3rd, 1926.

WIRELESS WITHOUT WEIGHT.

Sir,—With reference to Mr. Laister's letter in your issue of September 1st, I, too, have made up the single valve portable, but in a fibre case having a metal rim around the top edge for strengthening purposes. I found that the best position for reception was with the case standing on one end with the longest side of the frame upright. My layout was not as specified and the controls were inside and not outside the case, thus necessitating the case being open when tuning. This meant that the metal rim was touching the article on which the set was standing (or the ground when outdoors) and was consequently practically earthed, thus acting as a screen and reducing signal strength almost to inaudibility. However, upon removing this metal rim results were all that could be desired and I have not had the trouble occur again although my frame is an exact fit inside the case as in the original. If the receiver works perfectly outside the attaché case surely just placing it inside a leather or fibre case cannot cause signals to almost disappear. Perhaps metal enters into the contructions of Mr. Laister's case and this is the cause of the fading.

London, S.W.15. EDGAR A. UPSDELL.

September 2nd, 1926.

AMERICAN RECEPTION.

Sir,—I notice on page 394 of the September 15th issue of *The Wireless World* that you ask for details of American reception, so perhaps a report from myself would interest you. The first case of good reception was on the morning of the 8th inst., and the set used was home-made, employing auto-coupling and the 0-v-2 arrangement for the valves.

01.20. G.M.T.—WJP and WPG on S.B. Music was R6, but speech was rather broken up by a burst of sparks.

01.22 G.M.T.—Dance music, "Blue Danube." The last valve being switched off, signals were R3, but using all three valves signals fair on loud-speaker. Contact was kept up until:—

02.25 G.M.T., when the announcement WJP Philadelphia

and WPG Atlantic City were operating. Signals were then R7, but fell off immediately afterwards and died away. Static and Morse was not too troublesome, but at times fading was very bad and quite rapid. W. MACARTNEY FILGATE.
Borth, September 15th, 1926.

A.C. MAINS RECEIVERS.

Sir,—On page 388 of your issue of September 15th, and again in a caption on page 386, a statement appears that the first set to be produced in this country in which filament heating as well as anode current supply is derived from A.C. mains is shown on a stand at the Exhibition.

As this is rather an injustice to us, may I say that we were producing and demonstrating mains sets, both A.C. and D.C., operating both filament and H.T. from the mains, so long ago as 1924? In 1925 we were equipping hospitals with sets operating entirely from the mains, both A.C. and D.C.

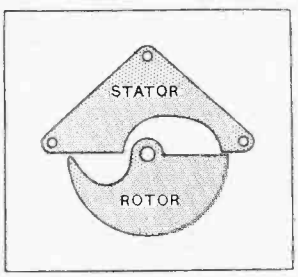
Our All-mains Receivers in some hospitals are supplying some 300 pairs of phones, and we now have orders in hand for sets to serve much larger numbers of phones. Incidentally, we have yet to learn of any other set operating entirely from the mains which is able to cut down hum sufficiently to be able to be used for phones.

For READ AND MORRIS, Ltd.,
London, W.1. W. E. H. Humphrys, Managing Director.
September 15th, 1926.

FREQUENCY AND WAVELENGTH.

Sir,—I was interested to read Mr. Bryan Groom's letter published in *The Wireless World* of September 8th further to mine which appeared in your issue of August 18th.

Dealing first with the straight-line frequency condensers, I would suggest that it is by no means impossible to devise a condenser retaining the essential compactness of the old type and at the same time having the S.L.F. characteristics and a low minimum capacity. The diagram shows the approximate contour of the plates of one such condenser actually on the market (Messrs. Raymond, Lisle-st., W.C.1). The extra 2in. referred to by Mr. Groom is more like 8 sq. in. per condenser, or 24 sq. in. for the two H.F. stage receiver I suggested.



Condenser vanes of a compact S.L.F. condenser.

Incidentally it would appear that too low a minimum capacity is often actually undesirable, as the low capacity ratio becomes so large that the selectivity necessary to separate two stations 10,000 cycles apart at the upper end of the frequency range will not be obtained. Calculations based on Fig. 5 of Mr. James's article, "Everyman's Four Valve," *The Wireless World*, July 28th, p. 112, indicate that there is about 36 micro-mfd. stray capacity present in the stage, a large proportion of which, judging by the lay-out, must be in the variable condenser.

This brings me to a point I omitted to mention in my previous letter, viz., that a "law" condenser, to be of maximum use, must be corrected for a declared stray (*i.e.*, condenser and circuit fixed minimum) capacity, and a fitment on the lines of a neutralising condenser might well be incorporated to bring up the total fixed minimum to the declared value. In amateur hands the setting of this condenser would be done experimentally.

The other point, namely, the need for compensation in the L.F. portion of the circuit for the attenuation of the higher frequencies in the modulation of the transmission, due to the shape of the H.F. response curve of a selective receiver, is, I think, quite clear.

Mr. Bryan Groom states that the prominence given to the low notes by H.F. amplification and reaction is, from the point of view of quality, desirable. This is merely an admission that his loud-speaker is, in common with so many others, unable to handle low notes well.

It stands to reason that a resistance coupled L.F. amplifier, the action of which is unmodified by acceptor or rejector chokes and condensers, will pass on to the loud-speaker L.F. energy suffering from the higher frequency attenuation present in the H.F. amplifier, and perfect results would only be obtained when the loud-speaker frequency response curve happened to be a reciprocal of the H.F. response curve. I think we can safely say that we have no reason to expect any of the existing instruments to provide us with such a convenient means of correction for this attenuation.

The most recent developments in the technique of loud-speaking appliances indicates that it is from the small coil-driven, inertia-controlled diaphragm that we may expect an acoustic output which is sensibly free from resonance, and the response curve of a typical instrument of this type shows very little variation from the horizontal, hence the necessity for compensation in the L.F. amplifier. The moment one starts to compensate a resistance-coupled amplifier phase angle frequency variations creep in, which make such an amplifier little, if any, better than a transformer-coupled instrument with the very best transformers.

With regard to "synthetic X's," I may have been particularly fortunate in not having run into this trouble, and I have yet to have a transformer break down in my own set, although I have several times traced trouble in friends' sets to this cause.
London, S.W.20. D. KINGSBURY.
September 14th, 1926.

THE POLICY OF THE B.B.C.

Sir,—The policy of the British Broadcasting Company has been to cater for the crystal set. I suppose that in doing so we should try to credit them with the best motives, that is to say, the B.B.C. have chosen to make broadcast reception both cheap and easy.

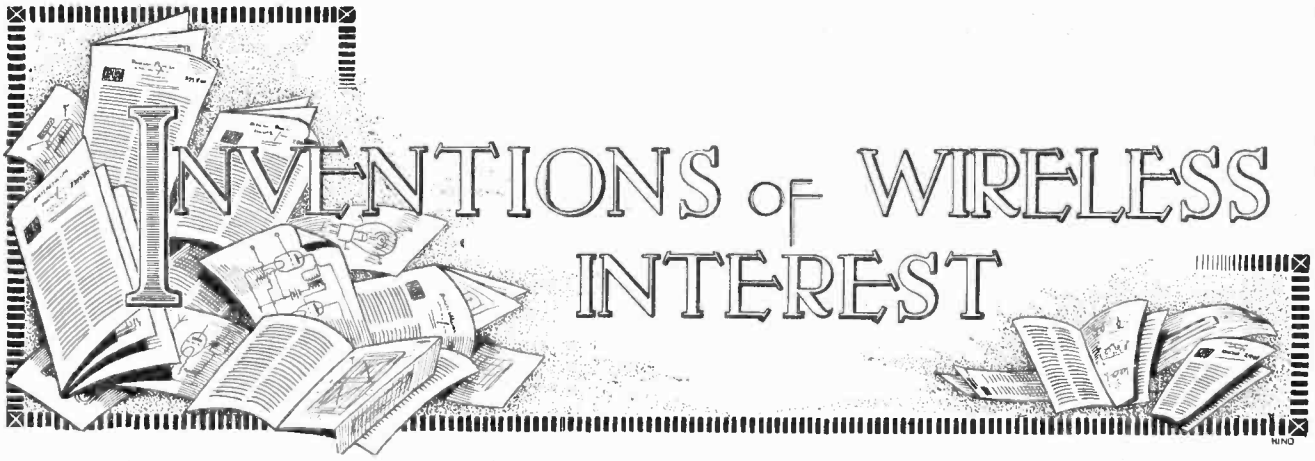
As a result it is probable that crystal sets are in the majority, and we shall not be going far wrong if we add that most of them are highly unselective, and that a very large proportion are constructed from the most crude apparatus. The outcome of the B.B.C.'s policy is that the crystal user can listen in with almost any junk so long as it comprises headphones, wire, and a crystal detector of sorts, and, judging by the sets I have seen, most of them do so.

Now this sounds very admirable, and at first sight the critic might be tempted to hold his peace, were it not that the said policy proves itself upon a very brief consideration to be both foolish and short-sighted. Indeed, we shall find, if we give the matter a little thought, that by making things ultra easy for the crystal user the B.B.C. have been guilty of the most crass folly and ineptitude.

With the glaring example of America before them, they have fostered the growth of the most unselective apparatus. It should have been evident to the meanest intelligence that the people of this country would not rest content with one programme to take or leave. Alternative programmes must come; high power regional stations are rumoured. The vast sums expended upon the present system will perforce be forfeit, and the crystal user will find himself high and dry. Many will get programmes superimposed. Many will get nothing.

I have every sympathy with the crystal user, for I realise that in most cases it is a question of cost. Tens of thousands of these people will have to scrap their receivers, and in consequence will not unnaturally blame the B.B.C. for having led them into a totally false position of security. The gifted engineers of the B.B.C., with our genial Captain Eckersley at their head, will doubtless point out how easy it is to obtain selectivity. As an amateur I know this, and so do thousands of my fellow amateurs. But there are tens of thousands who neither have the elementary knowledge of such alterations as may be necessary nor the wherewithal to do them.

As for Daventry, I venture to say that nine manufacturers out of ten have cursed the 1,600 metre station soundly, whilst many a valve user, cheated of the foreshadowed alternative programme, has done the same. The way to give coastal listeners an uninterrupted programme was to stop the interruptions, and not to try to climb out of them. Broadcasting has been under way for some years now. What have the B.B.C. done in this direction save to shield themselves behind the Post Office when the question arose?
London, N.W.11. G. CHEERS CHALONER.
September 14th, 1926.

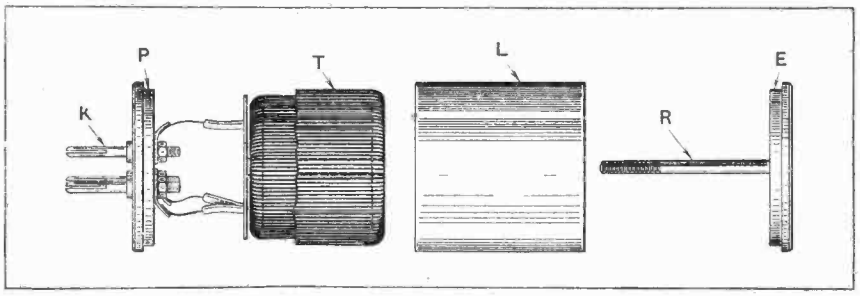


The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

Transformer Mounting.
(No. 256,075.)

Application Date, Sept. 12th, 1925.

A convenient method of mounting transformers for experimental purposes is claimed by A. F. Godden and P. T. Bradley in the above British patent. The invention consists in providing a transformer with plug and socket mounting, instead of the usual terminals. Thus, the accompanying illustration shows one method of carrying the invention into effect. A transformer T is of the hedgehog type, and is enclosed by a cylindrical casing L, provided with an end plate E and a top plate P of insulating material, which carries valve pins, or similar contacts K. The whole are assembled and held in position by means of a threaded rod R. When mounting a number of transformers in this manner they may be readily interchanged for experimental purposes.



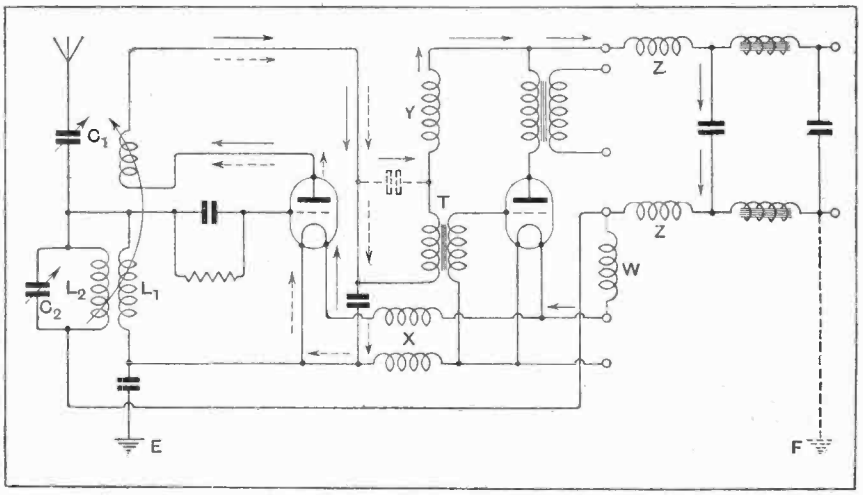
Plug-in L.F. transformer (No. 256,075).

o o o o

Multiple Earth Connections.
(No. 256,317.)

Application Date, May 4th, 1925.

It is well known that unless a properly balanced earthing system is employed with a receiver, difficulties arise which may bring about flatness of tuning and loss of signal strength. When an ordinary broadcast receiver derives the anode potential from domestic power supplies a condition such as this may be brought about. According to this invention, which is disclosed in the above British patent by Fuller's United Electric Works, Limited, and A. P. Welch, the difficulty is overcome by the introduction of high-frequency chokes, which isolate any high-frequency currents from the earth connection due to the electric light mains. It will be obvious that many circuital arrangements can be devised for bringing about this effect, and the accompanying illustration shows how various chokes may be inserted for this purpose. An ordinary aerial tuning circuit is shown, with a variable condenser C_1 and an inductance L_1, the normal earth connection being made through a stopping condenser at E. If sharpness of tuning is required it is essential that radio frequency currents are prevented from reaching the earth connection due to the negative pole of the mains, as shown at F. Radio-frequency chokes are, therefore, included in both the negative and positive leads of the mains supply, that is, on the far side of the filter, as shown at Z. Owing to the appreciable capacity which may exist across the primary of the first intervalve transformer T, another choke Y is included in this lead. Again, chokes are shown to be included at X, this time directly in the filament leads between the two valves. The circuit actually is shown in conjunction with a wave trap, and here the lower end is taken to the junction of the choke Z and a choke W. In this way it will be seen that there is no high-frequency path for currents between the whole circuit, and the earth of the supply mains.



Circuit for use with multiple earth connections (No. 256,317).

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.

A Useful Circuit.

In the "Readers' Problems" section of your journal for July 14th, a four-valve circuit was given which made use of a separate reaction valve. I have constructed this receiver, and have been struck by its remarkable efficiency, but I wish if possible to arrange for reaction to be controlled by a condenser. Can you, therefore, give me this modified circuit?

W. K. K.

It is quite a simple matter to modify this circuit in the manner you propose, and we give the necessary circuit herewith. The aerial and reaction coils should be mounted side by side in two fixed coil holders, at a distance of about 1 inch. The circuit now becomes a combination of the Reinartz and separate reaction valve circuits, and is an extremely effective one. It is necessary, however, to experiment carefully with the correct value of reaction coil. If too large a size is used reaction control will become very erratic due to the presence of electrical backlash. This circuit should be tried both with an ordinary earth connection and a rough counterpoise, consisting of about 30ft. of rubber-covered wire led away anywhere, such as round the skirting board of a room, the far end being free. The earth or counterpoise, as the case may be, should be attached in the usual manner to the bottom end of the aerial coil.

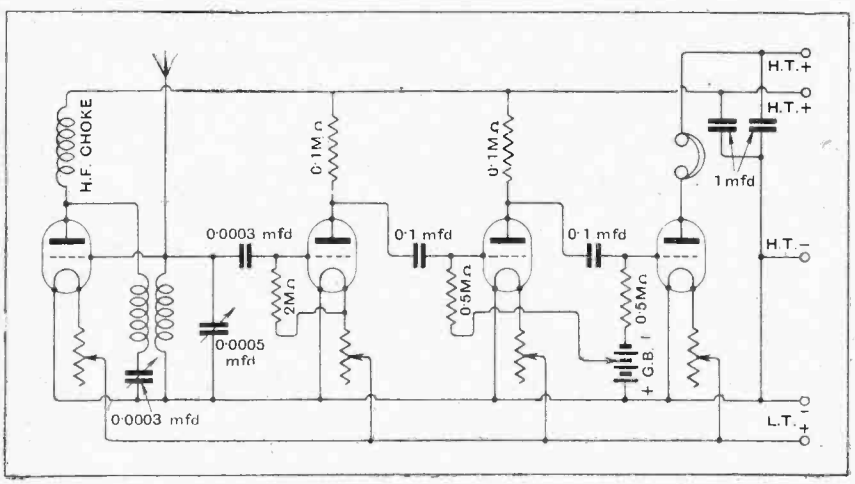


Fig. 1.—Four-valve circuit with separate capacity controlled reaction valve.

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Wireless without Weight.

I have built the portable single-valve Hartley receiver described in your July 21st issue, under the title of "Wireless without Weight." The receiver functions admirably when removed from the case, but when using it in the case it is impossible to make the receiver oscillate. Can you tell me the probable cause of this trouble?

T.P.F.

In this receiver, the first aim in the design was to reduce bulk and weight to the smallest values possible, and actually the aim was that the complete receiver, including all batteries and also headphones and frame aerial, be fitted into an attache case measuring 12in. × 8in. × 4in., and that the complete receiver, including all batteries, etc., be under 10lb. in weight. Both these aims were successfully achieved, but, in order that these conditions be complied with, it was necessary to do three things:

1. Wind the frame aerial in the form of a hank, and squeeze it in between the wooden framework and the inside of the carrying case.

2. Reduce the H.T. voltage to a comparatively low value in order to save bulk and weight in the H.T. battery.

3. Use a very small feed back condenser in order that both bulk and weight be economised by the ability to use a neutralising condenser for this purpose.

Now, all these three conditions taken together militate strongly against the ability of the set to oscillate, although any one of them taken singly would not be sufficient to stop oscillation. Thus, any given valve will oscillate fiercely when 60 volts H.T. is used, but will oscillate less strongly with only 30 volts, but, still, it *will* oscillate, unless various reaction opposing conditions, such as heavy damping or small feed back, are included in the circuit.

In the original receiver smooth oscillation was obtainable with a medium impedance valve, but on sets made by readers extra damping, sufficient to stop oscillation, might occur.

This possibility was not forgotten when designing the receiver, and for experimental purposes extra damping was temporarily introduced into the frame aerial until the receiver refused to oscillate. It was then found that the best method of overcoming the difficulty was to use a low impedance valve, the actual valve used being a Cosmos S.P.18 "Red Spot" valve. Oscillation was then easily obtained, even when still more damping was introduced. An alternative method tried was to retain the medium impedance valve and to raise the value of the feed back condenser by connecting a 0.0001 mfd. fixed condenser in parallel with the existing variable instrument, thus raising the maximum value from 0.00005 mfd. to 0.00015 mfd. This expedient, however, meant obviously that, even with the variable feed back condenser at minimum, the capacity in circuit was still 0.0001 mfd., and it was found that oscillation could not be stopped. Finally, it was found that the correct value of fixed condenser to add in parallel was 0.00005 mfd., thus giving a variable capacity of from 0.00005 mfd. to 0.0001 mfd. Oscillation was then easily obtained and readily controlled even with using the medium impedance valve with extra damping deliberately introduced into the frame aerial. A small fixed condenser of 0.00005 mfd. capacity may be obtained from Messrs. Peto Scott, Ltd.

Using a very high impedance valve, it was also found possible to stimulate oscillation, other than by increasing the capacity of the feed back condenser, by temporarily raising the value of H.T. or of using a slightly larger case in order to allow of the frame aerial being suitably spaced between the wooden framework and the case. Either of these two measures, however, necessitates a redesign of the receiver, and these are, therefore, not admissible. The alternatives, if difficulty is experienced in getting the receiver to oscillate, are to use a low impedance valve such as the Cosmos S.P.18 "Red Spot" valve, or to add a 0.00005 mfd. fixed condenser in parallel with the existing feed back condenser, and of these two methods the former seems, from experience, to be the more effective.