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THE OSCILLATION NUISANCE: A REMEDY.

ACCUSTOMED as we are to the periodical reprimands of the B.B.C. accusing us of causing interference by permitting our sets to oscillate, the nuisance still continues. Thousands of listeners, particularly those who understand the properties of reaction, feel embarrassed when their locality is singled out as the area to which an appeal is addressed. The non-technical listener turns his tuning and reaction dials until he obtains the best signal strength from his set, consisting invariably of a detector valve with reaction, followed by one or more note magnifiers, and energises his aerial with impunity. There is always another offender ready to heterodyne the continuous wave "transmission" which he emits, and between them and a score of others complaints are addressed to the B.B.C. and its assistance solicited. The enthusiast knows better than to complain, for to some extent by so doing he incriminates himself.

The "Don't do it!" appeals of the B.B.C. have been made without result. A slogan, unless conveying a remedy is ineffectual. Statements have been made that the Post Office authorities have armed themselves with gear for tracking down oscillators, yet we still await the bringing of an offender to book, while the technical evidence to be tendered in such a prosecution would be of the utmost interest. The time is long overdue when the Post Office saw that their instructions given to every listener in regard to causing interference are carried out, or they might just as well delete the rule and give peace of mind to the conscientious listener. Some of the wireless societies anxious to help have dabbled in the matter, but have now learned that it is one best left alone.

The use of aerial reaction and the swinging plug-in coil are on the decline as being unnecessary if good reception is required from the local station. Undoubtedly the best method of tuning in a distant station is by the use of a correctly designed and properly stabilised high-frequency amplifier, and tuning must not be carried out by heterodyning the carrier wave, a process so often seen. Thus, as regenerative circuits are no longer needed for listening to the transmissions of either local or distant stations it would seem that the time has now arrived when regulations could be framed which would definitely put down the oscillation nuisance. A set designed for good quality reception from a local station should not employ a self-oscillating circuit, while it is only necessary to see that the long range set is properly designed and that the user is acquainted with its principles.

Interference by oscillation will undoubtedly diminish in the near future, and the change is not being brought about either by regulations or propaganda. The former depend for their carrying out upon considerable technical skill, while the latter consists of drawing attention to the symptoms without offering a reasonable cure. It is due to technical development that an improvement is to be attained. To-day there is no excuse for building an interfering receiver, and designers must no longer look to the indiscriminate use of reaction for claiming long-range reception for their sets.

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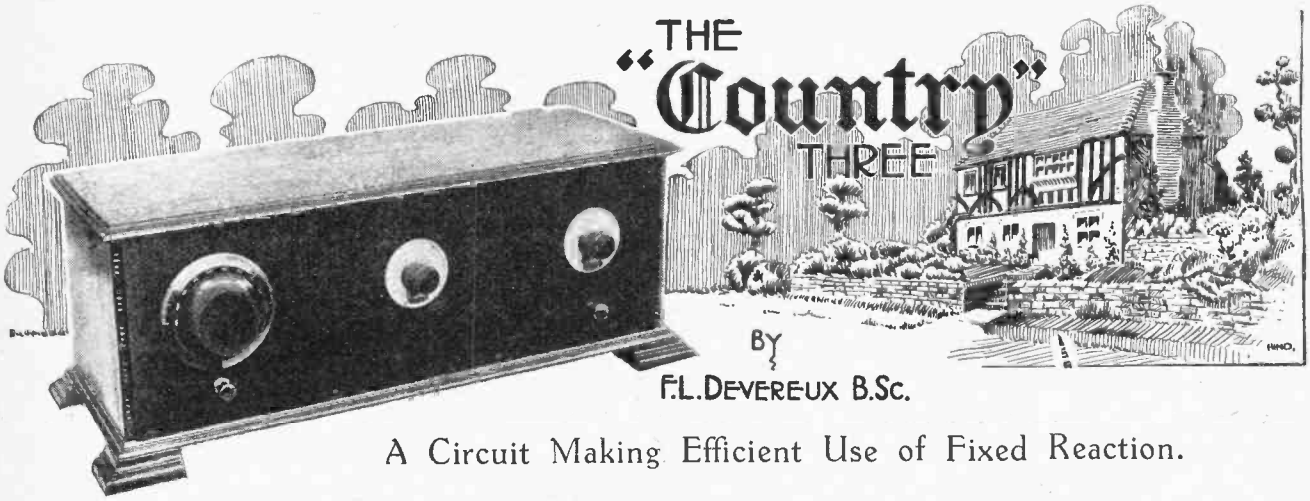

THE "Country" THREE

BY F.L. DEVEREUX B.Sc.

A Circuit Making Efficient Use of Fixed Reaction.

DWELLERS in country districts who are more than twenty miles from the nearest broadcasting station are not troubled by the problem of selectivity, and are not under the necessity of building sensitive and delicate receivers to bring in distant stations, to the exclusion of the local station. In the town the local station would be heard all over the tuning dial of a receiver of the type described in this article, but at a distance of twenty miles, the local station occupies only a few degrees, leaving the remainder of the dial open for the reception of other stations.

Relieved of the necessity of achieving a high degree of selectivity, it is possible to direct one's efforts—and financial resources—to the attainment of a quality of far greater importance to the country listener, namely, reliability. Failure of any part of the receiver—components, valves or batteries—will probably involve a five-mile walk to the nearest radio dealer or charging station. Therefore, not only must the set itself be robust in design and construction, but H.T. and L.T. batteries must be considered as integral components of the installation, not as minor accessories, and as much care must be expended on their choice as upon the circuit itself.

The circuit arrangement may be briefly described as a reacting detector followed by two transformer-coupled, low-frequency, amplifying valves. Owing to the indiscriminate use of variable reaction, circuits of this type have lately fallen into disrepute, but this is clearly no reflection on the circuit, which is intrinsically highly efficient; it is unskilful use of the variable reaction in unpractised hands that is the cause of all the trouble.

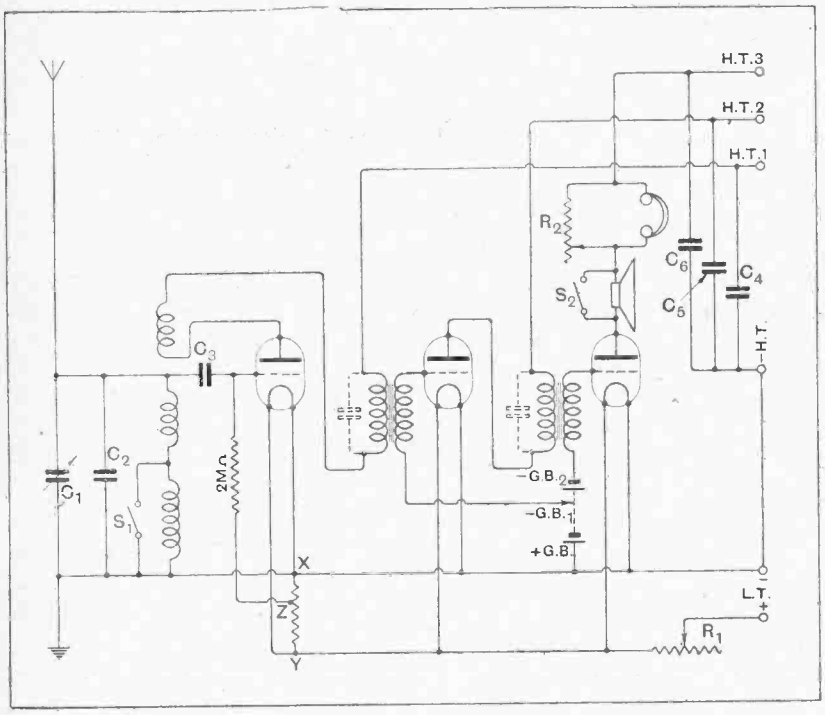

Fig. 1.—Circuit diagram. C_1=0·0003 mfd.: C_2=0·0003 mfd.; C_3=0·0003 mfd.; C_4, C_5, C_6=2 mfd.; R_1=15 ohms; R_2=30 ohms for 120 ohm phones.

Fixed Reactions.

The obvious remedy is to apply a limited amount of fixed reaction not under the control of the operator, but to do this is to rob the circuit of its sensitivity. Amateurs skilled in the use of variable reaction will agree that it is only in the last few degrees in approaching the threshold of oscillation that the full benefit of reaction is obtained. They will also point out that, if fixed reaction is applied and adjusted so that the set is just not oscillating with the tuning condenser set at minimum, that the set will be far from the oscillation point, and consequently insensitive with the tuning condenser at maximum.

In practice, when using variable reaction, the coupling is gradually increased as the tuning condenser is rotated to increase wavelength, and it is by carefully observing the manner in which the reaction coupling follows up the wavelength that we shall arrive at a really efficient method of using fixed reaction. It will be noticed that, with

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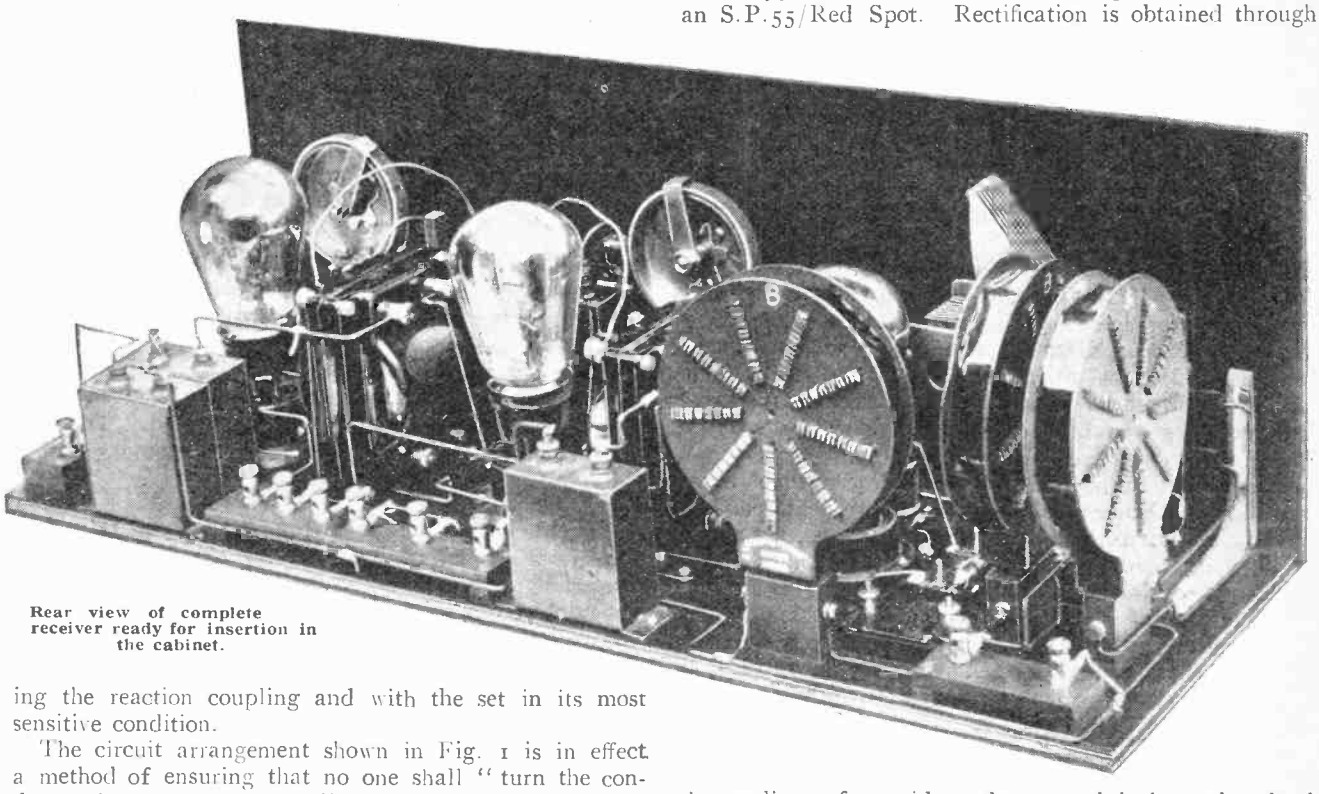
a semi-circular vane condenser, the greatest change of reaction coupling per degree of the condenser takes place near the beginning of the scale. In other words, if the set is adjusted on the verge of oscillation with the condenser at 10 degrees, it will burst into oscillation when the condenser reading is reduced to 8 degrees, whereas if the same adjustment is made at 180 degrees the condenser may be reduced to 140 or even 120 degrees before oscillation sets in. Now, if we could be sure that no one would turn the condenser below 120 degrees, we could set reaction at this point and then search for distant stations between 120 and 180 degrees without touching the reaction coupling and with the set in its most sensitive condition.



Rear view of complete receiver ready for insertion in the cabinet.

The circuit arrangement shown in Fig. 1 is in effect a method of ensuring that no one shall "turn the condenser below 120 degrees." The capacity between 0 and 120 degrees is represented by the fixed condenser C_2 and the variable portion between 120 and 180 degrees by C_1. These condensers tune an aerial inductance consisting of two parts: a small coil for use on the lower broadcast band of wavelengths and a load coil for Daventry, which can be short-circuited when not required. Critical reaction is applied only on the 300-500 metre band, as ample amplification is provided for Daventry by the L.F. valves alone, unassisted by reaction. The reaction coil is, therefore, coupled only to the small aerial tuning coil, the slight residual reaction when S_1 is opened being ample for Daventry, although the set is far from the oscillation point.

Selectivity.

In practice this scheme is highly successful, and the manner in which stations are received at every few degrees of the condenser scale on the lower wavelengths is reminiscent of a "neutrodyne." The only drawback is that at least two pairs of coils (A.T.I. and reaction) are necessary to cover the 300-500 metre range of wavelengths. The selectivity is also poor compared with a receiver such as The "Everyman" Four, and the "neutrodyne" illusion is only obtainable outside a radius of twenty miles from a main station—the region for which the set is designed.

Detector and Amplifying Valves.

The amplifying portion of the circuit is quite straightforward. Six-volt valves are employed throughout the receiver, the detector and first L.F. being of the D.E.8 H.F. type, and the second L.F. or power valve being an S.P.55/Red Spot. Rectification is obtained through the medium of a grid condenser and leak, and a fixed potentiometer XYZ is used to obtain a suitable positive grid bias for the detector valve. For efficient rectification a positive bias of approximately 1.5 volt is necessary, and this is obtained by returning the grid leak to a point Z on the potentiometer, which is a quarter of the distance between X and Y. By this means a quarter of the filament voltage (+1.5 volt with respect to the negative filament lead) is applied through the two-megohm resistance to the grid. A value of two megohms for the grid leak has been specified on the assumption that weak signals are to be received. If the receiver is installed sufficiently near to the broadcasting station to obtain strong signals in the aerial circuit, a one-megohm grid leak is recommended in the interest of quality.

The detector is coupled to the first L.F. amplifier through the medium of a Ferranti A.F.3 transformer. A condenser across the primary winding is already incorporated in this transformer, and an additional by-pass condenser is therefore unnecessary. A D.E.8 H.F. valve

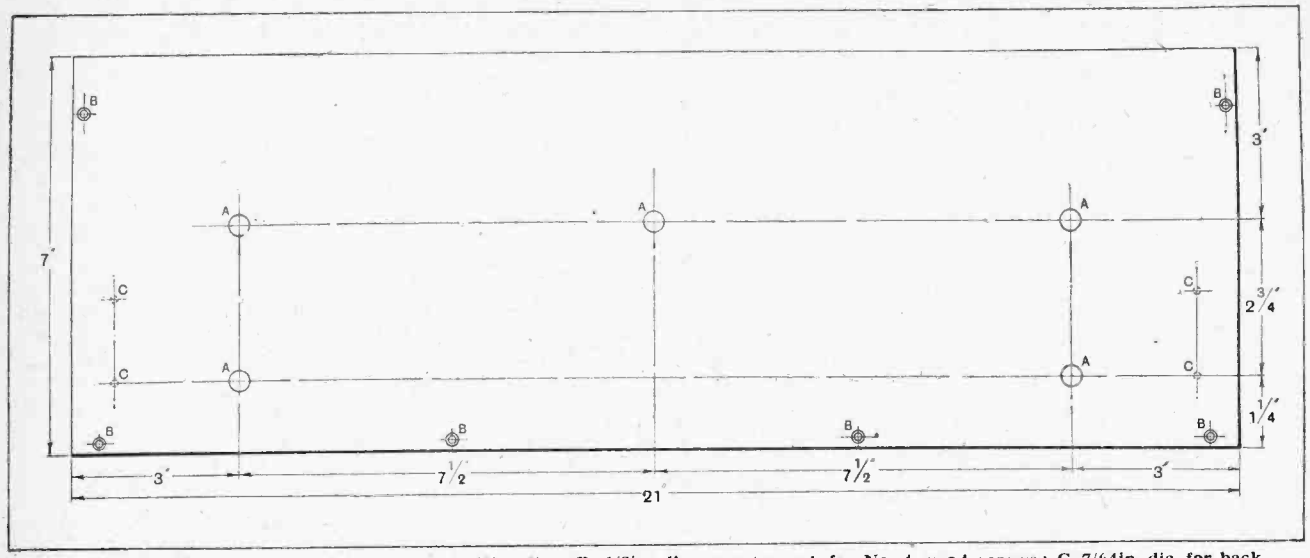


Fig. 2.—Drilling details of front panel. A, 3/8in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws; C, 7/64in. dia. for back, tapped No. 4 B.A.

is used in the first low-frequency amplifying stage. The title given to this valve may perhaps suggest that it is unsuitable for low-frequency amplification, but this is entirely erroneous, as its impedance of 25,000 ohms is perfectly suited to the primary winding of the A.F.3 transformer connected in its anode circuit. Further, the anode current under operating conditions, with 120 volts on the plate and a negative grid bias of − 3 volts is 1 mA, which is well within the limiting anode current of 4 mA specified by the makers of the transformer. The maximum permissible input amplitude to this valve must not exceed three volts, and this may seem a small value, but a moment's consideration will show that, owing to the high amplification of the valve-transformer combination, an input amplitude of only 0.2 volt will result in an input amplitude of twelve volts to the power valve. In some circumstances, where the output from the detector is large, it may be permissible to substitute a D.E.8 L.F. valve in this stage; not only is this valve capable of handling a larger input amplitude, but the amplification factor is considerably less, and this will automatically reduce the input to the last stage. If this valve is used, however, the anode potential must not exceed 100 volts and a grid bias of − 6 should be applied. This will ensure that the anode current does not exceed 3 mA.

The Output Circuit.

For the last stage an S.P.55/Red Spot valve was chosen on account of its extremely low impedance and comparatively high amplification factor. With an anode potential of 120 volts and a grid bias of − 12 volts, the valve is capable of supplying to a "Kone" loud-speaker a distortionless output of sufficient volume for the largest of living-rooms.

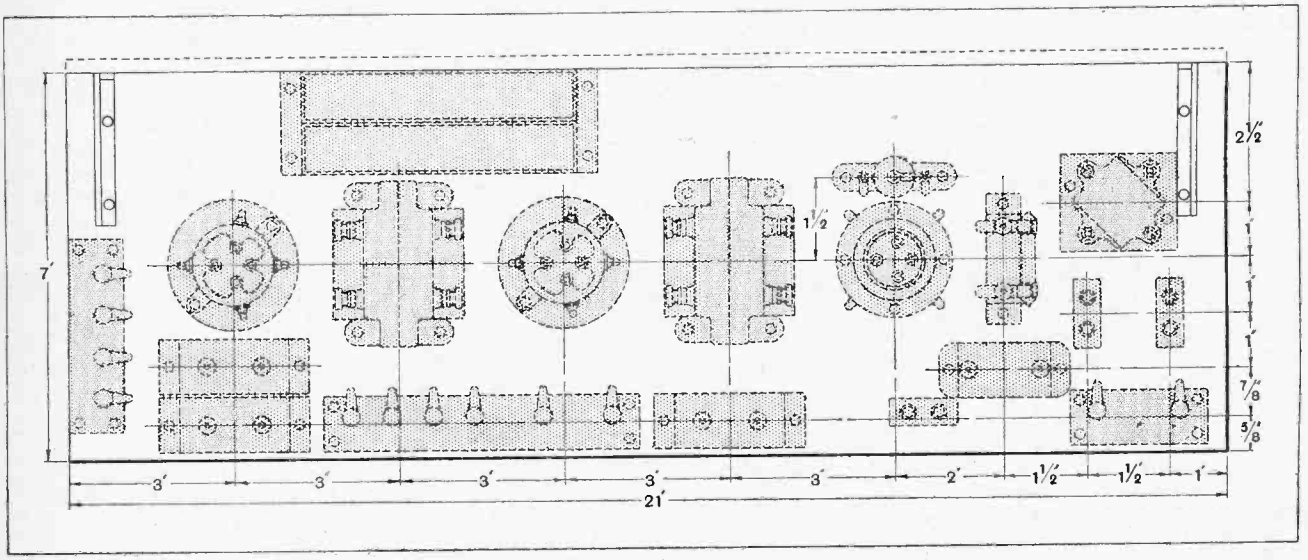


Fig. 3.—Layout of components on baseboard.

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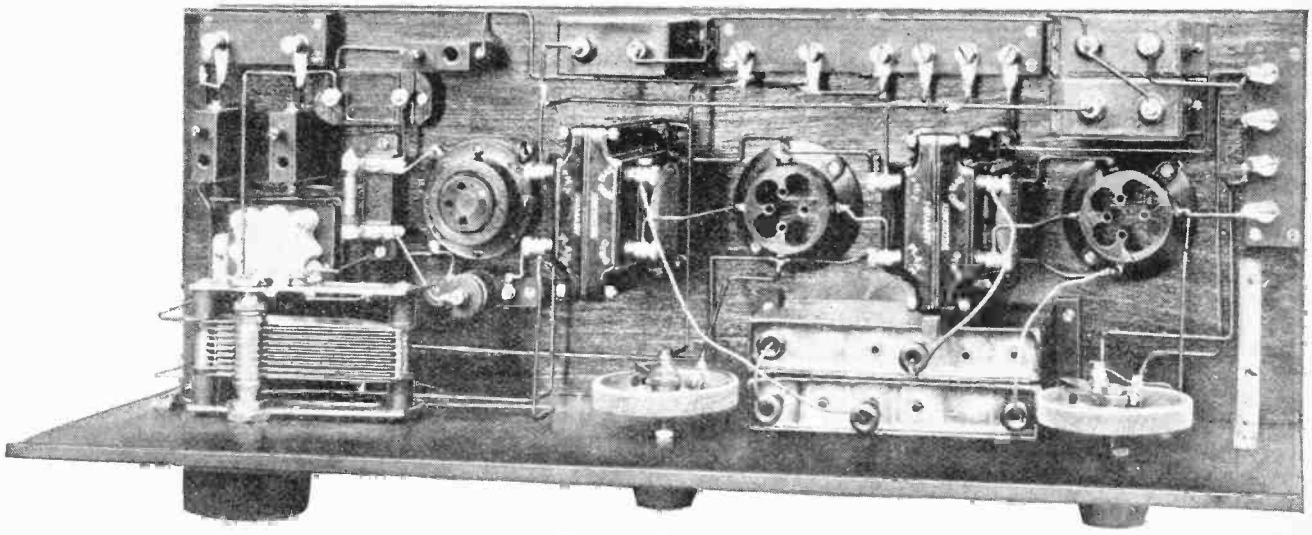
The output circuit has been arranged so that a loud-speaker and telephones can be used together or independently. Experience shows that such an arrangement is very desirable, particularly when one person wishes to listen-in without disturbing the remainder of the household with lusty sounds from the loud-speaker. In such circumstances the switch S_2 is closed, and the requisite volume in the telephones is obtained by regulating the resistance R_2. Telephones of 120 ohm. resistance are recommended, in which case a 30-ohm filament resistance may be used for R_2. If 2,000-ohm phones are already available, a potentiometer such as the 250-ohm Standard Burndept Potentiometer may be substituted.



Plan view, showing wiring and layout of components.

Economics of the Output Circuit.

Amateurs brought up in the days of bright emitter valves may possibly regard this as a highly inefficient method of supplying only one pair of telephones, but when it is remembered that the total filament current to the receiver is only 0.5 amp., it will be realised any saving of filament current which might be obtained by cutting out one or both of the L.F. valves is not worth the extra complication involved. By utilising the voltage drop across the comparatively low resistance of R_2, the quality of signals from the loud-speaker is unaffected by the motional impedance of the head telephones. When the telephones are not in use, they may be short-circuited by turning R_2 to zero.

Terminals are provided for three positive H.T. tappings, one for each valve. If it is definitely decided to use a D.E.8 H.F. valve in the first L.F. stage, two H.T. tappings only are required—one for the detector valve and the other for both amplifying valves. The third tapping point has been provided in order that the anode voltage may be reduced to 100 volts in the event of a D.E.8 L.F. valve being used in the first stage. Three Siemens Super Radio batteries are used for the H.T. supply, since H.T. accumulators are out of the question in a country district. The normal economic discharge current for these batteries is 20 mA, and since the total anode current of the set is only 10 mA, it will be seen that the battery should give nearly two years' service before requiring renewal. The filament current is obtained from a 6-volt 40-ampere-hour Exide accumulator, and is controlled by the filament rheostat R_1, which has a maximum resistance of 15 ohms. This battery will light the filament for eighty hours on a single charge, which is equivalent to one month's service.

A list of components used in the installation is given on page 472. The condenser C_2 has a capacity of 0.0003 mfd., and a very suitable component for this purpose is the small fixed air-dielectric condenser manufactured by the Ormond Engineering Co. In the case of condenser C_1 we are free to choose vanes of any shape, since no condenser has yet been produced to give any particular straight line law either of capacity, frequency, or wavelength, when connected in parallel with a fixed condenser as large as 0.0003 mfd. A "Devicon" condenser was, therefore, chosen on account of its robust construction, and the fact that the vanes were of the S.L.F. type have no influence on the choice. Gambrell coils were chosen for

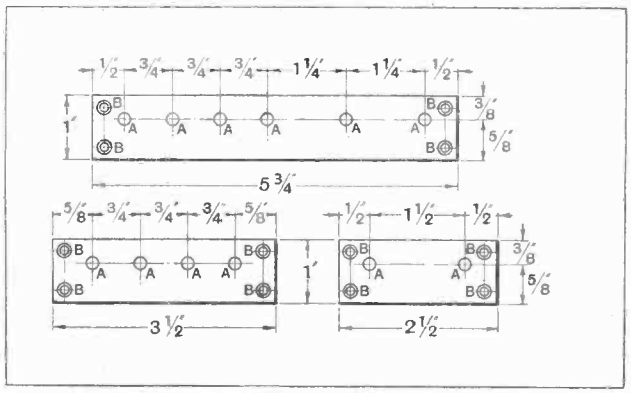


Fig. 4.—Terminal strips. A, 7/32in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws.

COMPONENTS REQUIRED.

1 Ebonite panel, 21in.×7in.×¼in. (British Ebonite Co., Ltd.).
1 Baseboard 21in.×7in.×¼in.
2 Panel brackets (A. J. Dew & Co., 33-34, Rathbone Place, Oxford Street, London, W.1.).
1 Variable air condenser, 0.0003 mfd. (Devicon).
1 Fixed air condenser, 0.0003 mfd. (Ormond).
3 Mansbridge condensers, 2 mfd. (T.C.C.).
1 Mica dielectric condenser 0.0003 mfd. (Dubilier).
1 Grid leak, 2 megohm and holder (Dubilier).
2 Transformers (Ferranti A.F.3).
3 Coil sockets, baseboard mounting.
2 Jack switches, single pole, single throw No. 6 (Lotus).
1 Filament rheostat, 15 ohm. (Burndept).
2 Filament rheostat, 30 ohm. (Burndept).
1 Valve holders (Aermonic "D").
1 Valve holder (Sterling "Non-Pong").
2 Grid batteries, 9-volt (Siemens).
12 Telephone type terminals.
33 yds. No. 38 D.S.C. Eureka wire.
Ebonite for terminal strips.
Four packets of Glazite wire.
Standard American cabinet for 21in.×7in. panel (The Caxton Wood Turnery Co., Salisbury Square, Fleet Street, London, E.C.4).

their robustness as much as for their electrical efficiency. For the two L.F. valves rigid valve holders of the "Aermonic" type were used, but for the detector a Sterling "Non-Pong" valve holder, which is mounted on sponge rubber, is essential. Howling between the loud-speaker and valves can always be traced to the detector valve, and this valve should always be mounted in an anti-vibration valve holder.

The fixed potentiometer was specially constructed, and consisted of a total length of thirty-three yards of No. 38 D.S.C. Eureka wire wound in four sections in a slotted cylindrical ebonite former ¾in. in diameter, the slots being ⅛in. wide and ¼in. deep. The total resistance of the winding is 785 ohms, and a current of only 7.5 mA is drawn from the L.T. battery. A tapping point for the grid leak is taken at the end of the first of the four sections, counting from the negative end. Two nine-volt grid bias batteries are incorporated inside the receiver for the L.F. valves, and should be renewed with the H.T. batteries.

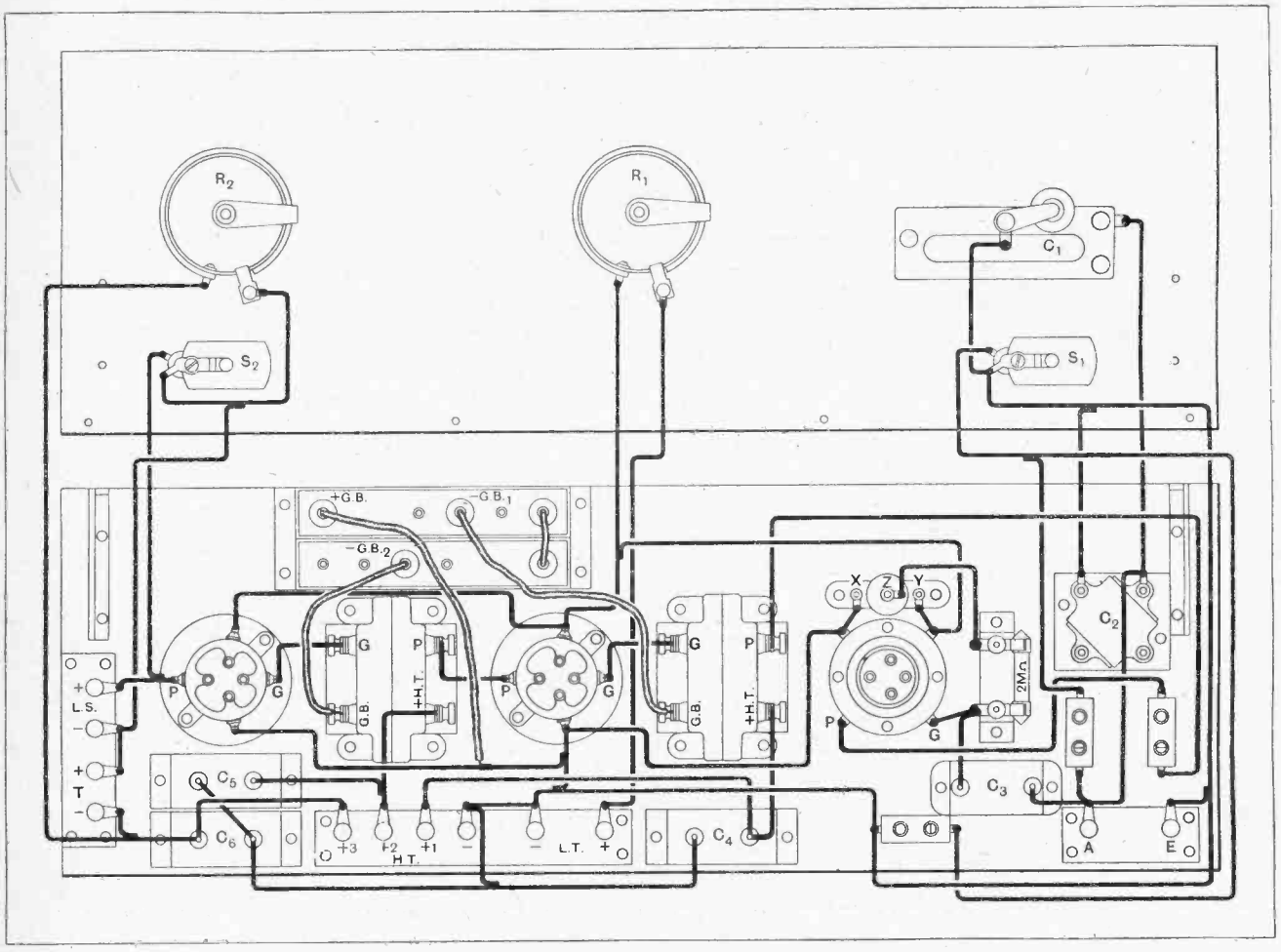


Fig. 5.—Complete wiring diagram.

Fig. 2 shows the dimensions of the ebonite front panel. On the left-hand side is mounted the tuning condenser,

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and immediately below it the switch for short-circuiting the Daventry load coil. On the left-hand side is the volume control resistance R_2, below which is mounted the switch for short-circuiting the loud-speaker. Between these two components in the centre of the panel is the filament resistance R_1, which is essentially the master switch for the set.

The layout of components shown in Fig. 3 is arranged in three natural groups falling immediately behind the controls on the front panel, to which they are associated; thus, the fixed condenser C_2, the coilholders, and the terminal strip for aerial and earth, are screwed to the baseboard immediately behind the tuning condenser, and form the tuning group of components. The valves are mounted in line, with the coupling transformers between, the power valve falling immediately behind the output-controlling components on the front panel. The output terminal strip will also be found on the extreme right of the baseboard (as viewed from the front). The battery terminal strip is mounted on the back of the baseboard. Telephone type terminals are used throughout, the heads being slotted with a hacksaw in order that they may be tightened up with a long screwdriver with the set in position in the cabinet. The battery leads are taken out through small holes in the back of the cabinet.

The wiring, which is carried out in accordance with Fig. 5, is greatly facilitated by the arrangement of components adopted; in particular the wiring of the high-frequency portions of the circuit has been rendered short and direct. It will be noticed that a diagonal connection has been made for the earthed terminals of the reservoir condensers C_5 and C_6. By this means the positive terminals become automatically adjacent to + H.T.2 and the output terminal panel respectively.

Tested on a standard 100ft. aerial, a 35-turn aerial coil gave a wavelength range of 365 to 450 metres with the Daventry load coil short-circuited. A 40-turn coil increased the wavelength range from 435 to 540 metres. A suitable size of reaction coil for this lower band of wavelengths is about 25 turns. It is not possible to give more accurate details than this regarding the size of the coils, since the correct size must be chosen for each individual aerial. For the Daventry wavelength a load coil of 100 turns will be found satisfactory. The set was tested both with a D.E.8 H.F. and a D.E.8. L.F. valve in the first L.F. stage, and, whereas signal strength was considerably reduced with the D.E.8 L.F. valve in use, no noticeable improvement of quality was observed. With a "Kone" loud-speaker full reproduction of the lower tones was obtained with the D.E.8 H.F. valve, and, of course, the amplification was very much greater.

TRANSMITTING NOTES AND QUERIES.

General Notes.

Mr. A. Sears, 29, Barbara Street, Barnsbury, N.7, is willing to give full reports of transmission. QSS, QRN, etc., to stations calling him any night from 2200 to 0200; on Saturdays from 1200 to 1800, and on Sundays from 0900 to 1500 and from 1800 to 2000.

o o o o

Mr. J. Hum, 17, Eastwood Road, Muswell Hill, N.10, writes that on September 19th, between 0350 and 0530 B.S.T., he received eleven U.S.A. Pacific Coast transmitters on an 0-v-1 receiver with a 30ft. vertical aerial, the signal strength varying between R2 and R6.

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A Caution to Transmitters on 45 Metres.

The Government station at Abu Zabal, Cairo (SUC), is now operating on a wavelength of 46.75 metres, and we understand from a correspondent that considerable interference with this station has been caused by British amateurs. For their own sakes, therefore, those who transmit on 45 metres should carefully check their wavelength and be very careful when experimenting and adjusting apparatus.

o o o o

Ulster Transmitters.

The open-aerial transmitters in Ulster have formed an association under the title of the "Radio Transmitters' Union of Northern Ireland." The rules of this society are at present under consideration, and the only office-bearer at the time of writing is the secretary. The office of president is temporarily vested in an executive committee of three. All candidates must be subscribing members of the T. and R. Section or of the parent R.S.G.B.

The first meeting was held at "Ye Olde Castle Restaurant," Belfast, on September 10th, when Mr. Eric Megaw (GI 6MU, late GX 6MU) was welcomed home from his Canadian trip. An anonymous donor had presented the Union with an Irish shillelagh, to be awarded annually to the member adjudged to have the most outstanding radio achievement to his credit in the previous year. The first honour was given to Mr. Megaw for the work done on his trip; he holds it until September, 1927, and the fact is recorded on a little silver shield on the handle.

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Cards for German Amateurs.

We are asked to state that all QSL cards and reports of German amateur transmitting stations may be sent *via* K L4, Herrn Kruschwitz, Funkverein, Reilstrasse 128, Halle-un-Saale. Herr Rolf Formis (K Y4), who has so long undertaken these arduous duties, has relinquished the task. We think we shall be voicing the general opinion of British transmitters in thanking Herr Formis for the very able way in which he has carried out the thankless duties of forwarding agent and wishing him a well-earned rest.

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Transmitters in Sarawak.

Messrs. J. R. Barnes (BN SK1) and H. G. Gray (BN SK2), of Kiching, Sarawak, wish it to be known that they transmit regularly on 34, 35, and 37 metres, c.w., between 2130 and 2230 G.M.T. daily, and occasionally between 1930 and 2330 G.M.T. They will be glad if all European amateurs will look out for them with a view to effecting communication.

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New Call Signs allotted and Stations Identified.

G 2BZW	H. E. Smith, 31, Wandle Rd., Hackbridge' Surrey.
GI 5WD	W. S. Davison, Dunmore, Taunton Ave., Belfast. Transmitting on 45 metres (2 watts).
G 5RU	L. D. Roberts, 26, St. Andrew's Ave., Ashton-on-Ribble, Preston, Lancs. Transmits on 90 metres.
KM1	Capt. G. C. Wilmot, Nigeria Regt., Zaria, Nigeria, transmits on 45 metres, 10-30 watts input, usually between 10.30 p.m. and midnight, and will welcome reports.
G 6NP	W. Gill, 6, Bank Terr., Heckmondwike. (Change of address.)
BZ 9QA	Paira Collegio Militar, Fortaleza, Ceara, Brazil.
C 8WM	(Ex C 8AZT), W. Machell, s.s. "Rosalind," Red Cross Line, St. Johns, Newfoundland. Transmits on 37.5 metres.

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Rhodesian Call-Signs.

The following list, for which we are indebted to our South African contemporary *Radio*, will probably be of interest to British transmitters :—

1 SR	J. M. Davidson, Box 580, Salisbury.
2 SR	G. Musgrave, Box 38, Selukwe.
3 SR	E. Jephcott, c/o G.P.O., Salisbury.
4 SR	D. Mail, Box 165, Bulawayo.
5 SR	The Rev. Witeside, St. George's School, Bulawayo.
6 SR	H. P. Heaume, Post Office, Selukwe.
7 SR	A. Pryce Williams, Antelope Mine, via Bulawayo.
8 SR	J. van Ryneveld, Shepherds' Reef, Hartley.
9 SR	S. Emptage, Salcombe, Plumtree.
1 SRA	Portable Station of 1 SR.
2 SRA	K. C. Fynn, Box 387, Salisbury.
3 SRA	The Rev. Tull, c/o Post Office, Mrewa.
4 SRA	E. C. I. Ade, Box 267, Salisbury.

THE BERLIN WIRELESS EXHIBITION.

Enterprising Methods of German Radio Manufacturers.

THE third annual German Wireless Exhibition was held in Berlin from September 3rd to 12th. The exhibits were confined to German manufacturers, no goods of foreign manufacture being admitted. The exhibition was organised jointly by the State, the City of Berlin, and the "Verband der Funk-industrie," an association of wireless manufacturers. The official opening of the exhibition was made the occasion of the dedication of the new tower which is to carry the Berlin broadcasting aerial and which stands in the exhibition grounds. As the ceremony was broadcast from all German transmitters, some of our readers may have heard it, although the time, viz., 11 a.m to noon, was not one at which many people can conveniently listen-in. The ceremony, which took place in the open air at the foot of the tower, comprised speeches from Dr. Bredow, representing the State, the Oberbürgermeister of Berlin, the Director of the Berlin Messe-Amt, who is responsible for all the exhibitions held officially in Berlin, and the Secretary of the Verband der Funk-industrie; the musical items included the "Leonore" overture of Beethoven played by the Wireless Orchestra, several items by a special brass band stationed about 50 feet up the tower, and a chorus from the "Meistersingers of Nürnberg," given by the Wireless Orchestra and an enlarged Wireless Chorus.

At the close of the opening ceremony the exhibition was opened to the public.

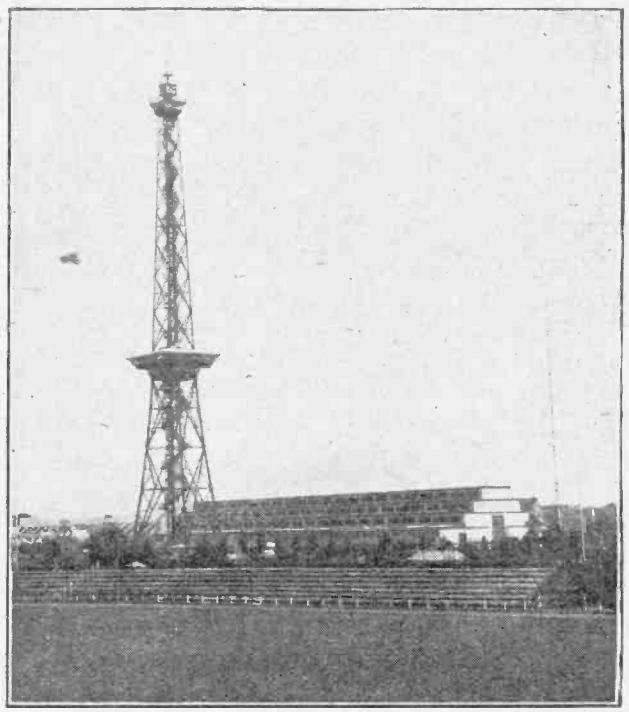


Fig. 1.—General view of the exhibition buildings and tower.

The Exhibition Building of the German Wireless Industry.

The City of Berlin has taken a large tract of land—an old parade ground about five miles from the centre of the city—and set it apart as an exhibition ground. On this land there are now three large exhibition halls, the first of which "Das Haus der Funk-industrie" was erected two years ago for the purpose of holding the first German wireless exhibition. The idea of the wireless industry of any country erecting their own exhibition buildings as a permanent structure on the outskirts of the capital is so striking, and the actual building presents so many points

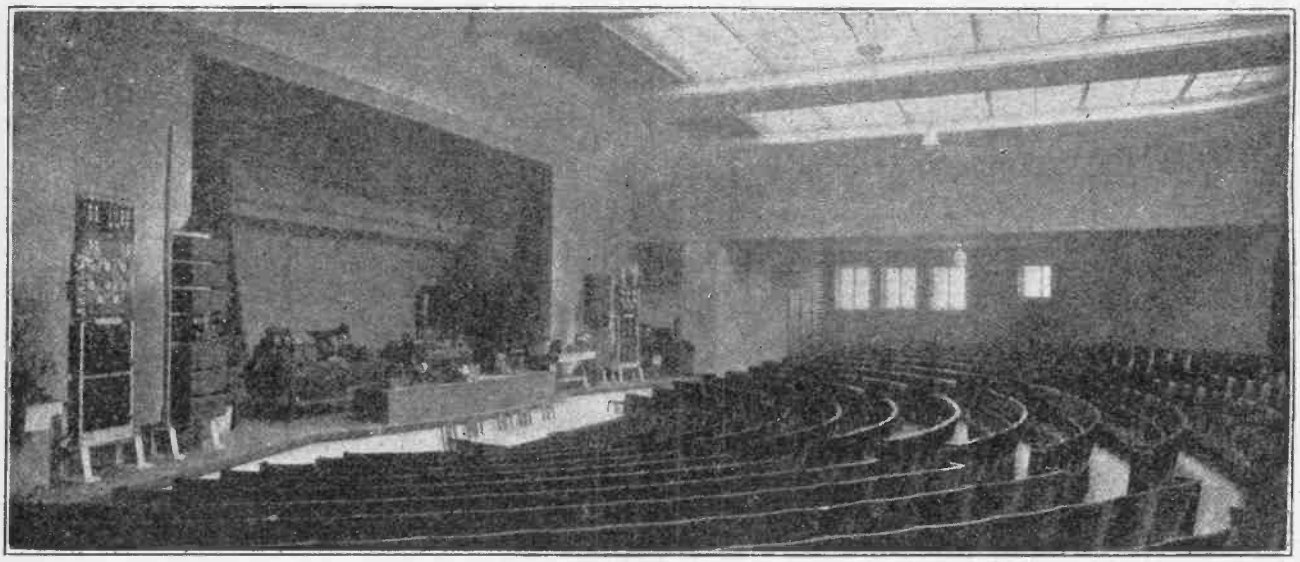


Fig. 2.—Lecture hall and experimental theatre.

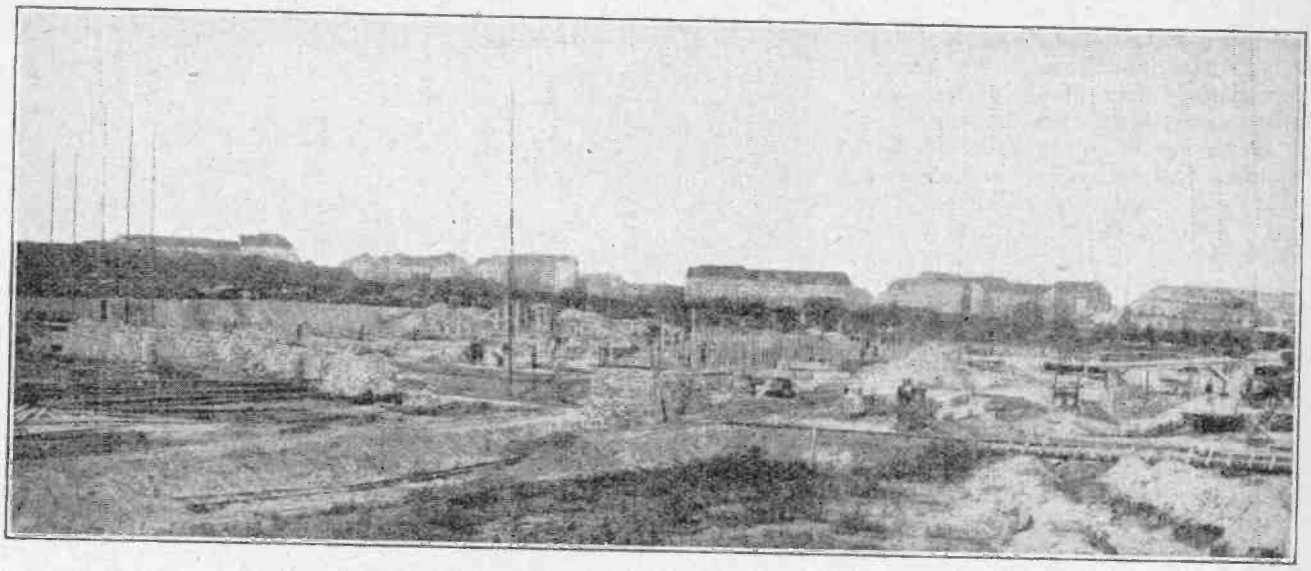


Fig. 3.—Site of the exhibition buildings as it appeared on July 27th, 1924.

of interest that we feel sure our readers will welcome a brief description of the undertaking.

After some discussion it was decided to avoid the use of iron as much as possible and to erect a wooden building. Except for the brickwork of the lower walls the building is almost entirely of wood; but owing to the wood being encased in fire-proof material, it has the appearance inside of a concrete building. The external appearance is very striking. As the building also houses the Berlin Broadcast Transmitter, an extensive system of earth wires was buried in trenches under the building before putting in the foundations. The main hall is rectangular, 430ft. long and 136ft. wide, with a gallery all round. Behind most of the stands, both on the ground floor and on the gallery, are sound-proof cubicles for demonstrating headphones and loud-speakers. During the wireless exhibition the local transmitter is not used, the Berlin broadcast being given from another aerial in another part of the city. Two wires were stretched from end to end high up under the roof, and from these were hung a large number of receiving aerials, one for each stand if necessary. This hardly commends itself as an ideal arrangement for demonstrating the qualities of receiving apparatus and loud-speakers, although several exhibitors stated that it

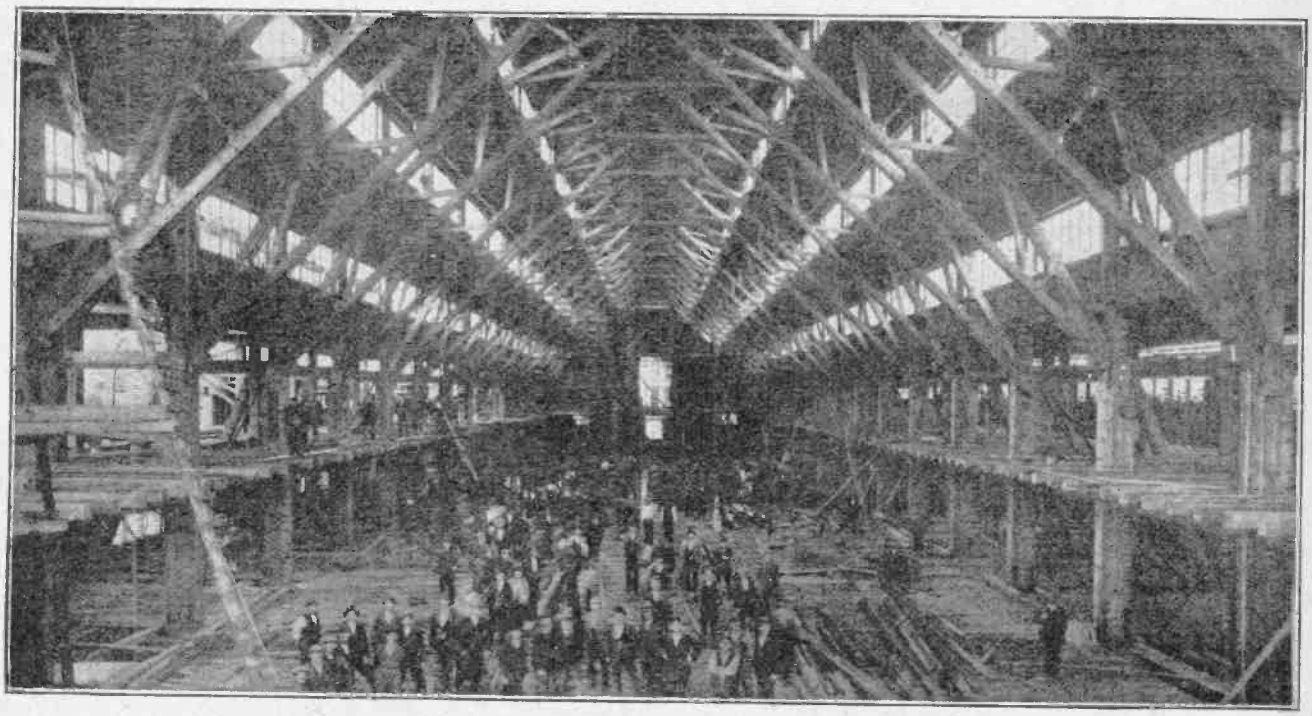


Fig. 4.—Interior of the main building on September 24th, 1924, after only two months' work.

The Berlin Wireless Exhibition.—

worked much more satisfactorily than one might have anticipated. We certainly heard many loud-speaker demonstrations without any sign of interference.

As an annexe to the main hall is the entrance hall and offices flanked on one side by the restaurants and kitchens covering a space 95ft. by 41ft., and on the other side by the lecture hall, which is fitted with a stage and all the necessary accessories for giving theatrical and musical performances. This theatre has a separate entrance from the street, and cloak-room accommodation, so that it can be used when no exhibition is being held. It should be explained that although built primarily for the wireless industry, the hall is used for a succession of exhibitions of all kinds. During the wireless exhibition a revue was performed twice daily in the theatre, tracing in a humorous way the history of music through the ages down to its latest development, in which it is associated with an aerial and loud-speaker.

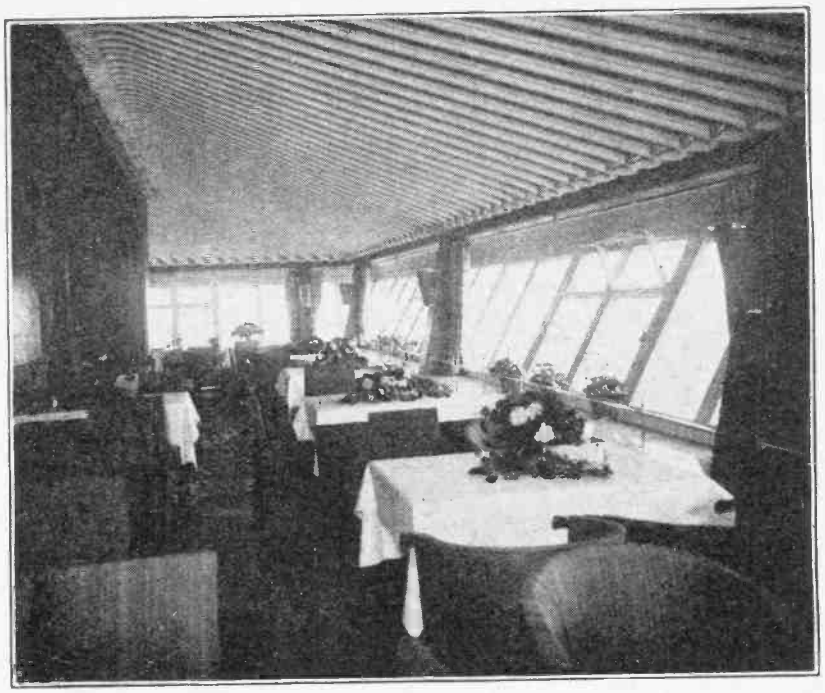


Fig. 5.—Interior of wireless tower restaurant erected on a platform at a height of 150ft.

One of the most striking things about the exhibition building is the fact that it was completed in three and a half months from the commencement of the work. Fig. 3 is from a photograph taken on July 27th, and Fig. 4 from one taken on September 24th, 1924.

The New Berlin Wireless Tower.

The tower has a total height of 453ft.; like the Eiffel Tower it is self-supporting, but is only about half the height and has not the widely spread base. It has been designed to answer a double purpose, for in addition to supporting the broadcasting aerial, it is to be used as an outlook tower and as an aerial restaurant. At the top is a revolving searchlight which will act as a useful guide to aircraft approaching Berlin. Just below the searchlight is a platform to which visitors are taken by a lift for ten persons; from this platform a very fine view is obtained, the city one one side, the Havel and Grunewald on the other. At a height of 150ft. a restaurant has been built into the tower with two floors, the upper one being the restaurant proper and the lower one the kitchens, etc. The restaurant is beautifully fitted and equipped and capable of providing first-class meals, and the windows are brought so low that one can sit at the tables and look down on the surrounding country.

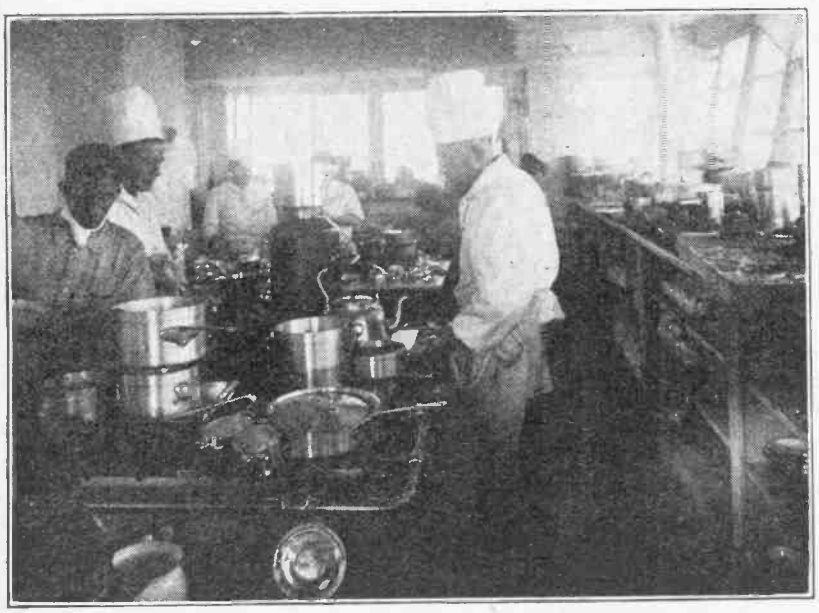
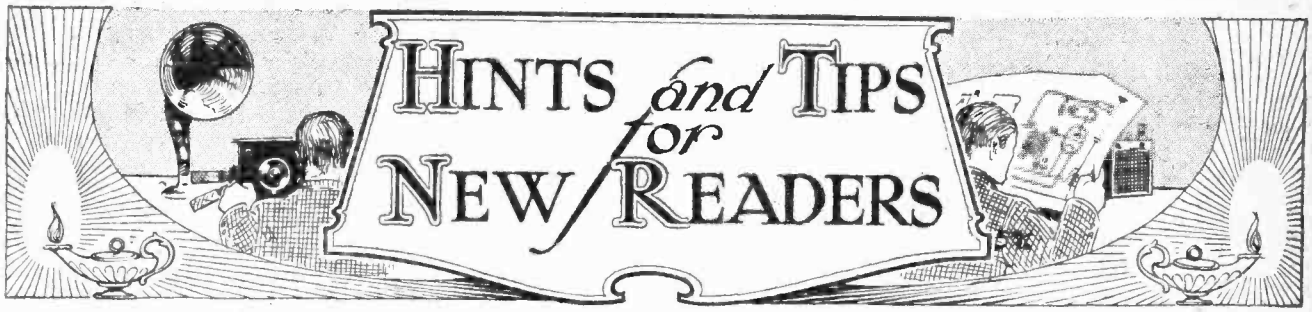


Fig. 6.—The restaurant kitchens.

This restaurant added greatly to the complication of the construction of the tower for it necessitated taking up to a height of 150ft. steam pipes for heating the restaurant in the winter, the pipes being very carefully lagged; electric cables for lighting and for ventilators, water pipes, drain pipes, and gas pipes. Not only had provision to be made for expansion and contraction of these various pipes, but it was intended at one time to insulate the tower from the earth and this would have necessitated special arrangements, but we understand that it has now been decided to work with the tower earthed; we noticed that the careful insulation of the feet of the tower was short-circuited by copper strip running to earth.

G. W. O. H.



A Section Devoted to the Practical Assistance of the Beginner.

FILAMENT RHEOSTAT CONNECTIONS.

Individual control for valve filaments may be desirable under certain conditions, and is generally provided by variable resistances. There is no doubt, however, that the turning on and off of a number of rheostats becomes a somewhat wearisome process with a multivalve set, and it is accordingly quite a usual practice to fit a "master" resistance, as shown at R_3 in Fig. 1 (a), which allows all the valves to be turned on or off in one movement without disturbing the settings of the individual rheostats, R_1 and R_2. Alternatively, a simple single-pole break switch is often fitted in place of this resistance.

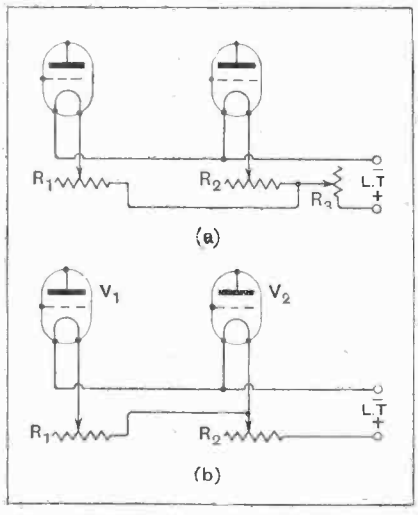


Fig. 1.—Methods of filament control.

When two different types of valves, taking different currents at approximately the same voltage, are used, it is often possible to simplify the filament circuits by adopting the arrangement shown in Fig. 1 (b), in which the rheostat R_1, controlling the low-current valve (V_1) is connected in series with R_2, which controls V_2 assumed to take a heavier current.

The advantage of this method of connection lies in the fact that both valves are turned "on" or "off" by means of the second rheostat (R_2) without interfering with the adjustmen of R_1, no extra apparatus being required. The same arrangement can obviously be used with any number of valves, provided that those of the same class are used in each group, although it will not be possible to arrange for separate control of each filament, except at the expense of some complication.

To take an example, we can imagine a four-valve set with two valves taking 0.3 amp. at 1.8 volts and two taking 0.09 amp. at the same voltage. The filament of the low-consumption valves would be connected in parallel in place of V_1 in the diagram, and the two rated at a higher amperage would be similarly connected in place of V_2.

It should be pointed out that the setting of the rheostat R_2 will affect the current passing through both valves (or groups of valves). This, however, is not a very serious drawback in practice, provided that an indicating dial is fitted to the control knob.

° ° ° °

CONNECTING TERMINALS.

The fitting of a "spade terminal" or thimble to the end of a flexible lead is by way of being a refinement often considered as unnecessary, but the use of these "gadgets" certainly reduces the possibility of a faulty contact and facilitates the changing of connections. They are particularly useful on L.T. battery leads, as corrosion due to the action of acid can be more easily prevented by the use of vaseline on a thimble than on the bare end of the wire.

The attachment of these spade (or pin) terminals to the leads is not such a simple matter as it might seem at first sight, particularly if the connection is to be soldered, as is specially desirable in the case of the accumulator connections mentioned above. If the bared end of the wire is merely laid into the sleeve and soldered in position, all the strains imposed by bending will be concentrated at the point where the bare wire enters the sleeve, and the strands will soon break. Moreover, the braided covering of the wire will become frayed unless it is bound with thread, which operation is apt to be tedious when a number of leads have to be prepared.

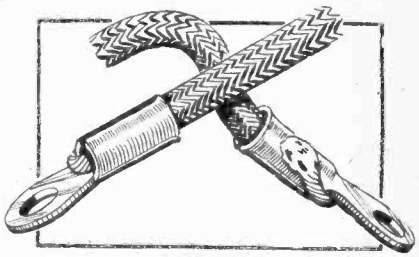


Fig. 2.—Finishing off connecting leads.

A better method of making the connections is shown in Fig. 2. The wire, with its covering, is laid into the sleeve and secured in position by compressing the sides with a pair of pliers or in a vice, after which a projecting bared end, about ½in. long, is soldered to the sleeve. Care should be taken to use as little heat as possible, to avoid melting the rubber insulation inside the sleeve.

RESISTANCE OR TRANSFORMER COUPLING?

The relative advantages of resistance and transformer L.F. intervalve couplings still provide grounds for controversy, and it is not strange that the amateur is sometimes puzzled as to which to adopt. A lengthy dissertation on the merits and demerits of rival systems is most certainly beyond the scope of these notes, but it is permissible to offer a hint which may possibly be of some assistance to readers who are in this position of uncertainty.

Where considerable volume is required, up to the maximum capacity of the average small power valve, there will be a tendency to overload on occasional deeply modulated passages, even if the valve is being worked to its best advantage. In cases of this sort the advantage may almost certainly be said to lie with the transformer-coupled amplifier, particularly as far as the last stage is concerned. The effect of an occasional flow of grid current such as will be almost inevitably produced when working a valve at the limit of its voltage-handling capacity is certainly more serious from the point of view of quality in a resistance-coupled amplifier, on account of the presence of the necessary insulating grid condenser. This condenser, when grid currents are flowing, acts in much the same way as does the condenser associated with a cumulative rectifying valve, and it is this cumulative effect which accounts for the trouble. Distortion may still exist for an appreciable period of time after the specially strong impulses which originally gave rise to grid currents have passed.

A reduction of the grid leak resistance may help to put matters right, but by adopting this plan we are apt to defeat our own ends by appreciably reducing the overall amplification which would otherwise be obtainable, particularly on the lower range of frequencies.

In view of the above, it is fairly easy to see why the majority of modern designers, when arranging an amplifier with a combination of resistance and transformer-coupled valves, usually prefer to put the resistance immediately after the detector valve, where the L.F voltages are low.

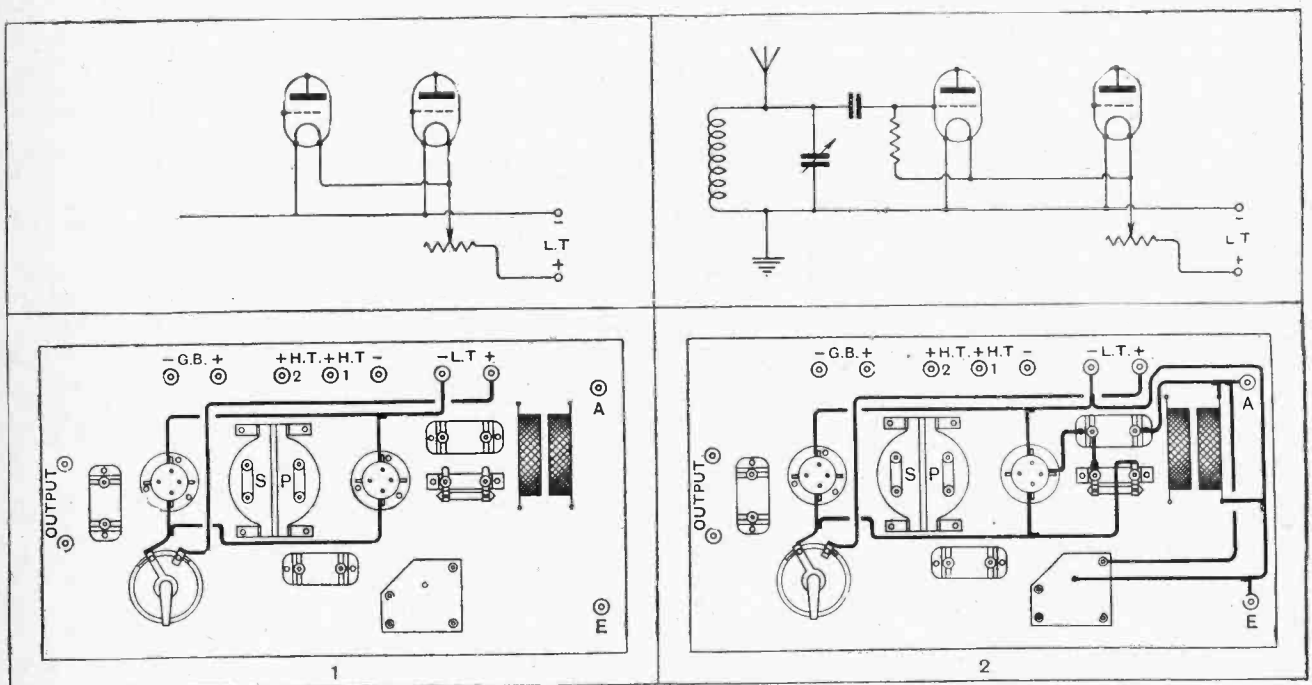
DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 45 (a).—A 2-valve Detector L.F. Receiver.

(To be concluded in next 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 receivers. The circuit shown below comprises a detector valve with reaction, directly coupled to the aerial, with one L.F amplifier, and provides one of the simplest possible loud-speaker receivers. It is a good set for the beginner, but is not particularly selective.



The filament circuits are wired in the usual manner. In this particular case a single rheostat isused to control both valves.

Aerial and earth are connected to the tuned circuit, which is joined across grid and filament of the valve. A leaky condenser is inserted.

INVENTION.

How Problems are Attacked by the Research Worker and Development Engineer.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

INVENTION is a fascinating pastime and a stimulating mental exercise for the amateur. For the professional it is a necessity, and does not always carry the same intense enthusiasm. There are two main categories into which invention can be divided: (*a*) Inventions to fulfil a specific purpose, *i.e.*, inventions to order, using available apparatus and methods, (*b*) futuristic inventions which aim at some purpose not formerly achieved, *e.g.*, television. There are difficulties in both cases, but those in (*b*) are usually by far the greater of the two.

Dealing with case (*a*) first, we might be asked to invent a receiving apparatus to respond to a certain sequence of long dashes. This at first appears to be very easy, but the conditions imposed are usually quite sufficient to lift the problem from the realm of consummate ease to that of grave difficulty. It would take too long to quote the whole issue from A to Z, and the reader is asked to use his imagination as far as possible.

Economic Restrictions.

The first and foremost restrictions in all invention are the inevitable ones of economy in prime cost and economy in maintenance. For example, in the above case a certain five-valve receiver might fulfil the condition of providing sufficient signal strength, but might be over-ruled on the question of cost. The inventor must, therefore, sit down and imagine he is solving a mathematical problem. He has certain variables and certain constants, and out of these he tries to construct equations of determinate form capable of solution in terms of the constants. That is to say, he marshals all possible modes of achieving the functions performed by the various components of the invention, and then proceeds to select one from each and build a composite structure.

Taking the above case, there are several components we can cite, namely (1) an aerial and receiving system which shall exclude as far as possible all signals but that required; (2) an amplification system in which the maximum of amplification and stability is attained with the minimum number of valves; (3) valves which are reliable and also cheap both in prime cost and maintenance; (4) A selector system which will respond to the agreed signal only, and shall be cheap, efficient, and easy to maintain in operation and adjustment.

Compromise.

The inventor, therefore, ascertains all feasible modes of fulfilling each of the four conditions, and endeavours to fit four of them to meet his requirements. But this is not the completion of the job. There are other phases to be considered. Examples of these auxiliary aspects are:—(1) Does the arrangement readily permit of replacement of parts in the event of a breakdown? (2) Can the wavelength be altered sufficiently to meet future changes? (3) Will the apparatus fit into the existing space? (4) Could the selector device be replaced by another form without serious alterations being required? These will show that when the whole situation is summed up, there are all kinds of conditions—climatic, circumstantial, spatial, financial, etc.—which govern the design. Sometimes one condition will ruin the possibility of an exceptionally good design. Occasionally, conditions can be commuted to cope with a good design, but this is more the exception than the rule, and in general some sacrifice has to be made in the efficacy of an otherwise excellent design.

Sometimes the conditions are so stringent that an economical design is quite impossible. In other cases space limitation is in question, and it may be impracticable to install the apparatus without extending the premises. Under such conditions it may be difficult to get permission to enlarge the premises, for it is extremely hard to persuade the administrative mind to spend money on anything but the bare equipment. This being so, one must be prepared for possible operating failures, which, if repeated sufficiently, call for some notice being taken, and ultimately there is a speedy rectification of the trouble which need not have arisen.

Utilising New Discoveries.

There is another side to the "job to order" invention which is of appropriate interest. Suppose it is necessary to improve on a certain operation or process. The inventor turns over and classifies in his mind the merits of each method of doing the job. He may find that no appreciable improvement is possible under the existing *régime*. Some new phenomenon or effect is required to supply the missing link. Now, one cannot sit down and say, "I am going to discover a new effect," and forthwith perform a series of experiments, when, lo! the rabbit appears in the hat. If this were so, there would be an end to research, for we should be able to conjure up anything we pleased.

When all available apparatus, ideas, and phenomena fail to supply the solution to our problem, we have more or less to wait and see what turns up, meanwhile directing our attention to other matters. Occasionally, one is fortunate, and a new effect is found which can be put to practical use immediately.

It is much more likely, however, that one will find an effect which must bide its time before being absorbed by industry.

Invention.—

Now we come to the problem of futuristic inventions. The example we quoted above, namely, television, is quite apt. It is occupying the immediate attention of a number of workers, but it still remains as elusive as ever. Here it is possible that some missing link is wanted. Just as the thermionic valve was the link required to make radiotelephony a commercial possibility, a national hobby and an entertainment, perhaps some equivalent link is required for television. It must be remarked, however, that radiotelephony was conducted before the advent of the valve, whereas satisfactory television has not been effected at all. Moreover, some form of television may be possible without the "link," which may prove necessary to make it a commercial proposition. At any rate, after the first successful attempts, and after a satisfactory system is attained, much work will have to be done to reach a reasonably high standard of reproduction. It is this last lap which is so difficult, *i.e.*, to get the invention well-nigh perfect. We have an excellent example in broadcasting, where the difficulties which blocked the path to extremely high-class reproduction have been really serious. Another example is to be found in the gramophone. The highest pinnacle cannot be attained without much mathematical skill and superb inventive faculties. It would seem just as difficult, if not more so, to perfect television as it would to invent a crude scheme which makes the thing possible. In both cases there are missing links. In one the link is crude, whereas in the other it bears the hall-mark of accurate workmanship.

So far as credit is concerned, it is often the case of the originator getting the lion's share after the enormous initial public interest. Whilst we are in the throes of the intermediate stages, the populace settles down to its fate, and accepts distortion cheerfully. The accommodating propensities of the ear are too well known, but will our optical arrangements be so lax in their behaviour? Shall we pardon a distorted ankle? That remains to be seen! If we get sufficiently accustomed to seeing and appreciating some star performer through distorted vision, what shall we think when he appears in the flesh? It will be interesting to see exactly what comic turns television can take under the benign influence of oscillation and the various ills to which radio is heir. Nevertheless, its inception will be very welcome. It will be much more pleasant to see the Boat Race or Brooklands than to hear a series of disconnected sounds which may mean anything or nothing, and are not always like the original. When the inventor perfects television, the idea will have lost all its novelty and charm. The broadcaster may be so accustomed to making allowances for distortion or feel disinclined for further financial investment that the superset may not tickle his fancy. And so the inventor who gets the last ounce out of television may neither reap the reward nor the recognition of him who created the invention. His efforts are likely to be appreciated by a later generation.

The positions, however, are often quite different, and the inventor gets neither cash nor kudos. If his idea is put into commercial form after the lapse of the usual fourteen years' patent lease, the reward will doubtless go elsewhere.

NOVELTIES FROM OUR READERS.

LOOSE VALVE BASES.

The bases of receiving valves are fixed to the glass bulb with a special compound containing plaster of Paris. Frequently this becomes loosened, and there is a risk of breaking the internal connections between the "pinch" and the valve sockets.

Valves in this condition should on no account be neglected. A turn or two of black adhesive tape over the junction between the glass and the base will effectively stop further movement if applied in time.

Incidentally, it is worth noting that methylated spirit will dissolve and loosen the plaster compound if it is desired to remove the base for special work on short wavelengths.—A. E. J. M.

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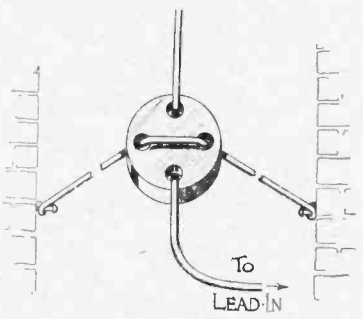
DOWN-LEAD INSULATOR.

The down-lead of an aerial when in proximity to the walls of buildings must be very carefully suspended in order to reduce capacity to earth, and also to prevent apparent fading effects due to swaying of the lead.

A very effective method of staying the down-lead is shown in the diagram. The insulator is the porcelain base of a wall plug or tumbler switch, and the down-lead is threaded through diagonally opposite holes.



Method of bracing aerial down-lead.

The staying wire or cord is then passed through another pair of holes at right angles and secured to staples driven into the walls of the adjacent buildings. It will be found that the tension of the down-lead can be easily altered to suit different weather conditions, but the insulator will not slip of its own accord.—W.A.T.

H.T. TAPPINGS

Having found by experiment the correct tapping points on a dry cell H.T. battery it is desirable to make a more positive connection than is generally given by wander plugs. This can be effected by tapping the inside of the appropriate sockets and inserting a $\frac{1}{2}$-in. length of screwed rod to which the tapping wire may be clamped by means of a terminal top or between lock nuts and a pair of No. 4 B.A. washers.

It will be found that the diameter of the hole in a standard H.T. tapping socket is No. 4 B.A., clearance. Before tapping the hole see that the socket is securely set in the pitch, or paraffin wax covering the tops of the battery cells and their connections otherwise the internal connection to the battery may be broken. If at all loose the socket can be secured by warming the surrounding material with a hot iron. After the sealing compound has set, the socket may be carefully threaded with a No. 4 B.A. "taper" or "intermediate" tap.—E. W. F.

DESIGN FOR A WAVEMETER.

Details of a Heterodyne Wavemeter for the Range 20 to 2,000 Metres.

By F. M. COLEBROOK, B.Sc., D.I.C., A.C.G.I.

THE following is a description of a heterodyne wavemeter for use on wavelengths from 20 metres to about 2,000 metres. The special characteristics of the design are as follow:—

(*a*) It is self-contained, *i.e.*, the necessary filament and anode batteries are contained in, or attached to, the case.

(*b*) The calibration is very little affected by changes in the valve or supply circuit. This point is considered in greater detail later on, but it may be stated that comparatively large changes in anode or filament voltage, and even the changing of the valve for another of the same or a different type, do not cause changes greater than $\frac{1}{2}$ per cent. of the wavelength generated, while the changes inherent in the operation of the wavemeter, such as the insertion of telephones in the anode circuit and comparatively small changes in the supply voltages, produce variations of considerably less than $\frac{1}{2}$ per cent. in the wavelength. It is recognised that this degree of constancy is not as high as can be obtained by means of specially designed circuits (see, for instance, the paper by E. Fromy in *L'Onde Electrique*, October, 1925, pp. 433-441, and the paper by Col. Edgeworth, read before the Wireless Section, I.E.E., on January 6th, 1926), but the constancy indicated is sufficient for most general purposes and is obtained with a very simple circuit using plug-in coils and only one tuning condenser.

(*c*) The oscillator can, if desired, be made to generate interrupted continuous waves having almost any desired frequency of interruption. This result is obtained without any mechanical interrupter by utilising a well-known but apparently little used grid-leak effect. This feature has proved to be of very great value in the adjustment of receiving apparatus to definite wavelengths by means of the wavemeter.

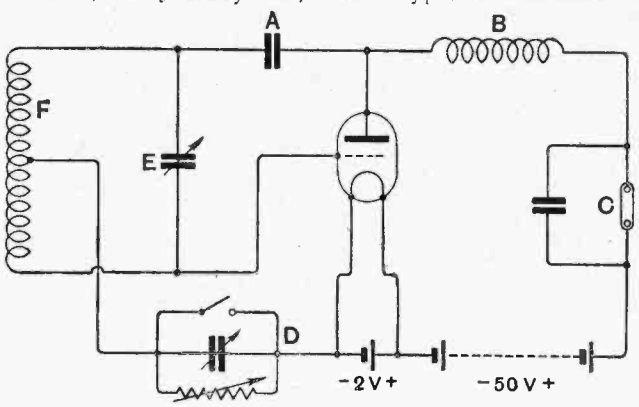


Fig. 1.—Circuit diagram of the wavemeter.

The range indicated is not the limiting range of the design described. For one of the models constructed the range has been extended to 5,000 metres by using a larger variable condenser and coils of greater inductance. In the region 2,000-5,000 metres, however, the degree of constancy indicated above is not maintained, and the changing of the valve would appear to require a fresh calibration, while the use of the interrupter causes changes of from 1 per cent. to 2 per cent. in the wavelength.

The circuit is shown diagrammatically in Fig. 1, and is seen to be an ordinary shunt Hartley arrangement, similar in principle to many of the circuits being used at present for short-wave generation. The details of the components are as follows:—

A. Small fixed air dielectric condenser, of capacity about 100 micro-microfarads. It has been found by experiment that from the point of view of wavelength constancy this coupling condenser should be as small as is consistent with the production of oscillations of sufficient amplitude. An experimental model was built up with switch gear for changing the valve from a dull emitter of one make to a bright emitter of another, and the consequent percentage change of wavelength was determined for varying magnitudes of this coupling condenser. At a wavelength of about 100 metres the change increased from 0.22 per cent. to 0.5 per cent. when the coupling condenser was increased from 50 micro-microfarads to 1,000 micro-microfarads, and at 1,000 metres a similar effect was observed. This effect changes sign at wavelengths beyond the range for which the present wavemeter is designed. Thus, at 3,000 metres the constancy improves as the coupling capacity is increased up to 1,000 micro-microfarads.

B. Radio-frequency choke coil. This is of the flat disc type, an annular slot of external and internal diameters 10 cm. and 4 cm. respectively and width about $\frac{1}{16}$in. being wound with two to three thousand turns of No. 44 enamelled copper wire.

In an earlier model this choke was wound in the form of a single layer solenoid, but this pattern was found to give rise to an effect which is of sufficient general interest to warrant a brief description. It was found that at certain frequencies the wavemeter oscillation was greatly reduced in amplitude and in some cases failed completely. The affected wavelengths, which were found to be independent of the oscillating circuit, were eight in number, ranging from 20 metres to about 115 metres, and were found to agree fairly closely with what may be termed the open organ pipe series of harmonics for a fundamental of 340 metres. This indicated that the reason for the missing wavelengths was harmonic resonance in the solenoid choke coil. The substitution of a pile wound disc choke, as described above, eliminated this effect completely.

C. Link for telephones, shunted by a 1,000 micro-microfarad mica dielectric condenser. This condenser is not essential, but reduces the very small change in wavelength caused by the insertion of telephones in the anode circuit.

Design for a Wavemeter.—

D. Interrupter. The interrupter consists of a variable grid leak, 0.5 to 5 megohms, in parallel with a 0-1,000 micro-microfarad variable condenser of the mica dielectric pattern, in parallel with a short-circuiting switch. On opening the switch and suitably adjusting the grid leak and condenser it will be found that an audible note can be produced in the telephones in the

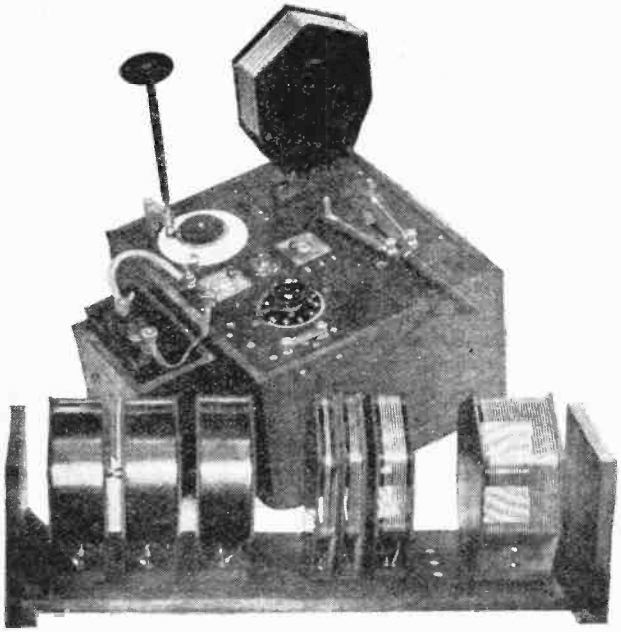


Fig. 2.—General view of wavemeter showing method of constructing short-wave coils.

anode circuit. This audible note, the pitch of which can be varied over a very wide range, is caused by the rapid starting and stopping of the wavemeter oscillations, an effect which is well known and has already been described.[1]

Effect on Calibration.

Over the range specified it will be found that the use of the interrupter does not cause a change of more than ½ per cent. in the wavelength, and in most cases the effect is considerably less than this.

E. Variable condenser. It was very desirable that this should be of low power-factor and robust construction, with as large an air gap as space will permit. A suitable maximum value is 250 micro-microfarads. A remote control vernier drive should be used, to facilitate accuracy of setting and to decrease the effect of body capacity, but the scale or pointer should be rigidly attached to the moving plates to avoid any effect of the vernier drive on the scale reading.

A fixed air dielectric condenser of 250 micro-microfarads is connected in parallel with the variable condenser by means of a low capacity switch, in order to extend the range of any given coil. This is not necessary, but reduces the number of coils required, or, alternatively, ensures a wide overlap of ranges for the various coils.

F. Coils. The type of construction adopted for the short wavelength coils is shown in the photograph, Fig. 2. It was adopted with a view to the minimisation of high-frequency resistance and self-capacity. At the short-wave end of the range low resistance is a very important factor. It was found that the introduction of a few ohms in the oscillating circuit was enough to stop the oscillations completely.

Coil Construction.

The windings are of No. 18 bare tinned copper wire, and are hexagonal in form, each side being approximately 7 cm., the wire being located in square grooves, ten to the inch, cut in ½in. diameter ebonite rod, six of such grooved rods of appropriate length being supported between end plates of ⅛in. ebonite. Valve legs are used for the three contacts, mounted as shown in the photographs. The centre contact must be taken to the exact geometrical centre of the winding, or, alternatively, the three valve leg contacts must be disposed unsymmetrically to ensure that the coils are always plugged in the same way round.

The ranges covered by the various coils with the 0-250 micro-microfarad variable condenser and the additional fixed condenser are as follow:—

(*a*) 4 turns: 20 to 90 metres.
(*b*) 8 turns: 40 to 160 metres.
(*c*) 14 turns: 60 to 250 metres.
(*d*) 24 turns: 90 to 370 metres.

It will be seen that a very generous overlap is provided by this range. Actually, the first coil and one other of, say, 20 turns, would between them cover the range 20 to 300 metres, but a fairly wide overlap is desirable for various reasons.

For the range above 300 metres the type of coil construction is not quite so important. It seems that almost any type can be used provided it gives fairly low self-capacity and a reasonably low resistance. For the present model two equal honeycomb windings on pins of ⅛in. ebonite, which are left in position to give rigidity, are used for each coil, and mounted side by side between end plates similar to those used for the short-wave coils. No detailed description is necessary, as there are no special points in the construction.

Miscellaneous Details.

(*a*) *Provision for Coupling:* As can be seen in the photograph, a pair of valve sockets are mounted on a movable ebonite fitting supplied with two terminals. A coil for coupling the wavemeter to some other circuit can, if desired, be plugged into these sockets. It should be remembered, however, that if any such coupling is used, the oscillation wavelength will necessarily be altered, unless the coupling is exceedingly small.

(*b*) *Valve:* A two-volt dull emitter receiving valve has been found quite suitable. An ordinary R valve can also be used, but has the disadvantage of requiring a higher anode potential.

(*c*) *Anode Battery:* A 50-volt block dry battery of large capacity is housed in the base of the wavemeter case.

[1] "Howling in Resistance Amplifiers," F. M. Colebrook, *Experimental Wireless*, Vol. I., No. 6, pp. 321-323.

Design for a Wavemeter.—

(*d*) *Filament Battery:* A 2-volt accumulator is housed in a wooden case attached to the side of the wavemeter.

Constancy of Calibration.

The data in the following table, which are representative of a large number of readings, will indicate the degree of constancy of wavelength with respect to changes in the valve circuit. This constancy does not appear to depend to any marked extent on the magnitude of the tuning capacity, though there is a tendency for larger variations to be associated with the very small or zero tuning capacity readings. For this reason a fairly generous overlap of wavelength range in the various coils is advantageous.

This work was carried out for the Radio Research Board under the Department of Scientific and Industrial Research, and the writer is indebted to the Committee on Propagation of Waves and to the Board for permission to publish this description.

TABLE.

Wavelength (Metres).	Circuit Change.	Percentage Change in Wavelength.
100	Dull emitter changed for R. valve	0.43
1,000	" " " "	0.35
1,000	Dull emitter valve. Interrupter in circuit ..	0
100	" " " " " ..	0
65	" " " Changed for another of same type	0
65	" " " Changed for D.E. 2-valve	0.13
570	" " " " "	0.1
570	" " " " Interrupted	0.1
1,830	" " " Changed for another of same type	0.4
1,830	" " " Changed for D.E.2	0.3
1,830	" " " " " Interrupted	0.4
450	Original valve. Anode voltage raised from 50 to 75	0.09
450	" " Anode voltage reduced from 50 to 25	0.25
	Valve changed to D.E.5B valve (fil. volt 6)..	0.17
	" " " fil. voltage reduced to 5	0.25

MANUFACTURERS' NEW APPARATUS.

A Review of the Latest Products on the Market.

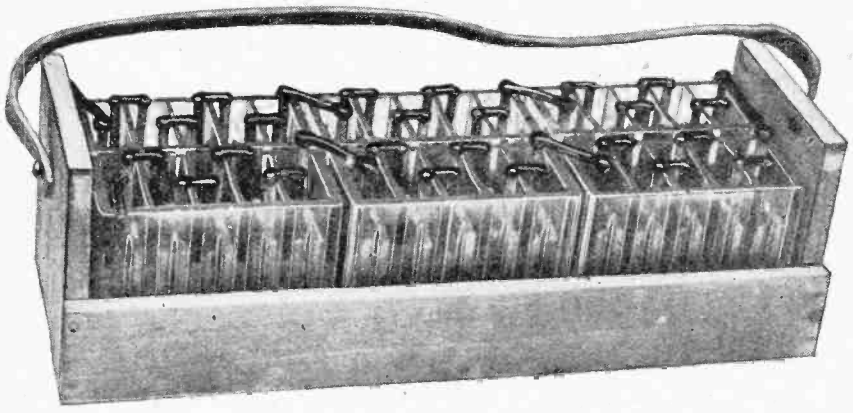
OIL SUBMERGED ACCUMULATOR BATTERIES.

It is well known that accumulator high-tension batteries give reliable service only when the connecting lugs in the tops of the cells are kept scrupulously clean. If neglected, a cell to cell low insulation results, which eventually leads to the discharge of the battery with corrosion between the lugs and terminals. Considerable interest was aroused by a recent article in the pages of this journal describing an accumulator battery which was completely immersed in a trough of oil, and the production of these batteries commercially will undoubtedly be welcomed.

Several types are available, and are manufactured by Accumulators Elite, 32, King Cross Street, Halifax, a popular 60-volt model being shown in an accompanying illustration. It is built up in six sections, each comprising five cells enclosed in a single container. The plates are held in position by grooves moulded in the sides of the containers so as to avoid the need for wood, ebonite, or celluloid separators; at the same time, the absence of separators permits of the easy withdrawal of the plates. Each cell, after being filled to the required level with the electrolyte, is covered with a layer of oil, which effectively stops the escape or creeping of acid and prevents evaporation.

Larger batteries are available in which the entire assembly of cells is oil-covered, including the lugs and cross connectors.

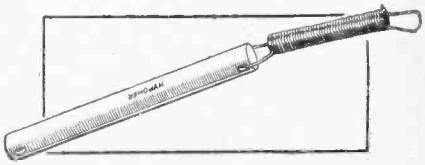
The elimination of surface leakage by an oil covering increases the number of hours' use obtainable from each charge and tends to prolong the life of the battery, while, apart from the danger of spilling which is always present with batteries of this type, it is almost as clean in operation as a battery of dry cells.



New "Elite" oil covered battery of the semi-submerged type. Another model is available in which the sections are totally submerged in an oil trough preventing evaporation, corrosion and low insulation.

PORCELAIN ROD AERIAL INSULATOR.

There is little better than a long porcelain rod as an aerial insulator. Not only is a liberal leakage path obtained, but the dielectric properties of porcelain used in the form of a rod will lessen the aerial losses as compared with the use of small bobbin or single shell type insulators.



The "Hypower" porcelain insulator has a long leakage path. It is fitted with a tension spring to allow for shrinkage of the halyard

The insulator is some 6ins. in length by $\frac{5}{8}$in. in diameter, possesses a considerable tensile strength, and is amply strong enough for supporting the usual broadcast receiving aerial. Another useful feature is the inclusion of a moderately stiff spring secured permanently to one end of the insulator. By this means, if the aerial is a single wire and not unduly heavy, it can always be kept taut and the rope halyard need not be left slack to allow for shrinkage.

Apart from the general adoption of this insulator for broadcast reception, it is particularly applicable for supporting aerials to be used for short wave work, as well as being of considerable interest to the transmitting amateur operating on wavelengths below 100 metres. The insulator is a product of Spring Washers, Ltd., Eagle Works, Alexander Street, Wolverhampton.

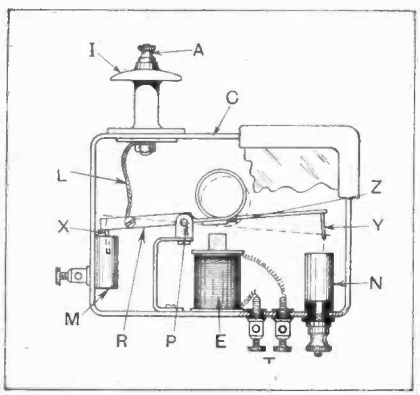
INVENTIONS of WIRELESS INTEREST

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.

Automatic Aerial Switch. (No. 254,851.)

Application Date, May 21st, 1925.

An automatic aerial switch is described by P. Elphick in the above British patent. The object of the invention is to provide a means for earthing the aerial when the set is not in use, and, at the same time, guard against any possibility of this procedure being neglected. Essentially the invention consists in closing



Automatic earthing switch (No. 254,851).

an earthing switch, which is controlled by an electro-magnet, which is only energised when the set is in use. The accompanying illustration should make the invention clear, and it will be seen that the device is contained in a metal casing C provided with an aerial terminal A and an insulator I. An arm R is pivoted at P, and is provided with two contacts X and Y. The arm also carries an armature Z, which is in proximity to an electro-magnet E, provided with terminals T, insulated, of course, from the case. The two contacts X and Y are provided with mercury cups M and N. The cup M is earthed, and the cup N is insulated, both cups being provided with terminals. The arm R is pivoted so that the contact X is normally resting in the cup M, and is also joined to the aerial T by a flexible lead L, and accordingly the aerial is normally earthed. The terminals T of the electro-magnet are connected in parallel with the valve filaments, and thus as soon as the valve filaments are switched on the magnet is energised, attracting the armature, thereby causing the contact Y to dip into the cup N. The terminal connected to the cup N is joined to the aerial terminal of the set, and thus the aerial is electrically connected to the receiver. Switching off the set, of course, automatically earths the aerial, since the electro-magnet is de-energised, and the arm returns to the normal position, earthing the aerial through the cup M.

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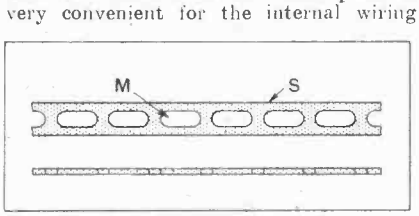
A Perforated Conductor. (No. 255,512.)

Application Date, April 15th, 1925.

The construction and use of a perforated conductor, particularly applicable to the internal wiring of wireless sets, is described in the above British patent by A. Edwards. The invention really consists in making an electrical conductor in the form of a flat strip S of thin metal, provided with a number of equally spaced longitudinal slots M. It is claimed that a conductor of this description is very convenient for the internal wiring



Perforated connecting strip (No. 255,512).

of a set, since it can simply be locked into position by means of the various terminals or connecting nuts on the various components comprising the receiver. In addition, the strip is capable of being easily bent at right angles, or given a twist through any particular number of degrees, so as to vary the plane of the surface of the strip. Again, if desired, the strip may be soldered to the shank of a terminal, or the screw to which it is to be connected.

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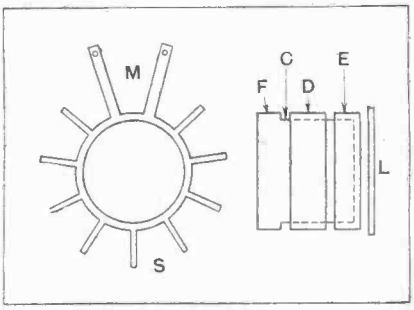
Winding Air-spaced Coils. (No. 254,390).

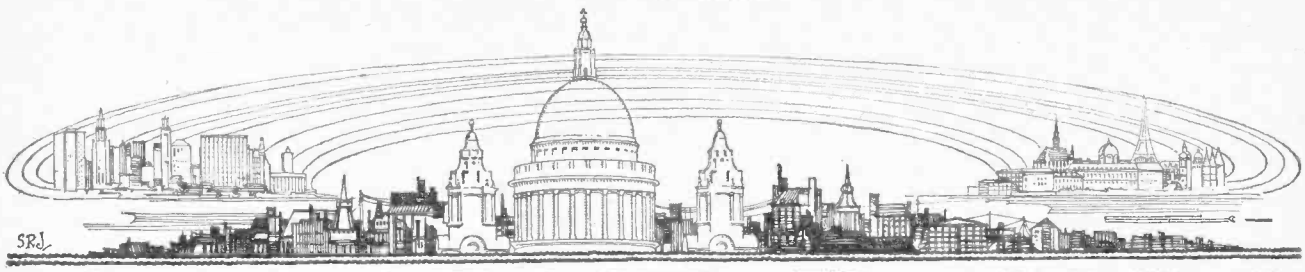
Application Date, April 2nd, 1925.

Many types of air-spaced or double-weave basket coils are, no doubt, familiar to readers, and the above patent, granted to A. J. Clitheroe, gives details



Former for winding double-weave coils No. 254,390).

of a winder which should prove to be very useful. The coil is wound round two series of spokes which are cut out of a flat sheet of insulating material, as shown at S. Two of the spokes M are made longer than the others for the purpose of attaching a mounting block. Two spoke members S are then assembled on a winder, which consists of a cylinder C provided with a flange F. One spoke member is then placed against the flange and a distance piece D is slipped over the cylinder C, after which another spoke member is placed in position and finally held on the cylinder by means of another distance piece E and a locking plate L. After the coil has been wound the locking plate is removed and the distance pieces E and D slipped off the cylinder. The distance piece D is of flexible collapsible material, so that it can be removed from the coil when wound.



CURRENT TOPICS

Events of the Week in Brief Review.

A NOBLE UNDERTAKING!

A special bureau to deal with the complaints of listeners has been instituted by Polish Department of Posts and Telegraphs.

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CULLED FROM THE KITCHEN.

Why do people who seek new wireless terms invariably rush to Mrs. Beeton? American *hams*, having lost interest in the *pancake* coil, are now waxing enthusiastic over the *doughnut* type.

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EXHIBITION AT BIRMINGHAM.

The *Birmingham Weekly Post* Wireless Exhibition, which opened its doors yesterday (Tuesday) at the Thorp Street Drill Hall, will remain open to the public until Saturday, October 16th.

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WIRELESS STATION "CAPTURED."

The wireless station at Nigg Hill was "captured" early on the morning of September 27th during the Atlantic Fleet exercises in Cromarty Firth. There are certain stations nearer home which some of us would like to see captured.

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DE FOREST PHONOFILMS ON VIEW.

The Capitol Theatre, Haymarket, continues this week with the inclusion of a number of phonofilms in its regular programme. The De Forest phonofilm device, which records sound on the film by means of a photo-electric cell, was demonstrated privately before the Radio Society of Great Britain in 1924.

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R.S.G.B. INCORPORATED.

The Radio Society of Great Britain entered upon a new chapter in its history on September 25th, when it became registered as the Incorporated Radio Society of Great Britain, with an unlimited number of members. The subscribers were Brig.-General H. C. L. Holden, 2, St. John's Park, S.E.; M. Child, 60, Ashworth Mansions, Maida Vale; O. F. Brown, 13, Hampstead Way; J. H. Reeves, 2, Penywern Road, S.W.; J. R. Halliwell, Manchester; G. M. Marcuse, Caterham; and H. B. Levett, 49, Kingsmead Road, S.W. The registered offices of the society remain at 53, Victoria Street, Westminster, S.W.1.

A SHORT CUT.

"When the high tension negative is connected to the high tension positive . . . it very often makes some appreciable difference to the performance of a set."—*Daily Chronicle*.

We hadn't tried it.

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THE WILY ATMOSPHERIC.

It is understood that the atmospheric direction finder developed by Mr. R. A. Watson Watt, of the Radio Research Station, Ditton Park, will be used on the India air route to prevent aircraft from running into storms.

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WIRELESS FOR MINERS.

When the Miners' Institute at Cambuslang, Lanarkshire, is completed, members will have at their disposal a palatial wireless room. Here listeners will enjoy themselves, whilst things are so arranged that members in other parts of the building will not be disturbed.

PRESS PHOTOGRAPHS BY WIRELESS.

In the last week or two more wireless photographs have appeared in the daily Press than ever before. Pictures of the Florida disaster and the Dempsey-Tunney fight were published within a few hours of the event.

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ANOTHER TRANSMISSION TRIUMPH?

Wireless apparatus which, it is claimed, may render undersea cables obsolete is undergoing test by the French Post Office authorities at the Croix d'Hins station, near Bordeaux, preliminary signals being sent to Antananarivo, Madagascar. Transmission is reported to be fifteen times faster than is possible by present methods.

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TELEVISION DESCRIBED.

To-morrow evening (Thursday) at 5 o'clock Mr. J. L. Baird will give a popular explanation of television at the

AWAITING DADDY'S RETURN. Mr. Alan Cobham's little son listening with his mother for news of his father's homecoming. The sounds accompanying the famous airman's landing at Westminster last Friday were broadcast by the B.B.C.

Royal Institute of British Architects, Conduit Street, W. A model of his original apparatus will be on view, as well as the original "televisor" used in the recent demonstration before members of the Royal Institution.

The lecture is the first of a series of Popular Talks in aid of King Edward's Hospital Fund for London. The charge for admission is 2s. 6d. (seats numbered and reserved 5s.), and tickets may be obtained from the secretary of the Fund at 7, Walbrook, E.C.4, any of Keith Prowse's branches, or at the door. The chair will be taken by Sir Richard Gregory.

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JAPAN LAUNCHES OUT.

The Japanese Government has embarked upon an ambitious scheme of wireless development, which provides for the erection of stations at Taikoku, Tamsui, Giran, Taito, Karenko, and Itabashi.

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M. BELIN'S WORLD TOUR.

M. Edouard Belin, the celebrated inventor of a method of wireless photo transmission, has started on a trip round the world. It is understood that he hopes to install photo transmission plants in the United States, Japan, and China.

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FIFTEEN TRANSMITTERS AT ONE PLACE.

Fifteen transmission licences have been issued to the General Electric Company by the U.S. Department of Commerce for transmitting experiments from Schenectady, N.Y. It is stated that no interference will be set up between the stations, the wavelength of each being controlled by quartz crystal.

Most of the fifteen licences are for short-wave transmission, the stations being as follow:—2 XAW, 3 to 20 metres; 2 XO, 2 XAF, and 2 XAD, 10 to 50 metres; 2 XH, 2 XK, and 2 XAC, 50 to 150 metres; 2 XAK and 2 XAZ, 100 to 200 metres; 2 XAG (50 kilowatts), 380 metres; 2 XAH, 1,000 to 4,000 metres; 2 XI, general experimental licence; 2 XAM, 110 metres; 2 XAE, 110 metres. The fifteenth licence is held by WGY, the famous station broadcasting on 379.5 metres.

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FIGHT NEWS AT SEA.

Ships' companies and passengers at sea heard the story of the Dempsey-Tunney fight well in advance of the public on shore.

The contest started at 9.45 p.m. in Philadelphia, just five hours forty minutes behind English time. It was received in London at 3.25 a.m. on Friday, and at 3.36 a.m. wireless conveyed the result of the match to ships in all parts of the world, following it up at 5 a.m. with a story of the fight. Those on board liners in Australian waters, the Indian Ocean, and the China Seas, besides the Pacific, heard the result at the same time as those on the Atlantic, north and south.

It was through co-operation between the British Post Office officials, who own the wireless station at Rugby, and the Wireless Press, Ltd., who daily use that station for the transmission of their Press messages to ships at sea subscribing to their service, that this was achieved. Immediately the story reached London from Reuter's Philadelphia correspondent it was passed on to the Wireless Press office for collation, and within five minutes of its arrival the Rugby wireless station was transmitting it to the ships.

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NATIONAL PROGRAMMES FOR AMERICA?

That broadcasting may be done "in the fairest and best way, always allowing for human frailties and human performance" is the avowed object of the Radio Corporation of America in forming the National Broadcasting Company, Inc., which will take over the control of the popular station WEAF, New York, on November 15th.

Already handling the entire output of the Westinghouse and General Electric factories, the R.C.A. aims at providing the best programme available for 26,000,000 homes. At the same time it will not attempt to obtain a monopoly of the air.

Is this a genuine indication that American broadcasting is striving towards order out of chaos?

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WIRELESS AND "MENTAL INDIGESTION."

The avoidance of "mental indigestion" caused by the terrifying accumulation of materials of knowledge is the object of the Association of Special Libraries and Information Bureaux, which held its third conference at Balliol College, Oxford, a few days ago.

The classification of books concerning wireless in its ever-increasing ramifications would alone merit special attention, and it is conceivable that a conference approaching such a gigantic problem would only escape "mental indigestion" through "mental extinction"!

During the conference Mr. J. C. Stobart gave an account of the new educational programmes of the British Broadcasting Company and their effect on the demand for books from the libraries.

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RADIOPHONY FOR CZECHO-SLOVAK RAILWAYS.

The management of the Czecho-Slovak Railways has for some time past been studying the question of the installation of receiving stations of radiophony in the trains. In consequence of the success recently obtained in Austria in this direction, it is proposed that similar experiments should be made on the Czecho-Slovak lines. So far no decision has been arrived at on the subject of the actual arrangements, which could be entrusted either conjointly to the Ministries of Railways and Posts and Telegraphs, or to the Compagnie Internationale des Wagon-lits, or to a company which would be specially formed for this purpose.

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A CORRECTION.

In referring to the "Triumph" valve holder, a product of A. H. Clackson, Ltd., 119, Fleet Street, London, E.C.4, and illustrated on page 353 of the issue of this journal of September 8th, it was stated that the supporting strips were made of celluloid. The strips are, however, made from thin polished ebonite sheet.

31.—Oliver Heaviside, Originator of the "Heaviside" Layer Theory.

By ELLISON HAWKS, F.R.A.S.

IN the history of every science there are records of workers who were content to hide their light under a bushel—who entered the scientific arena unaccompanied by any fanfare of trumpets. Of these, in the story of wireless, there is no more outstanding example than that of Heaviside—a modest and retiring man, contemporary with Sir Oliver Lodge and Dr. Searle of Cambridge, and a mathematician of great brilliancy and originality.

A Retiring Disposition.

Oliver Heaviside—the son of Thomas Heaviside, an artist and engraver with a considerable repute as a book illustrator—was born on May 13th, 1850, and died at Torquay on February 3rd, 1925. He came of a family who had close associations with music, theology and medicine, and his uncle, Sir Charles Wheatstone, was the first (with Sir William Cooke) to make the telegraph available (in 1837) for the public transmission of messages in this country.

In his earlier days Oliver Heaviside was, for a few years, in the employ of the Great Northern Telegraph Company at Newcastle-on-Tyne, but after 1874 he lived a very retired life at Torquay, where he devoted himself to interpreting Clerk Maxwell's theory of electromagnetic radiation. He was more particularly interested in showing how the theory could be applied to a solution of the problem of practical telegraphy and telephony, both with or without wires.

Oliver Heaviside.

Perhaps Heaviside's most important work was in laying the foundation of the modern theory of telephonic transmission, especially for long-distance work. It is no exaggeration to say that in this connection he saved the governments of every civilised country in the world millions of pounds in the costs of their telephone schemes. His remedy for distortion in the sounds set up on long lines was to increase the self-inductance of the line. According to the theory long cherished by the Post Office, however, self-inductance was harmful to clearness of transmission and therefore to be avoided. Accordingly the authorities turned a deaf ear to his suggestions. But on Professor Pupin, President of the American Association for the advancement of Science, demonstrating the advantages of increasing self-inductance by the introduction of loading coils at intervals along the line, Heaviside's methods were adopted in the United States and in Germany, and by the National Telephone Company in this country. To-day, many of the submarine telephone cables under the English Channel are loaded, as are thousands of miles of underground cables, and as is the aerial telephone line, 3,400 miles in length, between New York and San Francisco.

The "Heaviside" Layer.

To the wireless enthusiast Heaviside's name is known as the originator of the theory of the "Heaviside" layer. It was in 1900 that he pointed out that in the higher regions of the air there probably exists a permanently ionised layer, which being a good conductor would act as an upper guide to

Pioneers of Wireless.—

electromagnetic waves. Reasons have since been advanced to explain the formation and maintenance of this "Heaviside layer," as it is now called, and these are no doubt familiar to all our readers.

In the early days of wireless telegraphy, when sceptics were denying the possibilities of electromagnetic waves travelling over the wide expanse of the Atlantic, Heaviside maintained, again on the basis of Clerk Maxwell's theory, that the conductivity of sea water would cause the waves to travel on the surface of the sea in the same manner as they follow a metallic wire.

He devoted the whole of his life to the study of Electricity and was responsible for many remarkable inventions. Working alone in Torquay, where he received many distinguished scientists from all parts of the world, he otherwise lived a quiet, independent, self-contained life. He was the author of several standard works on electricity, the chief being "*Electromagnetic Theory*," which contributed in no small measure to most of the electrical inventions of the last quarter of a century. The mathematical methods explained in his works are varied and fascinating, and have a distinct application in many branches of mathematical physics other than electricity.

Heaviside's constant endeavour seems to have been to show the value of a knowledge of physics and of mathematical theory in the electrical industry. Everything relating to induction, of the energy of electrical currents, and of energy in electromagnetic fields, the self-inductance of wires and the generation of electromagnetic waves, was elaborately worked out, and there is little doubt but that future workers in the science of the ether will make considerable use of his valuable work. He had a wonderful instinct for grappling with the difficulties of a subject, and giving symbolic expression to the inherent difficulty of any problem that he tackled.

In his early years Heaviside received but little recognition of his great work. He was misunderstood, and the telegraphic authorities of his time turned down all his theories. He felt this neglect very keenly, although recognition came later—he was elected a Fellow of the Royal Society, and the Institution of Electrical Engineers awarded him the Faraday Gold Medal in 1924.

Mention must also be made of one of Oliver's brothers, Arthur West Heaviside, of Newcastle-on-Tyne, another pioneer of wireless. He was a Superintending Electrical Engineer to the Post Office, and (as we have already related under the instalment dealing with Sir W. H. Preece) he carried out extensive experiments in connection with wireless transmission by induction for Preece, who was then the Engineer-in-Chief to the Telegraph Department of the Post Office.

A Distinguished Brother.

In 1887 A. W. Heaviside tested Preece's theory that a magnetic field exists around telephone wires, and that this extends through both earth and air, without interruption. He arranged a circuit, 2¼ miles in total length and in the form of an equilateral triangle, along the galleries of Broomhill Colliery, Durham. The circuit was 360ft. below the ground in a horizontal plane. Above the ground a second and similar circuit was placed, exactly over, and parallel to, the circuit down the pit. Telephonic conversation was easily established between the two circuits by induction.

Similar experiments have, of course, been carried out more recently. Among the earliest of these more recent tests were those made in 1922 by the U.S.A. Bureau of Mines, in conjunction with the Westinghouse Company, in order to ascertain the suitability of wireless communication for mine rescue work. In these experiments continuous waves of 200 metres were used, and signals were distinctly heard through 50ft. of strata, using single-turn frame aerials.

The rejection of Oliver Heaviside's theories has already been mentioned, and in this connection it is on record that a paper by A. W. Heaviside was also rejected by the Society of Telegraph Engineers because it embodied in practical form the results of his brother's mathematical researches! It is gratifying to learn, however, that A. W. Heaviside was later awarded the Imperial Service Order for his work connected with telephony.

NEXT INSTALMENT.

Marconi Comes to England.

New Appointment.

Mr. A. W. B. Wilson has resigned his position in the Fuller United Electric Works, Ltd., of Chadwell Heath, to take up an appointment as sales manager to the London Battery and Cable Co., Ltd., of Hesketh Road, Forest Gate, London, E.7.

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The Ormond 1927 Catalogue.

Following their usual practice, Messrs. The Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Cross, N.1, have issued a handsome art catalogue of "Ormond" machine parts and wireless accessories for the 1927 season. Attention is drawn to the fact that in almost every instance prices of screws have been reduced. A new factory has been opened at Hardwick Street, Clerkenwell.

TRADE NOTES.

An International Catalogue.

The third edition of the international radio catalogue issued by Messrs. Will Day, Ltd., of 19, Lisle Street, Leicester Square, W.C., covers a wide range of British and American accessories and components. Copies can be obtained, price 6d. post free, from the above address.

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Dew's Catalogue for 1926-7.

One of the largest wireless catalogues issued in this country is that of Messrs. A. J. Dew and Co., 33-34, Rathbone Place, Oxford Street, London, W.1. The 1926-7 edition contains 204 pages, with illustrated particulars of leading makes of radio receiving sets, accessories and components. The Company deals only with radio retailers, and can only accept orders from the general public if placed through a dealer.

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Mullard Valve Demonstration.

One of the most interesting stands at the recent Selfridge Wireless Exhibition was devoted to an actual demonstration of the various processes in the manufacture of the Mullard P. M. Valve. Arranged by the Mullard Radio Valve Co., Ltd., the demonstration dealt with grid winding and welding, anode stamping, testing, marking and boxing. Technical information was given to thousands of enquirers.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

Where are They?

Where are the broadcast listeners of Southern Ireland? Do they all use "superhets" and frame aerials?

These questions suggested themselves last week when I travelled by train through the counties of Wexford, Waterford, Cork, and Kerry. My eyes roamed the country in all directions for five solid hours. I saw about one aerial per hour.

Where were all the other aerials? Had they been torn down by jealous neighbours in the absence of their owners at Olympia? Had they been artfully concealed because their owners lacked licences?

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Cold Comfort for Pat.

Vain questions! The sobering truth is that aerials in the greater part of the Irish Free State simply don't exist. Neither do broadcast receivers. Why should they? The only broadcasting station in the State ploughs its lonely furrow at Dublin, in the east. Considering the resources at its disposal 2RN works wonders. With good receivers it is heard in Belgium and France; but that is scant consolation for poor Pat down in Kerry, to whom even a crystal set would represent a considerable outlay.

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Ripe for Broadcasting.

When Cork gets busy with the installation of a relay station, receiving aerials will spring up more quickly than many people imagine. Southern Ireland, with its lonely villages separated from the hum of cities by miles of peat moor, is ripe for broadcasting.

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Room for Development.

It is a truism that the broadcasting station creates a listening public. In the absence of a local station only enthusiasts will trouble to erect aerials and instal receiving gear for the sake of problematical reception from distant sources. As in Ireland, so in Northern France, the absence of a station within *reliable* range means a paucity of public interest in broadcasting and its possibilities. A recent visitor to Le Touquet tells me that the town and its neighbourhood are practically devoid of aerials, and that no shop exists where one can buy so much as a valve or a pair of phones.

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Wireless Wallpaper.

When we hear Mr. J. C. Stobart, Educational Director of the B.B.C., foreshadowing the establishment of a Radio University of Great Britain, it is time to sit up and take notice. The idea has already found favour in America, where one can obtain a "Radio Degree" for subjects which would draw a blush from an Oxford don.

It is comforting to learn from Mr. Stobart that the B.B.C. and their successors would refuse to be associated with any cheap and gaudy diplomas. The conferment of any mark of distinction would only be done in conjunction with university authorities of the highest standing. In other words: "No Wallpaper."

NEWS FROM THE SPOT. This photograph was taken on the arrival of Mr. Alan Cobham at Melbourne while on his world flight. The announcer is Mr. Norman McCance, of 3LO, who described the landing to the listening public.

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The University in Practice.

Before systematised educational broadcasting can be proceeded with further high power stations will have to be erected so that the lectures can be conducted independently of the ordinary broadcast programmes. It is probable that listeners taking advantage of the courses would be able to have their work papers marked by examiners on the payment of a small sum.

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Ourselves as Others See Us.

"Truth from his lips prevailed with double sway," says Goldsmith, concerning the parson in the "Deserted Village." I doubt whether the same can be said of a French writer who opens a discourse on broadcasting with the following flourish: "The English like talks and lectures, whereas the French are profoundly bored. . . ."

Enough for one paragraph.

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Where Tastes Differ.

"The Frenchman," continues the writer, "prefers crisp information and brief news, but he is hostile to long and prosy explanations."

There you have it. Our friend has put

his finger on the fundamental difference between the Anglo-Saxon and Gallic temperaments. He has evidently witnessed the intense rapture on the face of an Englishman while listening to a two-hour sermon on Patience, or to one of Professor Gurgle's half-hour rhapsodies on the habits of the lesser Lepidoptera.

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England Expects . . .

There should be something really dramatic in the Trafalgar Day programme which the B.B.C. will stage on October 21st.

A series of "radioviews" dealing with the life of Nelson will be presented by Mr. Corbett Smith, five of them being relayed from the "Victory." An interesting method of presentation will be employed. The dialogue will be provided by a retired naval officer whose little boy asks him to tell the story of Nelson's career. Musical effects will help to illustrate the tale that is told.

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Hilversum on Sunday.

Hilversum is rapidly becoming one of the front rank stations of Europe. The installation of a new transmitter is partly but not entirely responsible. Quality of transmission has always been a notable feature of the Dutch station's programmes, and a good opportunity for hearing the station at its best is on Sunday afternoon before the British stations are active. The wavelength is 1,050 metres.

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A Good Word for the Announcer!

There is an ageing tradition that the broadcast announcer receives more kicks than ha'pence. Here is a letter which should revive his drooping spirits:—

"Writing as a Yorkshire listener," says a correspondent, "may I say how pleased we always are to hear the regular announcer from London? His cultured voice and manner of speaking are a joy to listen to. Many of us prefer to hear his announcements than some of the other items. Long may he carry on."

Short-lived joy! The poor fellow will probably "get it in the neck" from those in charge of those "other items."

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Evensong from Westminster.

Evensong will be broadcast from Westminster Abbey from 3.0 to 3.45 to-morrow, Thursday, October 7th.

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R.A.F. Strings.

The String Band of the Royal Air Force will be relayed from Holland Park Hall on October 16th, 18th, and 20th, between 6.0 and 7.0 p.m.

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Albert Sandler and Carmen Hill.

Albert Sandler and the Grand Hotel Orchestra will be relayed from Eastbourne on Sunday evening, October 10th. Miss Carmen Hill will be the vocalist on this occasion.

FUTURE FEATURES.

Sunday, October 10th.

LONDON.—John Martin Harvey and Nina de Silva in Scenes from their repertoire.

BIRMINGHAM.—Symphony Concert.

BOURNEMOUTH STN. — Symphony Orchestra, Eric Greene (tenor), Mavis Bennett (soprano), Mary Lewis (harp).

BELFAST.—Harvest Festival relayed from Belfast Cathedral.

Monday, October 11th.

LONDON.—An Hour of Ketelbey's Music.

DAVENTRY.—St. Hilda's Colliery Band.

BIRMINGHAM.—Birmingham Pianoforte Quartet.

NEWCASTLE. — "The Crier by Night," Music Drama in one act.

GLASGOW.—"The Village" Concert Party.

Tuesday, October 12th.

LONDON.—Favourites from songs by Ralph Vaughan Williams.

CARDIFF.—Excerpts from famous Operatic Love Scenes.

ABERDEEN.—Will Seymour's "Bubbles" Concert Party.

Wednesday, October 13th.

LONDON.—The Philharmonic Piano Quartet. "Paddy the Next Best Thing."

CARDIFF.—"For France," an episode of the Franco-Prussian War.

MANCHESTER.—W. H. Cradock's Glee and Madrigal Prize Choir. "George Proposes," a Comedy by James Hodson.

GLASGOW.—National Broadcasting Conference.

HULL.—William Macready and Edna Godfrey Turner in Operatic Excerpts.

Thursday, October 14th.

MANCHESTER.—Old 3rd Cheshires' Military Band, Katie Peters (contralto) and Ralph Collis (entertainer).

ABERDEEN.—Second of new series of Thumbnail Sketches.

DUNDEE.—Dundee Radio Players present "The Idol of Jade."

Friday, October 15th.

LONDON.—"Faust."

Saturday, October 16th.

LONDON.—"Briny Breezes Calling," by Ernest Longstaffe. Coutinental Feature.

BIRMINGHAM.—Birmingham Radio Players present "The Powder Puff."

BOURNEMOUTH. — Birthday Programme.

MANCHESTER.—Revue: "The Violin in Dancing Mood"—Winifred Small.

NEWCASTLE.—'Cello Recital by Beatrice Eveline.

GLASGOW. — "Studio Snags," Radio Burlesque in Seven Bricks.

Broadcasting in Poland.

The Polish Government has decided on the reconstruction of the broadcasting station at Poznau on the most modern lines.

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Lord Chief Justice to Broadcast.

A speech by the Lord Chief Justice will be relayed from Manchester University and broadcast from the Manchester station on October 8th.

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Winter Plans at Radio Belgique.

"Radio Belgique" is embarking on a special winter programme, which includes rather an unusual number of talks. History, art, the drama, current events, feminine topics and modern languages will all have their turn at the microphone. M. Nino Salvaneschi, editor of *L'Époque Nouvelle*, will broadcast talks in Italian, dealing with famous love stories in his country's literature.

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Have You Heard Danzig?

The Free City of Danzig now boasts its own broadcasting station, which was officially opened on September 20th. In order that no hitch should take place in the opening proceedings a private rehearsal was carried out a few days previously.

The regular transmissions from Danzig on 272.7 metres take place daily as follows:—

Weather report.—10 a.m.

Concert.—10.30 a.m.

Time signal, news and Stock Exchange reports.—1 p.m.

At 3 p.m. the station relays the programmes from Königsberg.

Danzig is a Sovereign State under the protection of the League of Nations. It abounds in historical interest, and is one of the most popular seaside resorts on the Baltic.

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Sir Martin Harvey.

It has now been arranged for Sir John and Lady Martin Harvey (Miss N. de Silva) to give a programme from London and other stations on Sunday afternoon next, October 10th. Commencing at 5.30 p.m., Sir John will broadcast (1) a scene between Vjera and Count Skariatine from Charles Hannon's dramatisation of Marion Crawford's novel, "A Cigarette Maker's Romance"; (2) the story of Reresby the Rat, as told by him in Act II. of "The Breed of the Treshams," by Evelyn Greenland Sutherland and Beulah Marie Dix; (3) the scene between Lady Ann and Richard III. from Shakespeare's tragedy, "Richard III."

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A Broadcast Dinner.

Speeches at the annual luncheon of the British Passenger Agents' Association will be broadcast from the Hotel Victoria, London, on October 14th. The loyal toast will be proposed by Mr. John Frame. Among others who are expected to be present will be Viscount Burnham, Sir Joseph Cook, Sir C. J. Parr, the Hon. J. S. Smit, and the Hon. Victor Gordon.

GRID POTENTIALS.

Effect of Filament Circuit Connections on the Mean Grid Voltage of H.F., Detector and L.F. Valves.

By C. H. STEPHENSON, B.A., A.M.I.E.E.

THE importance of arranging matters so that the potential of the grid of an amplifying valve is such as to obviate distortion is now appreciated, but the conditions necessary to secure this are not always clearly understood. The fact that the changing of one type of valve for another may result in an alteration of grid potential is easily overlooked, and, furthermore, the effect of the grid potential on the performance of a rectifying valve, especially in regard to the smoothness of reaction control, deserves more attention than it usually receives. The following notes contain a statement of the general conditions governing grid potential so that reference to them will enable an amateur to check the correctness of his circuit arrangements, and to make such modifications as may be called for by reason of any change in valves which may be made from time to time.

When we speak of the normal grid potential we mean the potential of the grid of the valve relative to the negative leg of the filament when no signals are being received. The grid is always connected to the filament, either through the secondary winding of a transformer, or by way of a high resistance leak, and the correct grid potential is secured by selecting the right point on the filament circuit at which to make this connection, with or without the aid of grid cells. In the case of a valve whose filament is controlled by a resistance

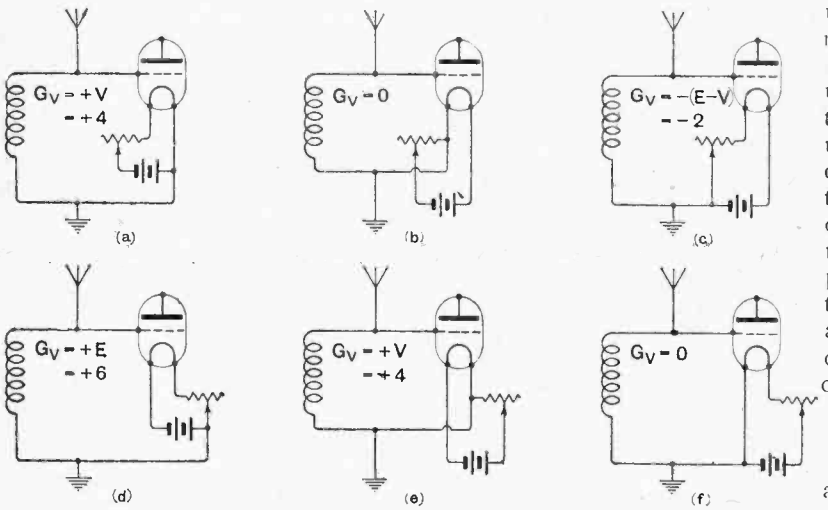


Fig. 1.—Six methods of connecting filament battery, filament resistance and grid return lead to obtain various values of grid bias. V = normal filament voltage = 4; E = voltage of L.T. battery = 6.

—for example, a 4-volt valve run off a 6-volt accumulator —there are six possible methods of connecting the grid lead, which are shown in Fig. 1. The potential of the grid relative to the negative end of the filament is given by the value of G_v. The expressions in brackets show the value of the G_v for any valve of V, the voltage across the valve filament, and E the voltage of the L.T. battery. The grid potential obtained with arrangement (*b*) will always be the same as in (*f*), but both are shown, as one may be more convenient than the other. The same remarks apply to the connections shown at (*a*) and (*e*).

The conditions holding when a potentiometer is used for grid voltage control are shown in Fig. 2 (*g*) and (*h*).

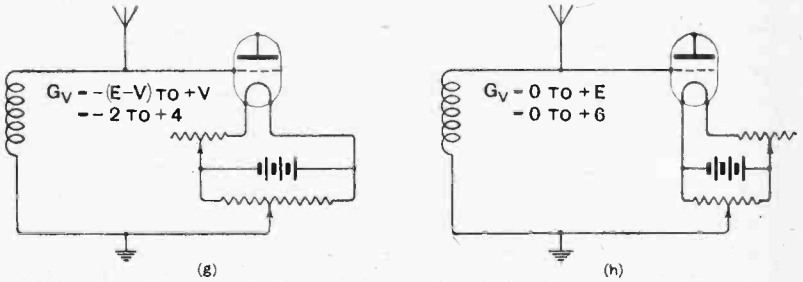


Fig. 2.—Range of voltages available with the addition of a potentiometer.

Before dealing with the question of grid potential in a typical receiver, the effect of this factor on the performance of the detector will be dealt with in some detail. A very great deal has been said concerning the evil of pushing reaction to the limit, and, whilst everyone admits the evil, there is a strong temptation to secure louder or more distant signals from a given number of valves than the other fellow is able to receive, and this usually means making the utmost use of reaction. The most one can reasonably hope is that reaction enthusiasts will make use of "controllable" circuits. Much of the oscillation trouble must be due to the use of apparatus so adjusted that the circuit bursts suddenly into violent oscillation instead of passing gradually from quiescence to the oscillating condition as the "feed back" is increased. It is impossible to handle a circuit of the former type with any degree of safety or pleasure, and it is largely by reason of its influence on such conditions that the grid potential of the detector is important.

Effect on Reaction.

In the case of a simple typical valve reaction circuit using a four-volt "R" valve, run off a six-volt battery and connected as shown in Fig. 1 (*a*), we have seen that the grid potential with respect to the negative end of the filament $G_v = +4$ volts.

This neglects the drop across the grid leak, which may be appreciable, but does not affect the point under discussion.

It will be found that in many instances where a circuit is connected in this way, the reaction is uncontrollable

Grid Potentials.—

when the point of the oscillation is reached. A very marked improvement can be obtained by reducing the grid potential, which is easily done by connecting the circuit as shown in Fig. 1 (*f*), or, better still, by using a potentiometer, Fig. 2 (*g*). It is perfectly easy in this way, provided the reaction coil is reasonably dimensioned, to adjust the circuit so that oscillation commences almost imperceptibly as the coupling is increased. Under these conditions one has such control over the circuit that radiation is reduced to a minimum when searching, and the sensitivity of the set is all that can be desired.

TABLE I.

Type of Valve.	Grid Potential.		
	H.F.	Detr.	L.F.
4 volt	−2	+4	−3.5
1 „	−5	+1	−6.5
2 „	−4	+2	−5.5
3 volt	−3	+3	−4.5
5 „	−1	+5	−2.5
6 „	0	+6	−1.5
Any type. E = L.T. battery volts V = Filament „ B = Grid bias „	−(E−V)	+V	−(E−V)−B

The writer is inclined to think that on powerful signals —main B.B.C. station at fifteen miles—the loudest results are obtained with the grid at about + 4 volts. There is then no objection to using the set in this manner, as little if any reaction is required to obtain excellent loud-speaker strength on a good detector followed by a small power amplifier. It is when one comes to receive weak signals that the maximum reaction is required, and then there is no comparison between the two adjustments, the lower grid potential being infinitely the better.

Let us now turn to a typical three-valve receiver as usually wired up, and, assuming that four-volt valves are used, tabulate the grid potentials. The diagram is seen

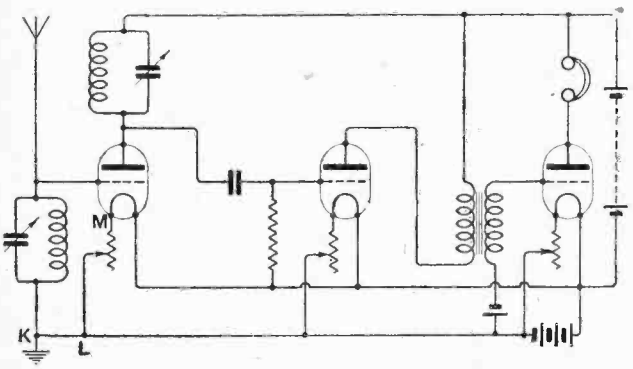


Fig. 3.—Typical three-valve receiving circuit.

in Fig. 3, and the first set of figures in Table I gives the grid potentials. It is quite possible that this circuit may be unstable owing to the absence of grid damping on the H.F. valve, and the fault could be cured by using a potentiometer connected as shown in Fig. 2 (*g*). Alternatively, an improvement would probably be made by connecting the point K to the negative end, M, of the filament instead of to L, which would have the effect of raising the grid potential from −2 to 0 volts.

The case of the detector has already been dealt with, and the grid potential of the amplifying valve is brought to −3.5 volts by the aid of a grid cell.

A Typical Circuit.

The circuit of Fig. 3, whilst admittedly open to improvement by the use of a potentiometer for controlling the H.F. valve, and possibly another for the detector, is, nevertheless, reasonably satisfactory. The conditions are, however, very materially modified should a change be made in the type of valves used, and are set out in Table II. The last horizontal column gives a general expression for the grid potential, so that values are easily found for any type of valve and any battery voltage.

If these figures are examined in conjunction with the valve maker's characteristic curves, some very interesting facts come to light.

H.F. Valves.—The performance of the one- and two-volt valves will be hopeless—in the former case no amplification being obtained at all, and in the latter the results will be very bad even with a high plate potential. The grid potential of the three-volt valve will also be too low, and should not be more negative than 1.5 volts in the

TABLE II.

Circuit.	A.	B.
(*a*)	Gv. = +2	Gv. = +4
(*b*)	= −2	= 0
(*c*)	= −(E−2)	= −(E−4)
(*d*)	= +E	= +(E−2)
(*e*)	= +4	= +2
(*f*)	= 0	= −2

Gv. = grid voltage of special type valve when connected as in Fig. 1 (*a*), (*b*), (*c*), etc. In column A are the values when the cap resistance is in the rheostat lead. Column B gives the values when cap resistance is in direct filament lead, *vide* Fig. 5 (*i*) and (*j*).

case of a typical valve of this type when the recommended anode potential of forty volts is used. The five-volt valve will be operating under fairly good conditions with moderate anode potentials, but higher plate voltages would call for the use of grid cells so as to reduce the grid potential. Finally, the six-volt valve will require a grid battery, the number of cells depending on the H.T. voltage.

Detector Valves.—If the circuit is used with critical reaction or for the reception of C.W., the one-, two-, and three-volt valves will be fairly well adjusted, whilst the grids of the five- and six-volt detectors will be too much positive. Of course, different makes of valves will not behave quite the same, so that these remarks can only be taken as a general guide. As has already been stated, the grid potential can with advantage be appreciably higher for the reception of strong signals where but little reaction is required than for weak signals or C.W. when smooth control of reaction is essential.

L.F. Valves.—The grid potential of the one- and two-volt valves will be too low; the former could be corrected by reversing the grid cell so that it increased instead of

Grid Potentials.—diminished the grid potential. The case of the two-volt valve, if of the D.E.R. type, may be dealt with by removing the grid cell, whilst the D.E.6 type will operate best if the grid cell is left connected up as shown in the diagram. The three-volt valve will perform better if the grid cell is removed, and the five- and six-volt valves will require additional grid bias according to the H.T. voltage.

Special Valves.

There is one special case which is particularly liable to give trouble unless the amateur is alive to the position. This occurs when a type of valve is used which has a resistance in the cap. There is, of course, no objection whatever to this very convenient arrangement provided that the grid conditions are looked after.

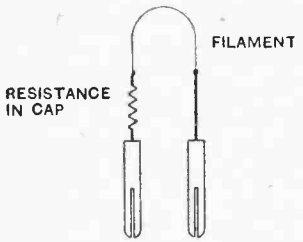


Fig. 4.—Special case of permanent resistance in series with the valve filament.

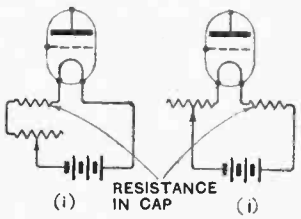


Fig. 5.—Alternative positions for external variable resistance relative to the fixed internal resistance.

The arrangement of the filament circuit of the valve is shown in Fig. 4, the resistance in the cap producing a drop of about two volts.

Now, the cap resistance may in practice happen to be in the same filament lead as the rheostat, Fig. 5 (*i*), or in the direct connection to the filament, Fig. 5 (*j*), and this results in an uncertainty as to the potential of the negative end of the filament relative to any other part of the circuit. As a result, the values given in Table I cannot be used, and accordingly Table II has been prepared so that the actual grid voltage may be worked out for any value of L.T. volts and for various circuit connections. It has been assumed that the correct *filament* voltage is two, and that the drop across the cap resistance is also two volts.

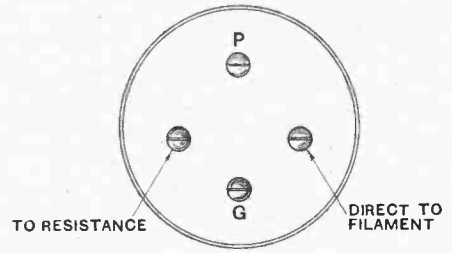


Fig. 6.—Conventional method of connecting internal filament resistance.

Fortunately, it is the practice of the only firm (to the writer's knowledge) making this type of valve to insert the resistance always in the same leg of the filament. The arrangement adopted is shown in Fig. 6.

In conclusion, the writer would like to add that, whilst the full understanding of the factors affecting grid potential involves some little trouble, the results obtained by careful adjustment fully justify the effort. It seems probable that many of the instances in which experimenters have not obtained satisfactory results from valves of undoubted merit may be due to neglect of the effect of grid potential. As far as control of reaction is concerned, this point is of the utmost importance, and the use of a potentiometer in the grid to filament lead is well worth the small extra expense.

BRAZILIAN AMATEUR TRANSMITTING STATIONS.

Through the courtesy of Señor Vasco Abreu (BZ 1AW), we are able to give a revised list of Brazilian stations, which cancels those previously published in the *Wireless Annual* for 1926 and the *Wireless World* of January 27th, 1926 :—

FEDERAL CAPITAL. RIO DE JANEIRO.

Bz 1AA	J. J. A. Gomes, 23, rua Xavier da Silveira.
Bz 1AB	H. Jacques, 86, rua Visconde da Gavea.
Bz 1AC	C. G. Lacombe, 105, Cosme Velho.
Bz 1AD	P. S. Chermont, Caixa Postal N. 1663.
Bz 1AE	V. A Borges, 168, rua Visconde de Silva.
Bz 1AF	J. C. de Almeida Sobrinho, rua Buenos Aires 41-2°.
Bz 1AG	E. R. Pinto, 13, rua Villa Rica.
Bz 1AH	H. May, 65, rua dos Oitis, Gavea.
Bz 1AI	E. C. Guimaraes, Caixa Postal N. 1.587.
Bz 1AJ	J. do Lago, 11, rua Leite Leal.
Bz 1AK	C. Santos, 130, rua Alzira Brandão.
Bz 1AL	M. Liberalli, 113, rua Voluntarios da Patria, C.VII.
Bz 1AM	A. R. Conteville 620, rua Copacabana.
Bz 1AN	W. Aguiar, 359, rua B. de Itapagipe.
Bz 1AO	F. N. A. Costa, Caixa Postal N. 1253.
Bz 1AP	N. de Barros Ignarra, 48 Laranjeiras, Caixa Postal N.68.
Bz 1AQ	M. Barbedo, 82, rua Xavier da Silveira.
Bz 1AR	J. P. Rosa, Jnr., 191, rua Grajahu.
Bz 1AS	F. P. Santos, 17, rua Nathalia.
Bz 1AT	D. Seabra, 1,170 Alto da Boa Vista, Caixa Postal N.567.
Bz 1AU	A. F. da Costa, Jnr., 71, rua Itacurussa.
Bz 1AV	A. da Silva Lima, 86, rua Voluntarios da Patria.
Bz 1AW	V. Abreu, 89, rua Riachuelo c/IV.
Bz 1AX	J. V. Pareto, 180, Praia do Russell.
Bz 1AY	Y. Moorby, Caixa Postal N.1595.
Bz 1AZ	J. Pereira, 52, rua do Livramento, sob.
Bz 1BA	N. dos Anjos Lima, 149, rua José Clemente.
Bz 1BB	R. K. de Lemos, 106, rua Barroso, Caixa Postal N.1587.
Bz 1BC	R. Berrogain, 144, rua Gomes Carneiro.
Bz 1BD	A. L. Villela, 76 Cosme Velho.
Bz 1BE	M. Macedo, 239, Av. 28 de Setembro, C/IV.
Bz 1BF	A. Tavares, 19, rua Senador Dantas.
Bz 1BG	G. P. Machado, 46, Av. Rio Branco, 1° andar.
Bz 1BH	G. Damm, 114, Estrada Itarare, Ramos.
Bz 1BI	L. G. C. Ayres, Caixa Postal, N. 152.
Bz 1BJ	J. P. M. de Vasconcellos, 80, rua Barão de Itamby.
Bz 1BK	J. C. Roos, 139, rua Paysandu.

SATE OF RIO.

Bz 1IA	H. Silva, 20, rua Coronel Julio Abreu, Nilopolis.
Bz 1IB	A. S. Freire, 47, rua Oswaldo Cruz, Nicteroy.

STATE OF ESPIRITO SANTO.

Bz 1QA	A. L. Campos, Banco do Brasil, Victoria.
Bz 1QB	Q. B. Netto, Companhia Costeira, Victoria.

STATE OF S. PAULO.

Bz 2AA	L. Y. Jones, Jnr., 22, rua Frei Caneca.
Bz 2AB	S. Justi, 19A, rua Visconde do Rio Branco.
Bz 2AC	L. do A. Cesar, 20A, rua Frei Caneca.
Bz 2AD	G. Corbisier. 24, rua Rodrigo de Barros.
Bz 2AE	J. Boccolini, 51, Av. Angelica.
Bz 2AF	J. S. Goes, 96, rua Cardoso de Almeida.
Bz 2 AG	C. Yazbek, 12, rua Ypiranga.
Bz 2AH	J. Tonglet, 73A, rua Barao de Itapetininga.
Bz 2AI	L. F. de Mesquita, 73, Av. Paulista.
Bz 2AJ	J. R. Baccarat, 504, rua Conselheiro Nebias, Santos.
Bz 2AK	C. Baccarat, 488, rua Conselheiro Nebias, Caixa Postal N.57, Santos.
Bz 2AL	J. L. Silva, 49, rua Arthur Prado.
Bz 2AM	J. Cancella, 64, rua Frei Caneca.
Bz 2AN	T. de Tolido Piza, 300, Bella Cintra.
Bz 2AO	H. Lindenberg, 7, rua Guadeloupe.
Bz 2AP	P. Yasbek, 12, rua Ypiranga.
Bz 2AQ	J. Saez, 59, rua S. Pedro, Villa Marianna.

All the above in the town of São Paulo except 2AJ and 2AK, which are in Santos.

STATE OF RIO GRANDE DO SUL.

Bz 3QA	T. R. Vianna, Praca 15 de Novembro s/n, S. Francisco de Assis.
Bz 3AA	P. C. Schuck, 3, rua D. Laura, Porto Alegre.
Bz 5AA	Tito de A. F. Xavier, 110, rua Padre Lemos, Recife.
Bz 5AB	J. C. Ayres, 251, rua Bemfica, Caixa Postal N.257, Recife.
Bz 5AC	S. de Mendonça, 127, rua Azeredo Coutinho, Recife.
Bz 5AD	H. Oliveira, Caixa Postal N.257, 554, rua Visconde de Govanna, Recife.
Bz 5AE	M. Penna, Caixa Postal N.44, Recife.

STATE OF MARANHAO.

Bz 6QA	A. A. dos Santos, S. Luiz do Maranhão.
Bz 6QB	J. M. A. dos Santos, rua Senador Chermont, S. Luiz do Maranhão.

STATE OF PARA.

Bz 7AA	R. Camelier, 102, rua Dr. Assis, Belém.

WIRELESS CLUBS AND SOCIETIES.

The Importance of Drafting Adequate Rules.

THE vast majority of wireless societies consist of a circle of wireless enthusiasts who meet together and finally decide to form a club. Maybe, they appoint a committee and a secretary, draw up a few general rules, hire a club-room, and make various arrangements for lectures and a supply of periodicals. But, beyond this, the government and constitution of their club are left unprovided for, and many contingencies may arise which are not mentioned in the rules, but which, nevertheless, have to be dealt with, and the secretary and committee will find themselves in difficulties if, when the club was first started, the rules were incorrect or inefficient.

What the man in the street, and most of the bodies into which wireless enthusiasts form themselves, call a "Club" is known to the legalist as "an unincorporated members' club." When inaugurating a Radio Club this kind of association is, in most cases, the best kind to adopt, unless, of course, a very large membership is anticipated, or the club is to be of world-wide reputation, when probably it would be necessary to establish it under the Companies' Act of 1908.

Constitution.

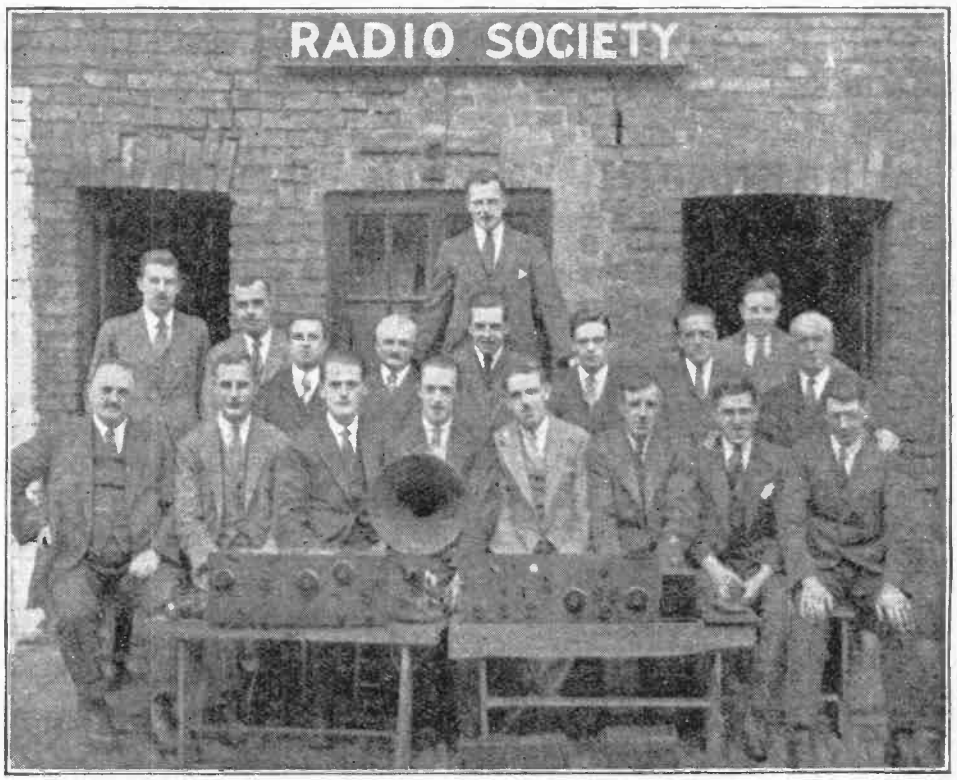
When forming a club it is essential that rules should be made that will provide for every possible contingency, for all clubs (of the class we are discussing) are governed by their rules. These rules should first enumerate and explain specifically the purposes and objects for which the club has been constituted; they should provide for all needs arising from the admission of new members, the conduct of members and their qualification (*e.g.*, that they hold a licence for a receiving-set) while they remain members; the resignation of members and provisions for their expulsion if this should be necessary. Most important of all, the rules must be so drawn up as to provide for their own alteration. This often proves necessary, especially where there has been an omission in the first set of rules, or the club has gradually changed its character since the time of its formation. The rules are part of the contract between the members, and each member must abide by the rules as he would by a contract.

In addition to the above provisions an opportunity should be given to all members—and especially new and prospective members—to have access to the rules at any reasonable time.

As to alteration of the rules, this cannot be done unless it is expressly provided for in the original rules themselves, which can be effected by the insertion of a clause covering such alteration on the resolution of a prescribed majority. And when it is proposed to alter the rules, special notice of the General meeting should be given to all members, alteration of rules not being included in such items as "General Purposes" or "General Business."

Election of Members.

As regards the admission of new members, there should be some provision in the rules that the candidate be proposed and seconded, and either elected by the committee or all the members, as it is decided. On election, the secretary should then inform the new member of this fact, and supply him with a copy of the rules, ask for his entrance fee and his yearly subscription. The new member, however, is under no com-



A group of members of the Stretford and District Radio Society taken at a recent meeting.

Wireless Clubs and Societies.—

pulsion to accept his membership or form any binding contract until he has paid his entrance fee and subscription.

Subscriptions and Finance.

In the absence of a contrary provision in the rules any member can, at any time, resign his membership by communicating this desire to the secretary, such resignation not requiring any acceptance by the secretary. A member remains liable, however, for the payment of his subscription until he has resigned.

Many clubs make it a rule that all subscriptions shall be paid "on the first day of a month or during that month," and also that "no member shall be allowed to vote if his current subscription is unpaid." Where such a rule is in force, the Courts have decided [1] that a member who has not paid his subscription is entitled to all the privileges of membership, including voting, until the end of the month.

The rules should also provide for the formation of a committee with power to manage and conduct the affairs of the club, as it is from this provision in the rules that such a committee derives its powers to bind the members as between themselves, or as regards contracts with tradesmen.

The property and assets of the club should be vested in trustees for the benefit of the members *pro tem.*, and the rules should make provision for the trustees or committee of management to be indemnified by the members against liabilities incurred by them on behalf of the club.

Members of a club may be made liable in contracts made by the trustees or the committee or secretary, if these contracts were within the powers given to the persons who made them, as provided in the rules, or because the members had sanctioned or ratified the particular transaction.

When any person endeavours to make the club liable for an injury suffered by him, and arising otherwise than by contract (technically known as a "tort"), then only the person or persons who actually authorised the act can be made liable for the result.

Dissolution.

If at any time it is desired to put an end to the club, unless there is some provision in the rules for dissolution (and there always should be one), it will be necessary to obtain the consent of all the members to the dissolution before it can be effectually carried out. If any of them do not agree, the club property will vest in them as the present members of the club. If, however, all the members agree to the dissolution, or if the rules provide for the dissolution and it is carried out according to the rules, after paying the club debts and liabilities, any surplus should be divided equally amongst the members (other than honorary members), provided, of course, that the rules are silent as to what should be done with it.

[1] (In Innes *v.* Wylie.)

NEWS FROM THE CLUBS.

Tottenham Exhibition and Demonstration.

All keen wireless men in North London should make a note in their diaries that on Thursday, October 21st, an exhibition and demonstration of wireless apparatus will be given by the Tottenham Wireless Society in the Lansdowne Hall, opposite the Gas Offices, High Road, Tottenham, N.17. The exhibiton will be formally opened by Prof. A. M. Low at 8 p.m.

Features of the show will include valve testing, transformer testing, tests of insulation and grid leaks, exhibition of short-wave transmitters and receivers, American apparatus, demonstrations of sets constructed by local manufacturers, a superheterodyne receiver, the Lodge "N" circuit, the Unitron receiver, trickle chargers and rectifiers, the Audiometer, the Thorne Baker apparatus for the transmission of photographs, and apparatus for the wireless control of torpedoes.

The demonstration, admission to which is free, will provide an excellent opportunity of coming into contact with the latest developments of wireless in different departments.

°°°°

An Active Convalescent!

Some interesting low power transmission work was described by Mr. J. E. Nickless, A.I.E.E. (2KT) at a meeting of the South Woodford and District Radio Society on September 20th. Mr. Nickless explained that he had carried out the tests during a recent period of convalescence. His aerial at that time was only 20 feet high and the counterpoise was simply a bell wire tied to a wooden fence at the bottom of the garden. With an input of only 120 volts H.T. on a single receiving valve (Ediswan P.V.51DE) he had succeeded in working short-wave stations all round Europe as far apart as Scotland and Czecho-Slovakia and the Mediterranean!

Mr. H. O. Crisp reported repeated reception of German stations, and brought up the question of litz-wound coils for receivers as adopted in the "Everyman's Four," described in *The Wireless World*.

Hon. Secretary: Mr. E. Turbyfield, 24, Alexandra Road, S. Woodford, E.18.

°°°°

Madrid with a Crystal.

Some time ago Mr. H. O. Crisp, hon. secretary of the Ilford Radio Society, reported that he had received Radio Toulouse without amplification on a crystal receiver. He now writes to say that this feat has been improved upon by the reception of Radio Madrid on the same instrument

Enterprise at Ipswich.

The Ipswich and District Radio Society has issued a compelling leaflet which should certainly act as a magnet to the many wireless folk in the district who are still uncertain regarding the advisability of becoming members. For the modest subscription of five shillings the society offers the following:—

Free advice about anything in radio that you care to ask. A free lecture or talk every fortnight on something to do with your set.

Spare Parts.—The Club Exchange and Mart will turn your spare parts into hard cash, and supply you with others at a low price.

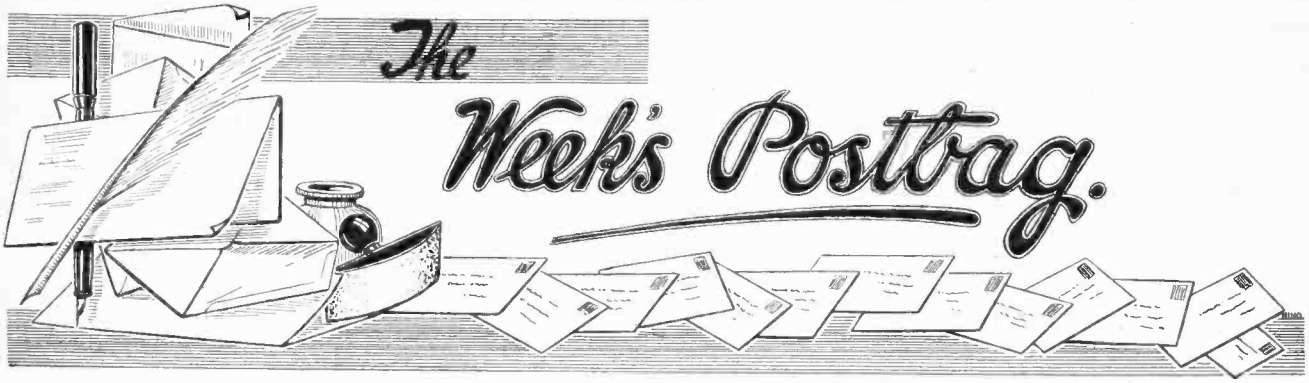
Insurance.—Membership entitles you to insurance at advantageous rates.

Prizes.—Prizes are offered to the member who can tune the most stations on the club set in a given time, and for other competitions.

Lastly, wireless is not the only feature. The social side is not overlooked. The first annual club dinner will take place in the New Year and socials at intervals.

The society's headquarters are at 55, Fonnereau Road (entrance in Charles Street). Meetings are held at 8 p.m. on the first Monday in the month, and special lectures are interspersed.

Full particulars of membership can be obtained from the hon. secretary, Mr. H. E. Barbrook, 22, Vernon Street, Ipswich.



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

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

AMERICAN RECEPTION.

Sir,—In your September 15th issue of *The Wireless World* you ask for reports of American broadcast reception.

The first time I tried was on Sunday morning, August 29th, at 4.45 a.m. The first station picked up was "WPG, The World's Playground, Atlantic City." He was playing dance music, and concluded—in the words of the announcer—"with the inevitable 'Valencia.'" He shut off at 5 a.m. till 2.30 the following afternoon. The most extraordinary thing was that the announcements could be plainly heard upstairs.

The same morning another (and fainter) station could be heard about 378 metres. On the Monday morning following WPG was also caught at good volume about 4.30 a.m., but was shattered by atmospherics.

The set used was one H.F. det. and two resistance-coupled L.F. All tuning was direct on the loud-speaker.

The H.F. valve was a D.E.5 and the transformer Litz wound as you recently described, with reaction on grid end of it.

Newcastle, Staffs. G. GOODWIN.

September 15th, 1926.

SIDE BANDS.

Sir,—In his letter in the September 22nd issue of *The Wireless World*, Mr. McAteer states that beat tones in sound have no physical existence, and appears to conclude therefrom that in a modulated carrier wave side bands of frequency are equally non-existent.

A voltage $e = E \sin \omega t$ modulated with a sine wave of frequency $p/2\pi$ gives rise to a resultant voltage. $e = A \sin \omega t + B \sin pt \sin \omega t$, the fraction A/B representing the amount of modulation, being complete when $A = B$.

The received E.M.F. is $A_1 \sin \omega t + B_1 \sin pt \sin \omega t$, which may be written.

$e = A_1 \sin \omega t + B_1/2 [\cos (\omega - p) t - \cos (\omega + p) t]$. The modulated wave therefore is equivalent to a fundamental of frequency $\omega/2\pi$, and two "side bands" of frequency $\frac{(\omega - p)}{2\pi}$ and $\frac{(\omega + p)}{2\pi}$ respectively.

The receiving aerial being tuned to the frequency $\omega/2\pi$ is purely resistive to that frequency; but it is not so to either of the side band frequencies which meet with a reactive impedance giving rise to attenuation and distortion.

It may be shown further that the modulation in the receiving aerial is less complete than that of the transmitted wave, and that there is a phase shift which varies, with p, so that low decrement receivers should not be used for reception of speech.

It is due to the fact that these side bands of frequency do exist, that a movement is on foot to separate all broadcasting stations ten kilocycles from one another, and that long wave transmission is difficult owing to the wide band of frequency occupied by each station.

Mr. McAteer may be interested to know that the Western Electric Co. have a system whereby the carrier wave and one side band are filtered out at the transmitting end and only one side band radiated. Reception is accomplished by means of an oscillating detector working at the same frequency as the suppressed carrier-wave. A. G. N.

Dundee, September 23rd, 1926.

Sir,—The letter of Mr. D. McAteer in your issue of September 22nd raises the question of the existence of side bands. This is a problem which interests me and possibly the following paradox might amuse your readers.

Firstly, since Rugby transmits side bands and no carriers, they apparently do have a real existence, also if your correspondent wires up an oscillator and then adjusts the high tension and grid leak until he gets a high pitched howl (squegger effect) and then listens on an oscillating receiver he will have further evidence pointing to the real existence of these bands.

Now the Birmingham station of the B.B.C. uses a circuit which is substantially a low-power choke control transmitter followed by high-frequency amplifier coupled to the aerial. The frequency of the oscillator at Birmingham is approximately 630,000 cycles: if a note frequency of 1,000 is super-imposed we get two side bands of 629,900 and 630,100 cycles frequency. These three frequencies—carrier and two side bands—are amplified by the H.F. amplifier which for efficient working is negatively biassed and consequently gives the usual series of harmonics. Take the second harmonics, *i.e.*, of double frequency, they will be 126,000; 126,200; and 125,800 cycles. These mutually heterodyning at the receiving station give a note of 2,000 frequency together with a faint 4,000 cycle note. This however, is very weak since both side bands are much weaker than the fundamental.

We conclude therefore that a 1,000 cycle note should give a 2,000 cycle note on the normal harmonic, that is every note is raised an octave. Now listen to 5 IT's second harmonic; *the music is at its normal correct pitch.*

It would be interesting to have the comments of your readers as to where the fault lies in the reasoning. Personally, I have an explanation to offer but as I am not perfectly satisfied with it I will withhold it until some of your readers have expressed their own opinions. FRANK AUGHTIE.

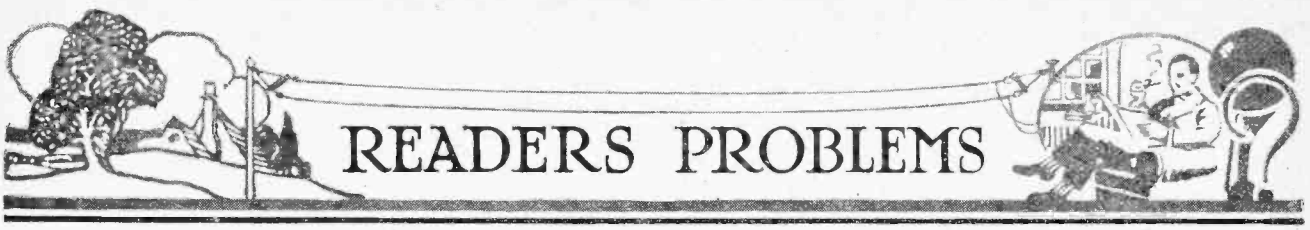
Dudley, September 25th, 1926.

Sir,—Mr. D. McAteer's letter on side bands in your issue of September 22nd is of great interest. The question whether side frequencies have an "objective physical existence" involves a clear understanding of the meaning of that expression.

For instance, has a wave of the sea an "objective physical existence" in the sense that the sea itself exists? Very tentatively it is suggested that no wave has an "objective physical existence." The mind analyses the complicated motion of the sea (or other moving medium) into a number of simple motions. Any such analysis must be logical, but it may be possible to analyse any given state of motion in more than one way.

In the particular instance one such analysis leads to the conception of side bands, while another (equally logical and correct) depicts the motion as a wave of constant frequency but of fluctuating amplitude. GEORGE M. MEYER.

Low Fell, September 22nd, 1926.



"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 Tone Control Unit.

Some time ago you published full constructional details of a tone control unit for adding to any existing receiver. I have unfortunately mislaid this issue, can you therefore give me the circuit diagram and main details of the unit. *D. R. C.*

This unit was described with full constructional details in our February 10th issue, which is, unfortunately, now out of print. We repeat in Fig. 1 the circuit diagram of the unit which is, of course, interposed between receiver and loudspeaker. By means of the variable controls provided, the unit can be put to four main uses which are clearly shown by reference to Fig. 1. In Fig. 1 (a) the unit is used as a simple volume control, a 0 to 500,000 ohms variable resistance being merely shunted across the loudspeaker terminals. In Fig 1 (b) the unit is arranged for the suppression of the upper musical frequencies for use in those cases where the loud-speaker is apt to give undue emphasis to the higher notes at the expense of the lower ones. Fig. 1 (c) produces exactly the opposite effect, whilst Fig. 1 (d) gives us a low-frequency tuned circuit designed for the suppression of any particular frequency or narrow band of frequencies to which the loudspeaker may be resonant. The circuit is tuned by means of the tapped choke and the variable capacity shunting it. The necessary arrangement of the plugs in order to bring about this combination is clearly shown in the captions to Fig. 2.

The choke has a total inductance of almost 17 henries and has five equally spaced tappings. Actually the choke consisted of a total winding of 4,000 turns of No. 38 D.S.C. copper wire wound on an old transformer core. The winding was, however, divided into five sections of 800 turns each in order to facilitate the bringing out of the tappings. A layer of empire cloth was placed over the iron core, and the wire wound on this, each section being separated from its adjacent one by means of a cardboard disc.

o o o

Turns Ratio or Primary Impedance.

I have been very interested in reading the article entitled "Coupling L.F. Valves," published in your May 26th issue, where it is emphatically laid down that when using transformers of different ratio in a two-stage amplifier, the low ratio should come first. I have in my possession, however, two transformers of Continental origin, one having a 3 to 1 ratio, and the other a 5 to 1 ratio, together with a pamphlet of instructions which states that the high ratio must be used first, How can these two opinions be reconciled? *I. B. G.*

In the article to which you refer, it was shown that in order to receive good quality from the point of view of more or less even amplification of all frequencies, it was necessary that the impedance connected in the anode circuit of the valve be at least two or three times greater than the valve impedance. This means that if a transformer is used after a detector valve (which should be of medium or high impedance for reasons stated in that article), its primary winding must be of very high inductance, which, of course, calls for a large number of turns on the primary. If a high ratio of, say, 5 to 1, is to be obtained, the number of secondary turns would have to be five times the number of primary turns. Since the primary winding has already a large number of turns, it follows that the total number of turns of wire in the transformer would be very large indeed, resulting in high self-capacity, with the resultant production of yet another form of distortion, namely, the shunting away of the higher musical frequencies through this high self-capacity. Therefore, we cannot make a transformer which has both a high ratio and a primary of high inductance. The actual limit of ratio for a first stage transformer, that is, a transformer with a big primary, is between 2 and 3 to 1 before trouble commences to set in from the self-capacity effects of the bulky winding.

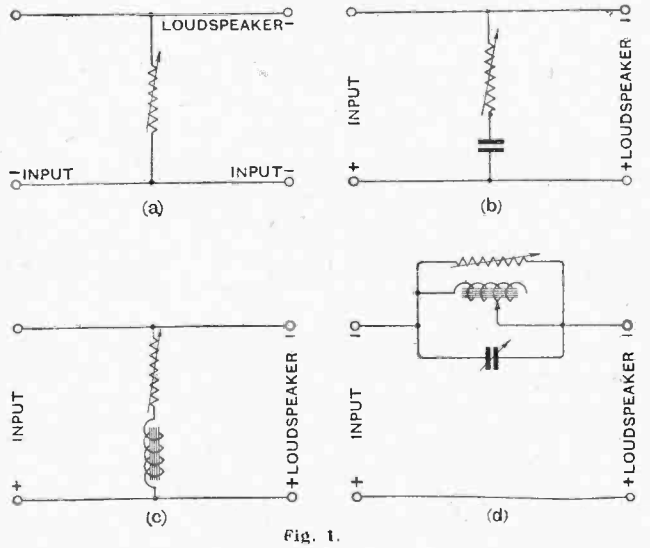


Fig. 1.

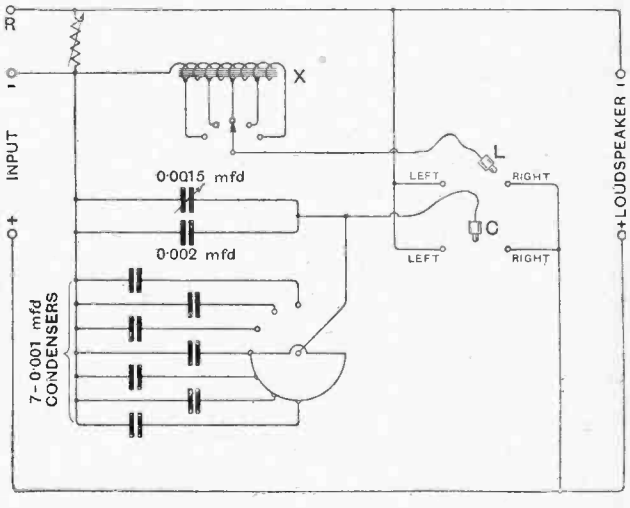


Fig. 2.

Fig. 1.—Universal tone control circuits. Fig. 2.—Complete circuit diagram. Positions of sockets for the circuits in Fig. 1. are as follow: (a) L, centre, C, centre; (b) L, centre, C, right; (c) L, right, C, centre; (d) L, left, C, left. In circuits (a), (b) and (c) the "Input —" terminal is joined to R.

Now our second transformer will follow the first L.F. valve, which should be a low impedance valve. Since, therefore, this valve has a much lower impedance than the preceding valve, it is obvious that the external impedance in the anode circuit can be much less, and yet enable us to still maintain the same ratio of internal valve impedance to external circuit impedance as in the case of the preceding stage. In other words, we do not require so big a primary inductance and so can use less turns on our primary winding. If we use less turns in the primary, it is obvious that we can use more turns in the secondary without increasing the total bulk of wire in the instrument or, in other words, without increasing the self-capacity. This means, therefore, that it is possible to use a far greater number of turns on our secondary and so use a much bigger ratio without ill effect. Actually, we can use a ratio of 4 or 5 to 1 before we once more come up against the self-capacity effects of the large number of turns.

Now, unfortunately, in the case of unscrupulous manufacturers, both British and foreign, it does not necessarily mean that because a transformer is sold as a low ratio transformer, that it has a high inductance primary. For instance, we can see from the foregoing that a transformer, having a primary of, say, 20 henries, and enough turns on the secondary to make it have a 2 to 1 ratio, would be less suitable to use after a high impedance detector valve than a 4 to 1 ratio instrument by a reputable maker, which had a 40-henry primary. Ratio is merely a secondary consideration. We all desire to get as much amplification as possible per stage, and if transformers with a 50-henry primary and a 5 to 1 ratio were available, then we should never use any other than a high ratio transformer. Now, in the case of many transformers (which are not necessarily sold at a low price) put on the market in a high and low ratio, exactly the same primary is used in each case, and the low ratio obtained by cutting down the secondary turns, an utterly senseless procedure.

The old fallacy of using a low-ratio transformer in the second stage is, or ought to be, completely exploded by now. If by low-ratio transformer we mean a properly designed low-ratio instrument, *i.e.*, one with a high inductance primary, then, of course, we should put it in the first stage after the high impedance detector valve, when it will be of benefit in improving quality. If, however, by low ratio transformer we really mean a high-ratio instrument with a small primary, which has been converted to a low ratio by merely pulling off a lot of the secondary turns, it does not make an atom of difference in which stage we put it. We shall get bad quality in either case.

It would appear almost as if the time has come for the abandonment of the quoting of transformers in terms of ratio, and to quote them in terms of primary impedance, just as it would be more correct to quote valves in terms of impedance rather than in terms of their reputed functions, such as "H.F." and "L.F.," or less confusing if we talked of frequency in kilocycles rather than of wavelengths in metres, as was pointed out on page 149 of the August 4th issue of this journal.

° ° ° °

Size of Anode Resistance.

I notice that nowadays when building a resistance coupled amplifier it appears to be the practice to make use of small-sized anode resistances no larger than a grid leak as compared with the large-size instruments used two years or so ago. Can you tell me the reason for this? *P. T. O.*

Two years ago the only type of valve specially designed for resistance coupling was one having an amplification factor of 20 and an impedance of 30,000 ohms. It has been frequently pointed out in this journal that in order to take as full an advantage as possible of the amplification factor of the valve, it is necessary to make the value of the anode resistance about five times the value of the valve impedance, although not much advantage could be gained by increasing the value of the external resistance beyond this value. This meant that there was not much object in using resistances of greater value than about 150,000 ohms. Since the plate current was comparatively heavy (2 or 3 milliamps.) it was necessary to make the resistance of larger cross-sectional area in order to enable it to carry the plate current satisfactorily. Hence the large bulk. It was found, however, that after a comparatively short period of use, the material of which they were constructed commenced to disintegrate under the influence of the steady plate current and crackling noises developed. These instruments, therefore, gave place eventually to non-inductive wire-wound substitutes which proved perfectly satisfactory.

Recently, however, valves have appeared which have an amplification factor of about 40 and an impedance of about 100,000 ohms. It is obvious that in order to take advantage of the high amplification of this valve, we shall still have to make our external anode resistance five times as great as the valve impedance as before. This means that a resistance of 500,000 ohms will be required. It would be a difficult matter to construct a wire-wound resistance having this large ohmic resistance without undue bulk and detrimental self-capacity effects. Fortunately, however, a wire-wound resistance is unnecessary since it is obvious from a consideration of Ohm's Law that the plate current will be reduced to a fraction of a milliampere owing to the large anode resistance. Consequently a wire-wound resistance is unnecessary to carry this small current. The ordinary type of graphite resistance is still unsuitable, however, even for this small current, but metallised resistances are now available which are of the same dimensions as a grid leak, and they are, of course, virtually grid leaks and can, when obtained in suitable values, be used as such in place of the ordinary graphite types.

° ° ° °

A Relay Riddle.

I have recently constructed the "Home Broadcast" receiver described in your April 28th issue, and have installed same complete with relay. In connection with the latter I have noticed that it will work exceedingly well with a two-volt accumulator, whilst a four-volt accumulator seems almost too much for it. I attempted to make use of a partially run-down H.T. battery, but it failed to operate, and I find on test that it does not work really properly even with an almost new H.T. battery, whereas a partly discharged four-volt accumulator is more than sufficient. Can you explain this phenomena? *T. K. O.*

The relay in question has an exceedingly low resistance, and is wound with very few turns of thick gauge wire. The result is that it requires a very heavy current (almost half an ampere) to operate it, but since the resistance of the winding is so low, only a small voltage is required to force this current through the windings. Consequently a two- or four-volt accumulator is ample. In the case of a partially run-down H.T. battery, however, although the voltage is high, the internal resistance of the battery is high also, and so the current flowing in the circuit is limited and is insufficient to operate the relay. It is of little use connecting a large number of such batteries in series in order to increase the voltage, because the internal resistance increases proportionately, and we should be all the time working in a vicious circle. It would be possible, of course, to arrange for the relay to operate at a high voltage, and so low current, by rewinding the magnet bobbins. Discarded H.T. batteries might then be used. The force of magnetic attraction exerted on the armature depends, of course, on the ampere-turns. It will be obvious, therefore, that this can be taken in the form of large amperage and comparatively few turns as in the original instrument, or alternatively it can be taken in the form of a large number of turns and a small amperage.

The Wireless World AND RADIO REVIEW

(14th Year of Publication)

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BROADCASTING PICTURES.

IT is with the coming of autumn, when outdoor recreation gives way to a renewed interest in broadcast reception, that both the listener and experimenter look to the introduction of features of new and novel interest. New ideas in the arrangement of programmes are undoubtedly needed at this time of revival, and on the technical side, also, we look for development to open new fields for experiment. To find something of new interest is not always easy, and we feel that, in the matter of programmes, those responsible have not been prompted in their efforts by any spirit of enthusiasm.

Now on the technical side a development has taken place which is capable of creating a vigorous revival in the wireless industry. An article in this journal [1] described apparatus capable of being used for the wireless transmission of pictures by methods suited for home use. The apparatus was tested and good pictures electrolytically recorded in half-tone were obtained, and we stated that we considered that the system would prove satisfactory and undoubtedly lay the foundations of a picture broadcasting service.

With our broadcasting organisation in the hands of a single company it would seem incumbent upon that company to investigate the possibilities and even endeavour to develop such an important auxiliary to broadcasting. Startling wireless developments are often claimed, but it is the duty of the expert to sift the technically sound from that which is merely sensational.

In the meantime we learn that a picture broadcasting service has been set up in Vienna, whilst from Germany come reports of successful demonstrations, and a number of articles have appeared in the German technical press describing in detail practical picture transmitting gear (which must not be confused with television) for use in conjunction with the wireless transmitter. It is understood, also, that application has been made to the British Post Office to conduct picture broadcasting in this country by a French inventor, though it is believed that permission has been refused.

It will be remembered as regards the introduction of broadcasting that the lead was taken by the United States, and it was not until broadcasting had been properly established in that country that the building of our stations was undertaken. It is to be hoped that England will not wait until picture broadcasting services have been established abroad before contemplating the erection of picture transmitting stations.

Much of the development work has already been done in this country, and if those responsible for our broadcasting company are not yet disposed to give their attention to the matter, then we trust that no obstacles will be thrown in the way of any British inventor prepared to exploit picture broadcasting, and that he may have some assurance that he will be permitted to carry on when it has been shown that his system is successful.

The setting up of a picture transmitting station, if only experimental, would give the listener an added interest in his set, stimulate trade, and eventually increase the power and importance of broadcasting.

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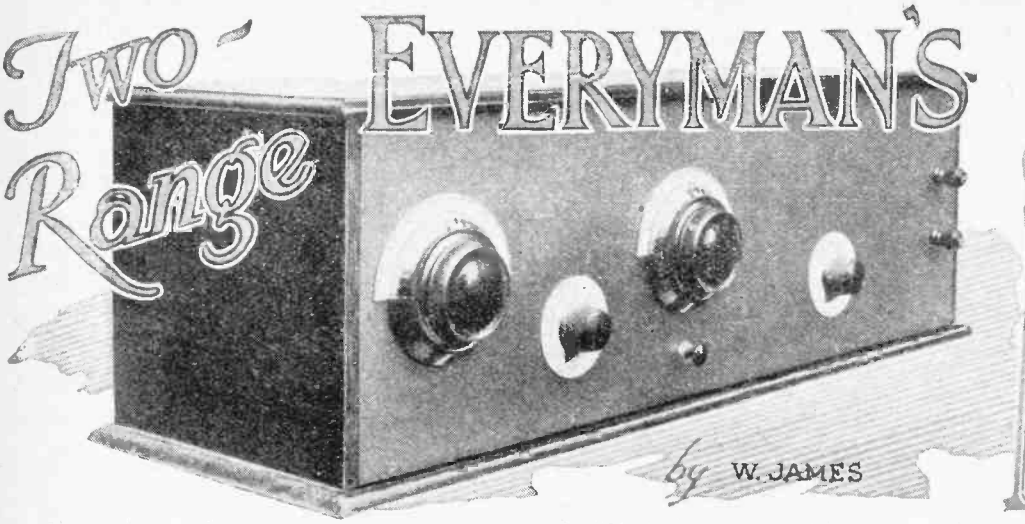
[1] Page 437, Vol. XVIII, March 24, 1926.

Two-Range Everyman's Four



An Efficient Receiver for Long & Short Broadcast Waves

by W. JAMES

SO great is the interest taken in the original "Everyman's Four-valve" receiver[1] that the writer receives numerous letters from readers living in parts where spark interference is troublesome, asking him to devise a similar highly effective circuit for Daventry. They invariably explain that on those occasions when spark interference is bad—and only those situated in coastal districts know how really bad this form of interference can be—the only station worth listening to is Daventry. Others have asked whether provision could be made for the reception of this station on the grounds that Daventry is often operating for a longer period each day than the local main stations. A particularly pleasing feature is that correspondents say they would rather do without Daventry than have the selectivity and amplifying power of the original receiver impaired in any way. Not long ago it was usual to include all manner of switches in high-frequency circuits, and, provided the switches were of not too bad a type, they could be used practically with impunity, for the reason that the high-frequency circuits themselves had large losses. But when dealing with a set such as the "Everyman's Four," where every care was taken to secure the highest efficiency from each part, switches have to be avoided. Obviously, if ebonite coil formers were rejected in favour of Paxolin tubes because of the losses caused by mounting the terminals in the

The receiver described in this article is the original "Everyman's 4-valve," to which has been added a circuit for the reception of Daventry; telephone terminals have also been provided. Many readers have written pointing out that they normally listen to Daventry, while others say this station is less liable to spark interference. The additions were made for their benefit.

[1] Described in the issues of July 28th, August 4th, and September 8th.

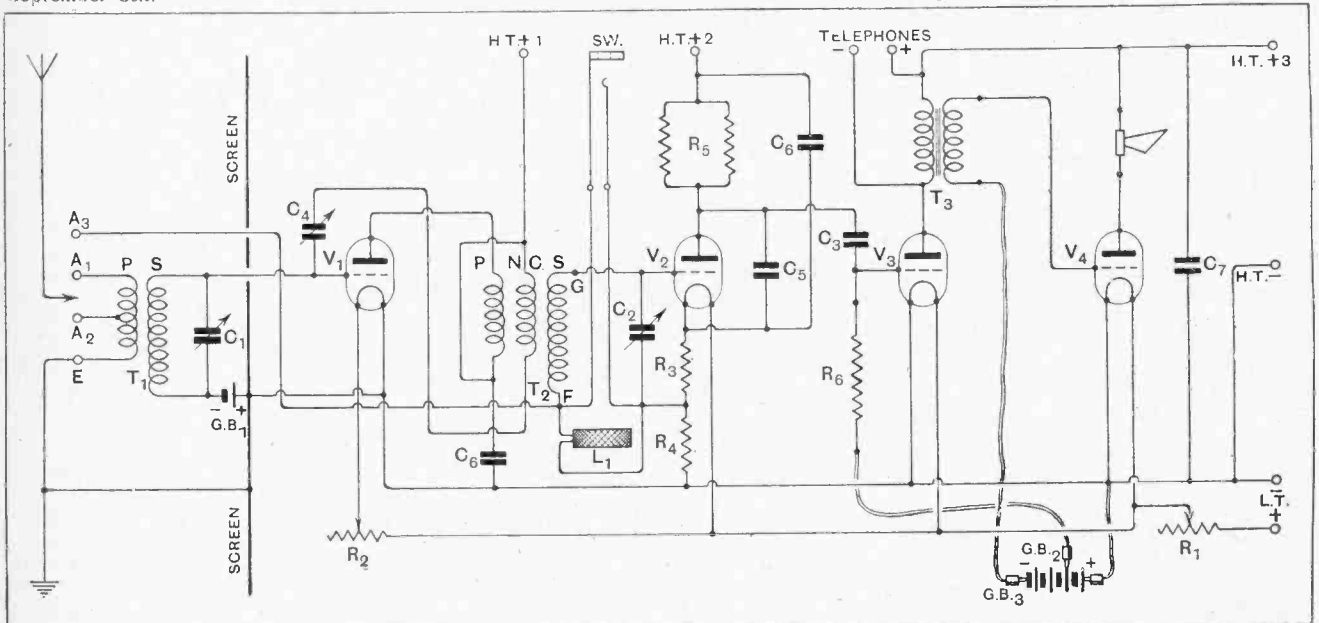


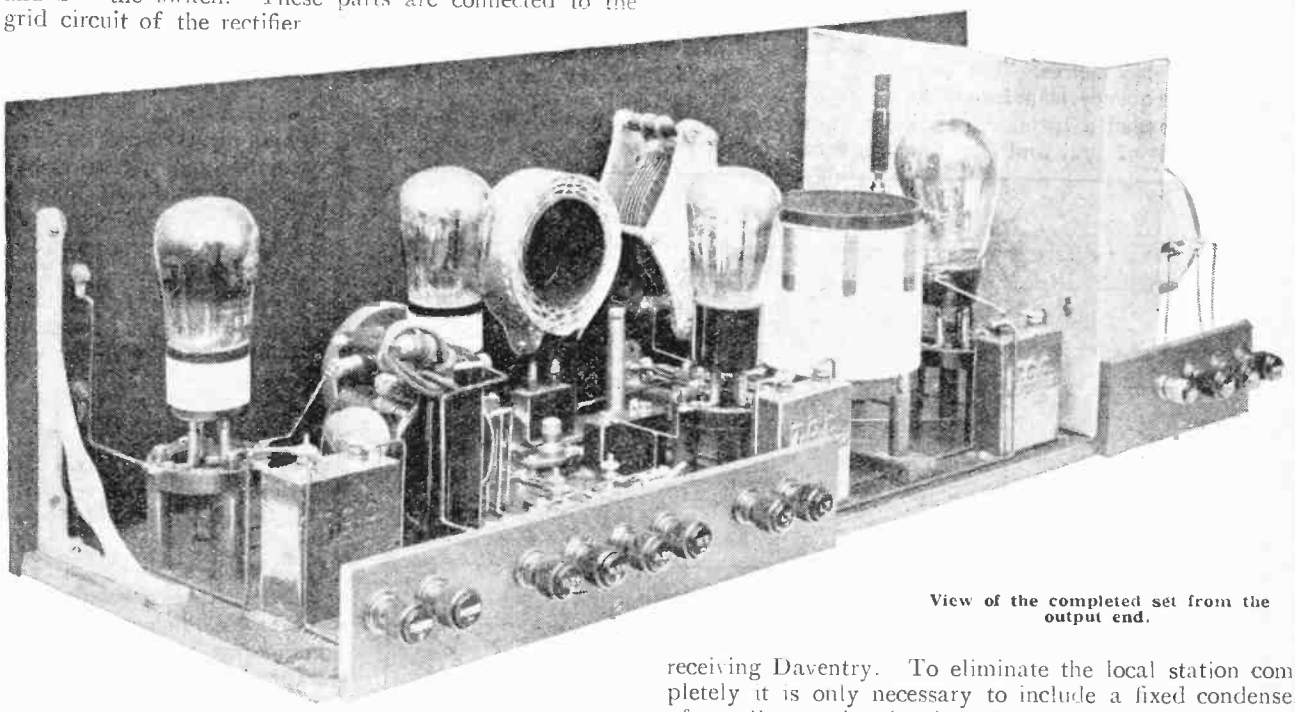
Fig. 1.—Theoretical diagram of connections. T_1, aerial-grid transformer; T_3, high-frequency intervalve transformer,; T_2, Ferranti 3.5 : 1 low-frequency transformer; C_1, C_2, 0.0003 mfd. square law tuning condensers; C_3, 0.01 mfd.; C_4, balancing condenser; C_5, 0.0005 mfd. fixed condenser; C_6, 1 mfd.; C_7, 2 mfd.; R_1, filament rheostat, 2 ohms; R_2, volume control rheostat 30 ohms; R_3 R_4, fixed resistors 15 and 7.5 ohms; R_5, 1 megohm each; R_6, 2 or 3 megohms; L_1, No. 200 plug-in coil for Daventry.

Two-range Everyman's Four.—

ebonite, it would be foolish to connect a switch across the coil.

The Daventry Circuit.

To meet the requirements of those who wish to receive Daventry in addition to the dozens of other stations working in the 200 to 550 metres wavelength band, the writer has devised a simple method of doing this. The method can be applied to existing receivers in a few minutes, and its great advantage is that the efficiency of the existing set is not affected at all. It is only necessary to fit a further aerial terminal, a coil plug and plug-in coil and an "on" and "off" switch. These parts can be seen in the theoretical diagram of the set, Fig. 1, A_3 being the aerial terminal for Daventry, L_1 the plug-in coil, and SW the switch. These parts are connected to the grid circuit of the rectifier



View of the completed set from the output end.

When the receiver is used for the 200 to 550 metres band of wavelengths, the switch knob is "in," thus short-circuiting the switch contacts, and the filament side of the tuning condenser, C_2, is connected to the filament end of the secondary winding of the high-frequency transformer, T_2. The wire between the aerial terminal A_3 and the end F of the secondary winding is, therefore, earthed, and so is the plug-in coil. By pulling the switch knob out, however, the short-circuit is opened, and the secondary coil and plug-in coil are connected in series with the tuning condenser, C_2, across them. If, now, the aerial is connected to terminal A_3, the grid circuit can be tuned to Daventry, and this station received at full loud-speaker strength in most parts of the country, as the rectifier is followed by two speech frequency amplifying valves.

It will be noticed that resistance R_4 is in the earth circuit; its value when using a Cosmos Green Spot (2-volt) valve as the rectifier will be 7.5 ohms. This resistance is not worth troubling about in many instances, but if the aerial and earth in use happen to be really efficient, it is worth while to connect a large fixed condenser, such as a 1.0 mfd., across the ends of resistance R_4. If 2-volt valves are used in all stages, these two resistors will not be used, and the wire connected to the junction of R_3, R_4 will normally be joined to negative 3 volts on the grid bias battery; a 1.0 mfd. condenser should be connected across this portion of the battery. Valve V_1 is, of course, not used when receiving Daventry, and filament resistance R_2 may be turned off. Fairly sharp tuning is obtained when a coil having low losses is used at L_1, and for this reason a "Lewcos" plug-in coil is recommended, but when the set is used at a place within a mile or so of a local station, it is sometimes found that the local station can be heard when receiving Daventry. To eliminate the local station completely it is only necessary to include a fixed condenser of small capacity in the wire connecting terminal A_3 and point F on the secondary coil of transformer T_2. A suitable condenser is of 0.0001 mfd. capacity. This will cut down the strength of Daventry, and the writer uses a condenser of this capacity for the purpose of weakening Daventry and eliminating the London station. A condenser is not included in the set illustrated here because comparatively few users would find one necessary. The coil used is a "Lewcos" No. 200, which is satisfactory with and without the series condenser.

The Tuned Circuits.

A full description of the design of the receiver was given in the three issues of *The Wireless World* referred to above, but the construction of the high-frequency transformers has been very slightly modified because 0.0003 mfd. tuning condensers are now used instead of condensers of 0.00027 mfd.[1] In the original model the

[1] We understand that the manufacture of the 0.00027 mfd. condensers has been discontinued.

Two-range Everyman's Four.—aerial grid transformer had a primary winding of 14 turns tapped on the eighth turn and a secondary of 74 turns of No. 27/42 Litzen wire, each of the 27 strands having a single silk covering and the cable a covering of double silk. If this coil is used with a 0.0003 mfd. tuning condenser, the wavelength range is about 220 to above 600 metres, but as there are no broadcast stations operating on so high a wavelength it is better to lower the wavelength a little by removing a few turns from the secondary. In the new design illustrated in Fig. 2 the secondary has 68 turns, and the wavelength is from 200 to 550 metres. The intervalve high-frequency transformer has also been changed a little, the secondary now having 68 turns instead of 74, and the double wound primary 15 + 15 turns of No. 40 D.S.C. instead of 16 + 16 turns. If 0.00027 mfd. tuning condensers can be obtained, the original specification should be adhered to, but when it is found necessary to use 0.0003 mfd. tuning condensers, it will be found that tuning is slightly easier if the new design of transformer is employed.

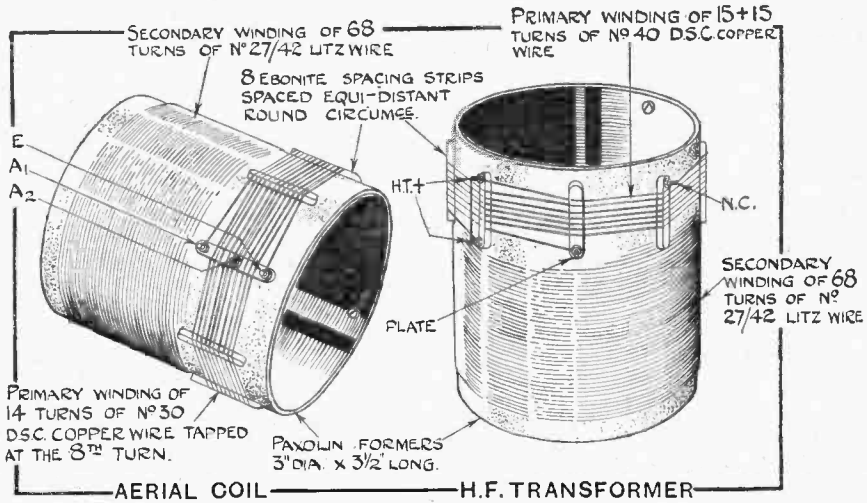


Fig. 2.—Details of the aerial-grid and intervalve high-frequency transformer windings.

Construction of the High-frequency Coils.

The aerial grid coil lies horizontally in the set, and has a base of wood (drawing F, Fig. 3), 4in. long × 1in. wide × ¼in. thick, with two ebonite supports ⅜in. diameter. These supports are drilled and tapped 6 B.A. at each end. The coil itself is wound on a Paxolin former 3in. in diameter × 3½in. long, and has 68 turns of 27/42 Litzen wire wound with the turns touching, as indicated in Fig. 2, the ends being connected to tags held by screws in the tube. It is only the work of a few moments to remove the insulation from the 27 wires of the cable and to solder them, but when removing the insulation with a piece of fine emery-cloth care must be taken not to break off one of the fine wires.

Over the secondary winding and at the earth end is placed eight ebonite spacers

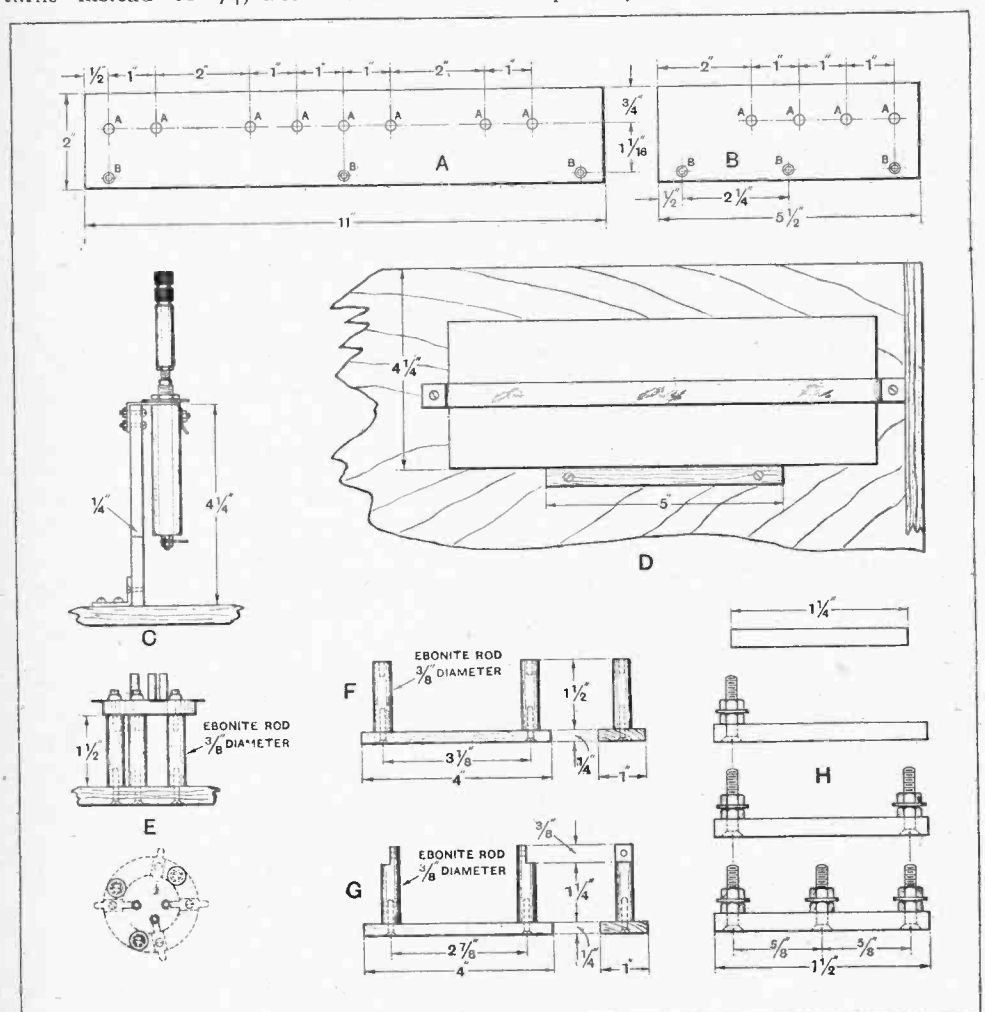


Fig. 3.—A and B, details of ebonite terminal strips: A, 7/32" diameter; B, 1/8" diameter. C: method of fixing balancing condenser. The upright piece is of ebonite and the two brackets of brass. D: method of fixing grid-bias battery to back of cabinet. E: valve-holder supports. F: base for aerial-grid coil. G: base for intervalve transformer. H: details of ebonite spacers.

Two-range Everyman's Four.—

cut from a length of ebonite tube 3in. in diameter with $\frac{1}{8}$in. wall. These are $\frac{1}{4}$in. wide. One of the spacers has three screws and tags, as shown in drawing H, Fig. 3, and in Fig. 2. A rubber band can be used to hold the spacers in position whilst the first few turns of the primary winding are being put on. No. 30 D.S.C. is used for the primary, and the direction of winding is the same as that of the secondary.

Details of the high-frequency transformer are given in Fig. 2, and details of a base for this will be found in drawing G, Fig. 3. Three of the ebonite spacers are provided with screws; two of them have a single screw at one end, as in drawing H, Fig. 3, while the spacer carrying the positive H.T. connections has two screws. Having wound the secondary, the spacers are put in position and held by rubber bands. The primary winding of No. 40 D.S.C. of 15 turns is then wound in the same direction as the secondary, commencing at the end + H.T. terminal and spacing the turns 15 to the inch. The end of this winding is terminated at the screw marked "plate." Begin the second primary winding at the screw marked NC, and wind this wire in the space between the turns of the primary terminating at the screw marked + H.T. Connect the two screws marked H.T. + with a wire.

The Front Panel and Baseboard.

Details of the ebonite front panel are given in Fig. 5. This measures 26 × 8 × $\frac{1}{4}$in., and carries the two tuning condensers, two filament rheostats, switch, and two terminals. In Fig. 6 will be found the arrangement of the parts on the wooden baseboard. On the right-hand side we have the aerial grid transformer T_1 and a dry cell battery GB_1; then there is a screen of copper or aluminium, details of which will be found in Fig. 4. To the left of the screen is a balancing condenser C_4, mounted on a suitable bracket, as shown in drawing C, Fig. 3. The remainder of the components will be easily identified, L_1 being the plug-in coilholder and T_2 the H.T. transformer. In the original "Everyman's four-valve" receiver the valve-holders were mounted on circular pieces

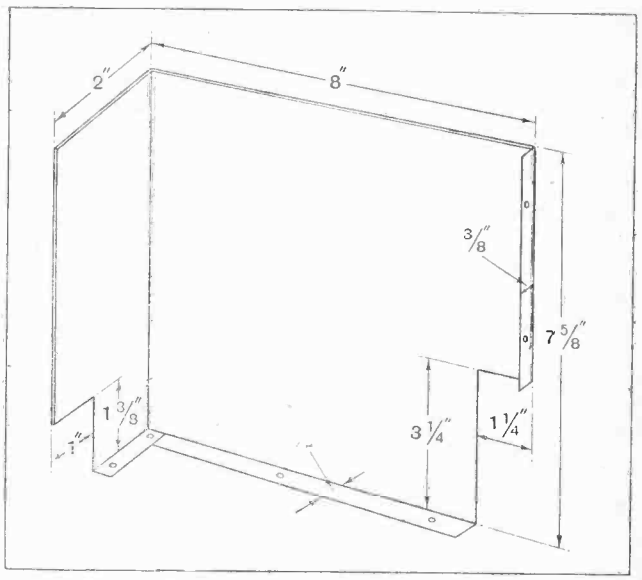
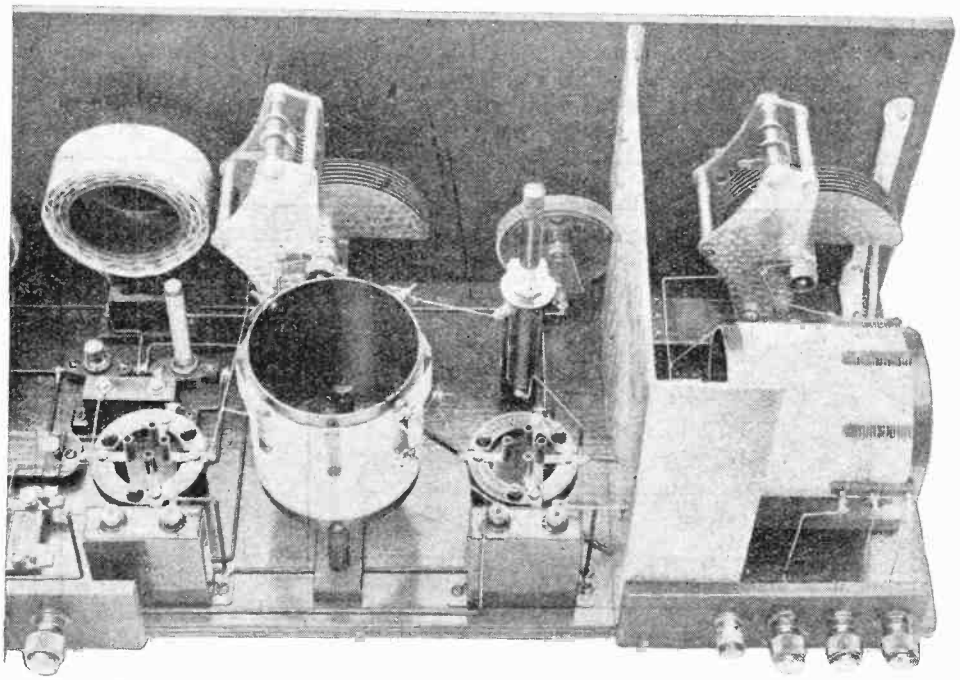


Fig. 4.—The copper or aluminium screen.

of wood 1in. thick, but in this receiver the valve-holders are mounted on short lengths of ebonite rod, as shown in drawing E, Fig. 3. Drawings A and B, Fig. 3, give details of the terminal strips, which are screwed to the back edge of the baseboard. Two brackets are used to hold the panel and baseboard together, the outside edges of the brackets being filed to allow the set to fit its cabinet.



The high-frequency and detector circuits; on the right is the aerial coil, tuning condenser, connection strip and screen. Behind the right-hand valve-holder is the balancing condenser and volume control rheostat, while to the left can be seen the Daventry plug-in type coil.

Wiring the Receiver.

When wiring this set it should be remembered that all filaments and H.T. wires should be run near the baseboard, and when possible be covered in Systoflex. Grid and plate wires should run in short and direct paths. It is convenient to wire a part of the set with the screen removed, but as the layout is very simple there is no need to go to any great trouble to remove parts when putting in some of the wires.

It should be noticed that the wire from terminal A_3

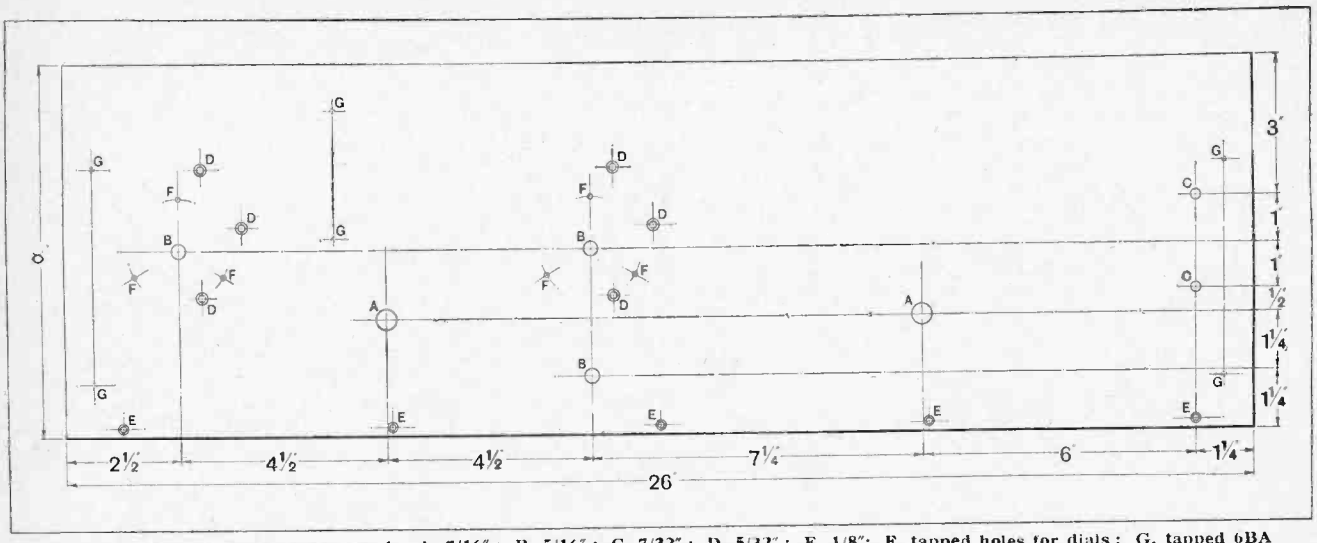


Fig. 5.—Details of ebonite front panel. A, 7/16"; B, 5/16"; C, 7/32"; D, 5/32"; E, 1/8"; F, tapped holes for dials; G, tapped 6BA for brackets and screen.

is insulated where it passes through the screen, as is the wire from terminal G of transformer T_1. The wire from terminal E is connected to the screen, and so is the wire from the positive side of GB_1. Condenser cases and the case of the low-frequency transformer are all joined to earth and negative L.T.

Testing.

When the wiring is finished put a DE5B valve in holder V_1, a Cosmos Green Spot in the holder V_2, a DE5B in V_3, and a DE5 in V_4, or valves of similar characteristics. Connect a 6-volt filament heating battery and apply 140 to 160 volts to terminals $+HT_3$ and $+HT_1$; to the detector connect 60 to 90 volts. Connect a pair of telephones to the telephone terminals or the loud-speaker to the loud-speaker terminals. As the telephones are merely connected across the primary winding of the low-frequency transformer, it is very important to remove the telephones when using the loud-speaker. The grid bias should be connected, GB_2 being plugged in negative 3 volts and GB_3 to negative 12 volts. This battery, by the way, is fastened to the back of the set above the terminal strip, the method of fixing the battery being shown in drawing D, Fig. 3.

Connect the aerial and earth and tune in the local station which will probably be heard at tremendous strength. Reduce the volume by turning down the filament rheostat R_2 and, keeping the set in tune with the local station, turn this rheostat off. Now it is necessary to balance the set, and this is done by adjusting the balancing condenser C_4 until the local station cannot be heard with the first valve off. When it is found that the local station cannot be heard with the first valve off, even though the two tuned circuits are in tune, the set is perfectly balanced. It is now necessary to turn on the first valve and tune in a distant station near the minimum and maximum ends of the dials respectively, to test whether the receiver is stable. If the receiver is found to be stable, slightly readjust the balancing condenser to obtain the maximum output from

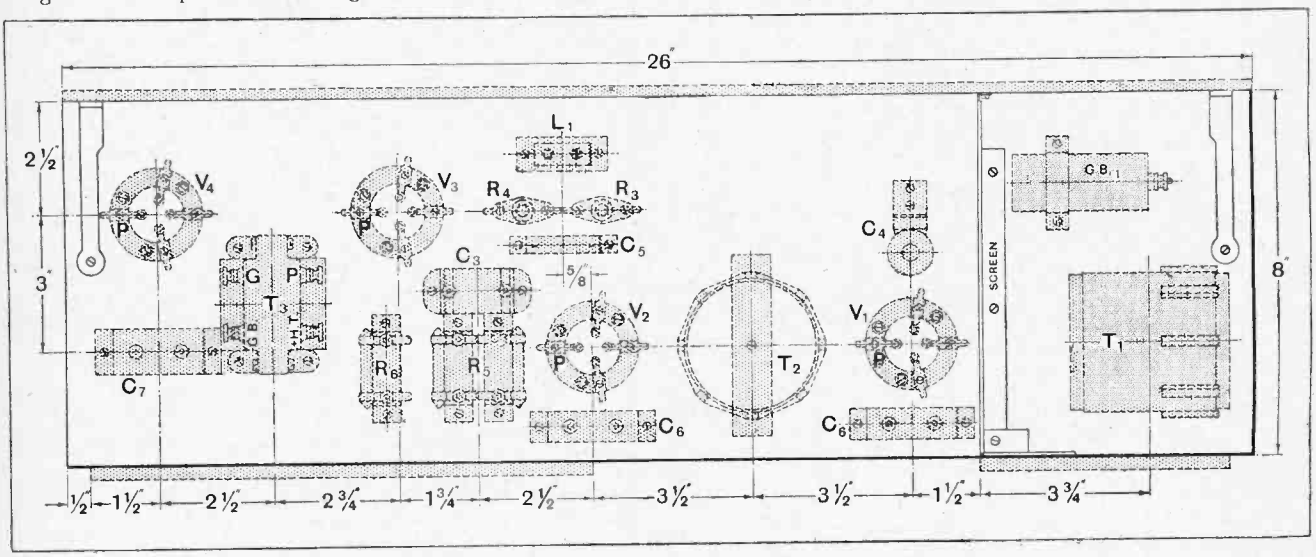


Fig. 6.—Arrangement of parts on baseboard. See Fig. 1 for values of parts.

LIST OF PARTS.

2 Variable condensers, square law, 0.0003 mfd. (Igranic Electric, Ltd.).
2 Rheostats, 2 ohms and 30 ohms (Burndept Wireless, Ltd.).
[illegible] resistors, 15 ohms and 7.5 ohms (ditto).
2 Resistor holders (ditto).
2 Condensers, 1 mfd. (Telegraph Condenser Co., Ltd.).
1 Condenser, 2 mfd. (ditto).
1 Neutrovernia (Gambrell Bros., Ltd., 76, Victoria Street, London, S.W.1).
1 Transformer, A.F.3, 3½ to 1 (Ferranti, Ltd., Hollingwood, Lancs.).
1 "T" type (square), 1½ volt grid battery (Siemens Bros. & Co., Ltd., Woolwich, London, S.E.).
1 No. 620 fixed condenser, 0.0005 mfd. (Dubilier Condenser Co., Ltd.).
1 No. 610 fixed condenser, 0.01 mfd. (ditto).
1 Grid Leak, 2 megohms. Dumetohm (ditto).
2 Grid leaks, 1 megohm (Edison Swan Electric Co., Ltd., 123-125, Queen Victoria Street, London, E.C.4).
3 Grid leak holders (Dubilier Condenser Co., Ltd.).
1 16-volt grid battery (Portable Electric Light Co., Ltd., 120, Shaftesbury Avenue, London, W.1).
50 yards Litzen wire (P. Ormiston & Sons, Ltd., 79, Clerkenwell Road, London, E.C.).
4 Valve-holders (Bowyer-Lowe Co., Ltd.).
2 Paxolin tubes (Micanite & Insulator Co., Ltd., Empire Works, Blackhorse Lane, Walthamstow, London, E.17).
Ebonite shrouded terminals (Belling & Lee, Ltd., Queensway Works, Ponders End, Middlesex).
Ebonite panel, 26" × 8in. × ¼in.
1 Cabinet and baseboard, 26in × 8in. × 8in. (Carrington Mfg. Co., 18-20, Mitchell Street, Central Street, London, E.C.1).
1 Single pole change-over switch (Edison Bell, Ltd.).
1 Plug-in coil-holder.
1 No. 200 "Lewcos" coil.
2 Brackets.
2 Burndept Vernier dials.

the receiver. It will be found that the set is more selective with the aerial connected to A_2, but that the stations of longer wavelength are louder when the aerial is connected 2½ miles from the London station, and about 40 stations have been received at good loud-speaker strength, many of them in daylight.

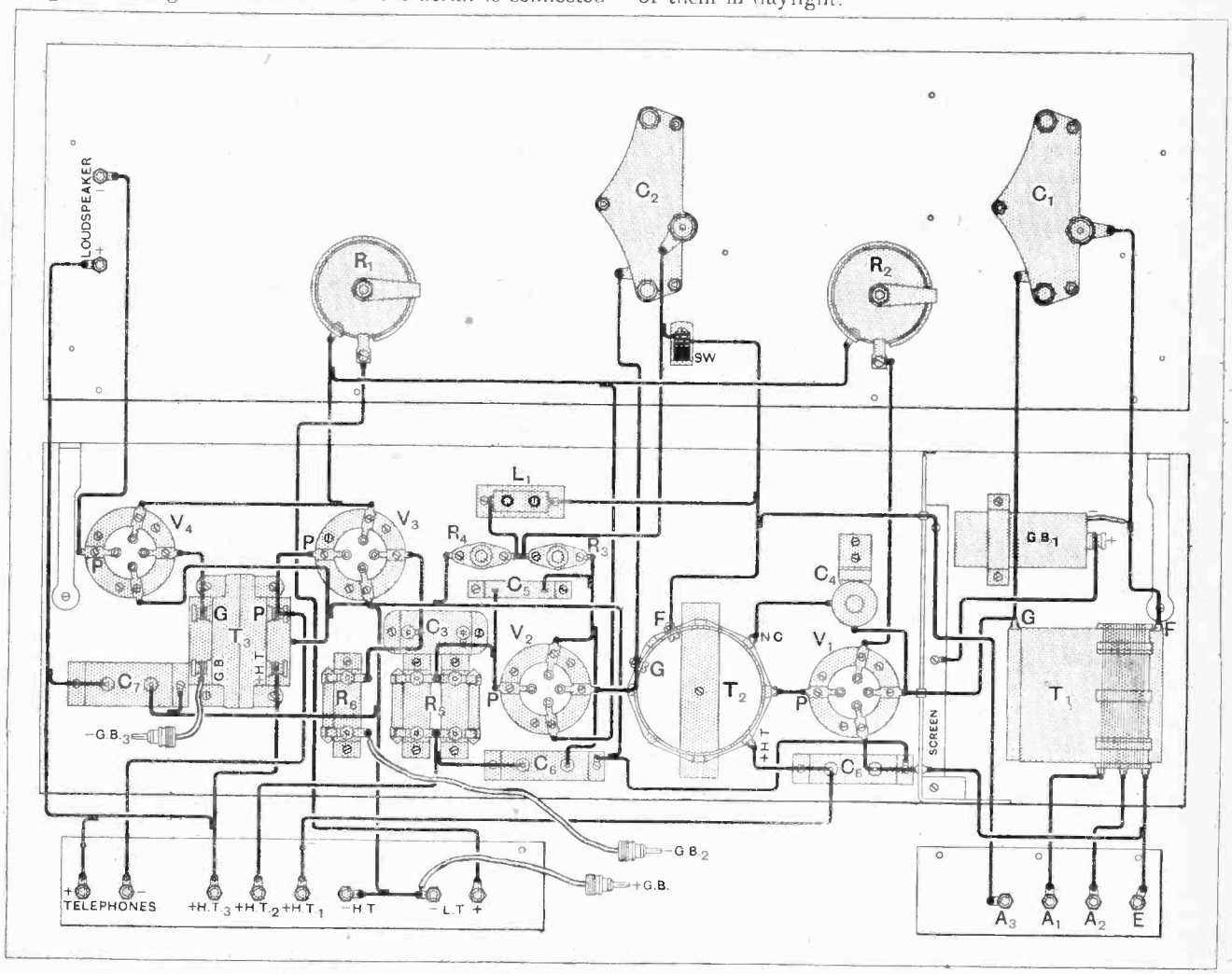


Fig. 7.—Wiring diagram.

to terminal A_1. To receive Daventry transfer the aerial to terminal A_3, pull out the switch, and tune with condenser C_2.

The receiver illustrated has been in use for some time and has been tried at different places. Bournemouth can be received without interference from London at a place

Selectivity and amplification depend on the valves used, and those recommended, or other makes of similar pattern, should be employed when possible. This matter was discussed in an article published in the issue of September 8th, 1926, and should be consulted by those who propose to use other valves.

A.Z.1

ACOUSTIC REFLECTION.

Influence of Echoes on Loud-speaker Quality.

By N. W. McLACHLAN, D.Sc., M.I.E.E., F.Inst.P.

WE are all familiar with the reflection which occurs when sound waves strike a large wall. Very little sound energy gets through the wall, but a good deal is thrown back. When the wall happens to be one of the boundaries of a room, the sound is reflected backwards and forwards from wall to wall, from floor to ceiling, and so on until its energy is gradually dissipated and it becomes inaudible. In this way echoes are obtained. Now, the air in a room can vibrate in an infinite number of ways. For example, end to end, top to bottom, diagonally along the sides, diagonally across the corners, and so on. The room can be regarded as a sort of stumpy organ-pipe closed at both ends. Sometimes the windows are open, and this varies the effect. The various resonances or modes of vibration of the room will occur at different frequencies. There are blind persons who can gauge the dimensions of a room merely from its echoes, provided it is not too heavily draped.

Resonance Effects.

Having got so far with room resonances, as we may call them, the next step is to apply the effect to the loud-speaker problem. Somehow we naturally forget that the output of a loud-speaker depends upon its environment. This can be very simply demonstrated by taking the instrument from a room into the open air when the whole musical atmosphere, so to speak, is travestied. In the open the reflection disappears, and the instrument sounds thin.

In addition to boundary reflection in a room, there are standing waves which we have all experienced with the tuning-in note. These occur on all the intermediate and higher frequencies and affect the reproduction so that it alters from point to point in the room. On the average it may not be very perceptible, since the musical frequencies of an orchestra change very rapidly and the nodes and antinodes of the standing waves dodge about the room hither and thither like an army of flies.

Then there are generally numerous subsidiary sources of sympathetic vibration in the form of ornamental vases, cabinets, hollow floors, etc., all of which have a definite influence. On the whole, unless the loud-speaker itself is free from resonance, these influences do not detract seriously from the reproduction. As a case in point, during experimental work a curious low resonance (quite pleasant to hear) was evinced on orchestral music in a certain room. It generally turned up with the lower notes of the 'cello and the double bass. This was due to resonance of a loose floor board, and when the output of the speaker was appreciable it made one's feet tingle. A similar effect was evinced with orchestral drums. Personally, I often feel the vibration of furniture (chairs, table), and even the pages of a book or newspaper, when a loud-speaker is in action. It is quite clear that under such conditions the various components of the room are adding their quota of resonant notes. An interesting effect is found with diaphragm loud-speakers—I never use horns—when reproduction is taking place in one room, and the experimenter listens in an adjoining room, the door between the two being open, the music *appears* to be louder in the latter room. So far as actual air pressure is concerned, we know full well that it cannot be louder, but the echoes in the reproducing room give the effect of vastness and add a richness which is not obtained when one is in close contact with the instrument. In fact, one can in a degree simulate concert conditions, where a mild degree of blurring is recognised to add appreciably to artistic effect.

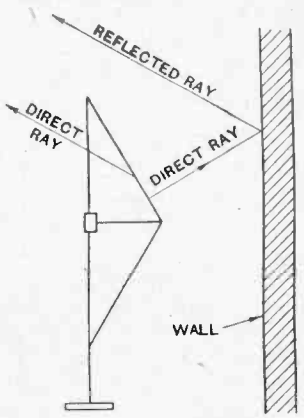


Fig. 2.—Direct and reflected waves from cone loud-speaker.

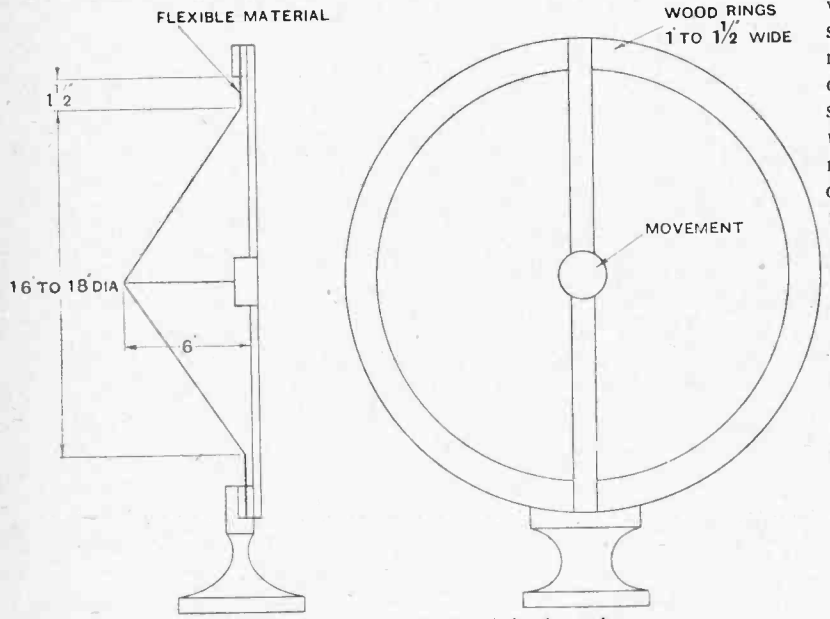


Fig. 1.—Details of experimental loud-speaker.

Acoustic Reflection.—

Some time ago I introduced the subject of loud-speaker reflectors consisting either of a wall or a suitably situated stiff board behind a large diaphragm type of instrument. By moving this board towards the loud-speaker the pitch of reproduction is elevated, due to suppression of the low tones. A number of persons have tried the experiment. Some got results; others did not. In virtue of the negative experiments it is well to investigate the reason for such absence of effect. In the first place, one condition must be satisfied, namely, there must be low tones to suppress. Absence of low tones can be attributed to three salient factors: (1) There may be none in the transmission, e.g., violin, piccolo; (2) the loud-speaker may have a weak lower register (most of them do), especially if the diaphragm is small; (3) the amplifier may be cutting off the low tones. If we take an experimental loud-speaker of the form indicated in Fig. 1 and move it towards the wall during the performance of an orchestral piece, as shown in Fig. 2, the lower tones will disappear and the music will sound high-pitched. It will be observed that this instrument has no baffle to isolate the two sides and prevent circulation which reduces the low tones. The diaphragm is large enough to act as a small baffle, although a baffle augments the lower tones nevertheless. Let us imagine that there is a baffle round the supporting ring, and that the hole in the baffle can be reduced at will, after the manner of an iris diaphragm so familiar in the art of photography for altering the camera "stop" (see Fig. 3). As the baffle is moved parallel to itself along the axis of the loud-speaker diaphragm, we can imagine the hole to be closed in order to fit over the diaphragm at all radii. Ultimately, when the baffle has reached the apex of the cone, there is no hole and it has become a reflector. During the intermediate stages it is partly a baffle and partly a reflector, so that the tone can be varied according to the radius at which the board is situated.

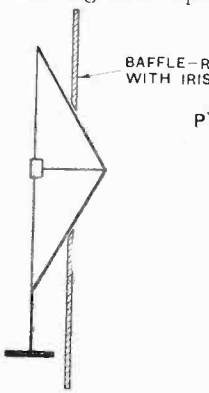


Fig. 3.—Loud-speaker with adjustable baffle-reflector.

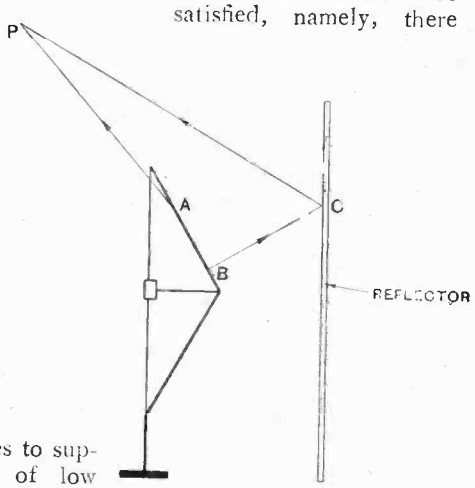


Fig. 4.—Diaphragm loud-speaker with reflector.

Interference Effects.

The explanation of the action of the reflector has been given before, but the following is more detailed. In Fig. 4 we have a loud-speaker with a wooden board at the rear about twice the diameter of the diaphragm During operation, pressure waves are radiated from both sides of the diaphragm. Those at the front are unimpeded by any obstruction, whilst those at the rear meet the board and are reflected therefrom. The result is that part of the sound from the rear is diverted into the same paths as that from the front. Considering the condition at a point, P in Fig. 4, there are two sets of pressure waves—(1) those from the front of the diaphragm; (2) those reflected from the board. The latter having further to travel, arrive at P a little later than the former, and are of *opposite sign* (see Fig. 5). Thus the two sets of waves are out of phase. At low frequencies the *time* interval between the arrival of the two sets of waves is small compared with the time taken to execute a semi-cycle. For example, suppose the difference in the lengths of the paths between two particular rays is 1 foot and the frequency is 50 cycles per second. The lateness of arrival is then 1 foot/ (vel. of sound) = 1/1,200th sec. Now every half-cycle of the wave occupies 1/100th sec., or twelve times as long, so that to all intents and purposes the waves arrive simultaneously Bearing in mind that the pressures due to the two waves are of opposite sign —a phase difference of 180°—it is clear that they practically wipe each other out. The effect is gradually reduced as the frequency is increased. This is due to two causes: (a) The low tone radiation spreads out laterally to a much greater extent than that of the high tones, these latter being concentrated in a divergent beam; thus interferences have more chance to occur in the former case; (b) the time interval between the arrival of the interfering waves is comparable with the semi-period at high frequencies. For instance, in the preceding case, at $f = 600$ cycles the semi-period and the difference in arrival times are equal. Thus the intensity should increase, for the waves add. The complete phenomenon is really extremely complicated, for in actual practice there are many paths from front to rear of the diaphragm, and a multiplicity of frequencies are in operation. In our case the path of the reflected ray was the longer of the two, but owing to lateral motion this is not always the case. Also there is a loss at reflection, and the longer the path the greater the attenuation, especially at high frequencies The reflector is certain to influence the diaphragm due to the formation of standing waves between diaphragm and wall. The prevention of absolutely free lateral spread upsets the pressure balance on the two sides and tends to restrict the amplitude of the diaphragm at low frequencies where it is needed most, e.g., for equal pressure changes the amplitude at 50 cycles is very much greater

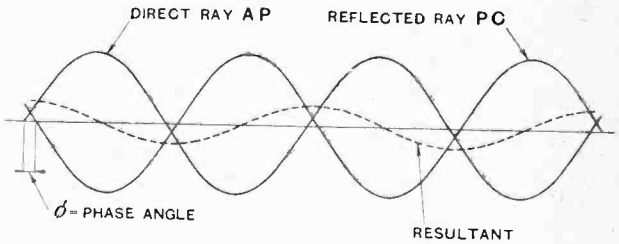


Fig. 5.—Curves illustrating low-frequency interference between rays A P and P C in Fig. 4.

Acoustic Reflection.—

than that at 600 cycles, assuming the diaphragm to move as a whole. This effect, however, is probably small. On the latter issue an interesting experiment can be performed by closing one side of the diaphragm with the reflector, as shown in Fig. 6, when the low tones will again disappear. This seems peculiar, since the reflector now isolates the two sides of the diaphragm and acts as a baffle. One would expect the general intensity to decrease since the radiation from one side is suppressed, but the reduction in low tones is another matter. The effect is due partially to the general reduction in loudness level, but mainly to the effect of the more or less air-tight chamber formed between the board and the diaphragm. The air in the chamber is not free to spread out laterally. During operation—especially at low frequencies where the amplitude is greatest—it is subjected to much greater pressure changes (compressions and rarefactions) than if it were free to move. Thus the motion of the diaphragm is restricted chiefly at the low frequencies, but there is reduced radiation at all frequencies. The effect is more marked the greater the reduction in volume, and to this end the rear of the diaphragm can be covered, as shown in Fig. 7. We are able, therefore, to draw the important practical conclusion that when the two sides of a large diaphragm loud-speaker are isolated by means of an enclosure, provision must be made to prevent appreciable pressure variations due to restricted chamber volume. To this end the enclosure should be of adequate volume, and must have breathing holes to allow the air to expand and contract, with small restraint.

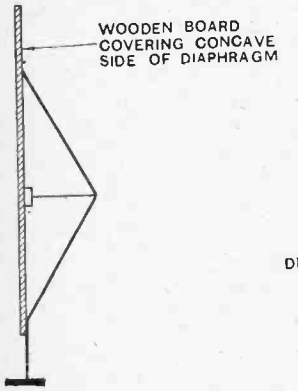


Fig. 6.—Experiment to show suppression of low tones by closing one side of diaphragm

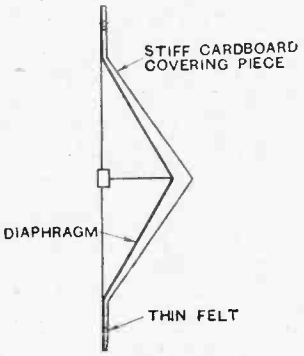


Fig. 7.—Alternative method of suppressing low tones in a diaphragm loud-speaker.

A diaphragm loud-speaker of the form illustrated in Fig. 1 has a definite polar curve, the high frequencies being most in evidence when facing the centre of the concave side. As one moves round the loud-speaker the high tones get weaker until they almost vanish, to come up again in lesser degree on the convex side. The influence of the reflector entirely alters the polar curve. The curve is different according as the reflector is at the concave or the convex side. It seems advisable to reiterate a statement made previously, namely: *There must be low tones in the reproduction for the experiments described herein to be successful.* To this we might add that the experimenter must have an ear capable of discriminating between high pitch and low pitch, especially when the line between the two is not particularly marked. Finally, there is the amplifier. With all due respect to the righteous efforts of many experimenters, I have found in too many cases that amplifiers have been the stumbling block. Double transformer amplifiers will not give the desired results, and the proper course to pursue is, either (a) resistance-capacity coupling with mica coupling condensers of 0.1 mfd., or (b) a large choke or resistance coupled detector followed by a high impedance transformer (low ratio) and low-impedance amplifying valve (7,000 ohms).

Catalogues Received.

(In most cases the publications referred to in this list can be obtained on application to the firms concerned.)

British Thomson-Houston Co., Ltd., Crown House, Aldwych, W.C.2. Leaflet R7433 showing price reductions in B.T.H. head telephones and loud-speakers. Leaflet R7447, relating to all types of B.T.H. receiving valves. Catalogue A.G.201, containing complete list of B.T.H. valves with data and characteristic curves.

o o o o

Wright & Weaire, Ltd., 740, High Road, Tottenham, N.17. Catalogues and literature relating to "Wearite" components.

o o o o

L. B. Tickle & Co., 61, Borough Road, London, S.E.1. Leaflet describing the "Orphean" Cabinet Grand Reproducer and the "Orphean" Baby Cabinet Grand Reproducer.

o o o o

Burne-Jones & Co., Ltd., Magnum House, 296, Borough High Street, London, S.E.1. Descriptive folder dealing with Magnum Screened Coils.

o o o o

Oxford Wireless Telephony Co., Ltd., 22 & 29, Queen Street, Oxford. Catalogue of "Oxford" wireless apparatus.

Redfern's Rubber Works, Ltd., Hyde, Cheshire. Price List of "Ebonart" non-metallic surface radio panels.

o o o o

Lehmann, Archer & Co., Ltd., 5, Farringdon Road, London, E.C.1. Catalogue of C.A.V. small tools, Wade laths and drilling machines.

o o o o

C. S. Dunham, 2a, Elm Park, Brixton Hill, London, S.W.2. Leaflet illustrating the Dunham 3-valve receiver.

o o o o

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. "Concerning Dubilier"—a brochure including the history of the Leyden Jar, a description of Dubilier factory processes, and a catalogue of Dubilier components.

o o o o

Edison Swan Electric Co., Ltd., 123-125, Queen Victoria Street, London, E.C.4. Complete guide to data and prices of Ediswan valves.

o o o o

B.S.A. Radio, Ltd., Small Heath, Birmingham. Catalogue of B.S.A. radio sets, loud-speakers, head-phones, valves and valve sockets.

o o o o

British Ebonite Co., Ltd., Nightingale Road, Hanwell, London, W.7. Art catalogue of "Becol" ebonite panels, dials, etc., etc., in black and grained finish.

o o o o

Marconi's Wireless Telegraph Co., Ltd., Marconi House, Strand, W.C.2. Leaflet No. 1059, containing full description of Marconi General Utility Wavemeters, Type M.g.1.

o o o o

Radio Instruments, Limited, 12, Hyde Street, New Oxford Street, London, W.C.1. New season's catalogue of R.I. receivers and components.

o o o o

Siemens Brothers & Co., Limited, Woolwich. Catalogue of radio batteries for low-tension, high-tension, and grid bias, with information of various characteristics of dry batteries.

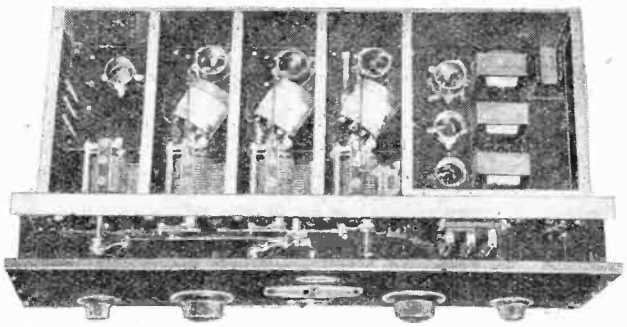
THE NEW YORK EXHIBITION

The Trend of Broadcast Receiver Development in America as Exemplified at the Third Annual Radio World's Fair.

By OUR SPECIAL CORRESPONDENT.

ON September 13th the Third Annual Radio World's Fair opened in New York with a great flourish. During the morning a radio parade formed up at the City Hall, composed of all the available leading lights of the radio world. After being reviewed by Mayor Walker, of New York City, this parade drove off in motor cars, accompanied by band music provided by distant broadcasting stations and picked up, amplified and reproduced by a portable receiving station mounted upon a truck.

Proceeding up Broadway to 50th Street, a distance of about four miles, the parade reached New Madison Square Garden, New York's newly built sports arena, and the radio show was officially declared open. Covering the floors of the basement, main arena, and balcony of this building were the exhibits of 300 radio manufacturers, the total value of the apparatus shown being estimated at $1,500,000. During the five days of the exhibition the promoters expected to deal with a total of 500,000 visitors, and the exhibiting manufacturers expected to do an amount of business aggregating $100,000,000. It is understood, however, that, as often happens in such cases, the actual amount of business done fell far short of this figure.



Seven valve "Howard" neutrodyne receiver with top shield removed. The condensers tuning the three H.F. stages are interconnected by a link motion between the front panel and screening box. The three L.F. stages are coupled by one 2 to 1 and two 1 to 1 ratio transformers.

By comparison with the two previous shows held in New York, the writer, after a careful survey of all there was to be seen, found this year's Fair rather disappointing. Most of the equipment on view looked "much of a muchness," and there was nothing of a very outstanding character to claim one's attention and relieve the monotony.

Entertainment Features.

Both in the basement and in the main arena huge batteries of loud-speakers provided musical entertainment for the crowds. In the basement was a regular broadcasting studio fitted with glass windows, so that the public could see the artists performing within. Small cone loud-speakers mounted on the outside walls of the studio reproduced these performances, which were also still further amplified and supplied to the main batteries of loud-speakers. The same programmes were also relayed to different broadcasting stations.

In a corner of the basement Mr. Bernays Johnson, the well-known inventor, gave periodical demonstrations of the possibilities of low-frequency alternating currents, lighting lamps without any connecting wires, and boiling water in a frying-pan by virtue of the heat created by induced eddy currents circulating through the metal of the pan. These and other similar feats of a sensational character served to draw large crowds.

At another booth a wire manufacturer had a wire-stranding and a wire-braiding machine in operation, showing how stranded and braided cables are made up.

The A.R.R.L. was well to the fore with a series of models of amateur wireless stations, from the spark sets of the earliest days down to the modern valve-operated station. On the floor of the main arena also they had a 100-watt amateur transmitting station in full working order. Using the temporary call sign 2ERC, this station was available to the public for the free transmission and reception of messages to and from any part of the world.

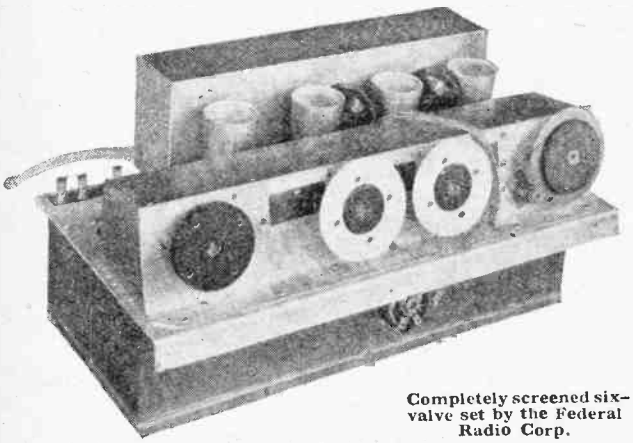
The Signal Corps of the United States Army had an interesting exhibit of army radio sets, ranging from what is now historical apparatus down to the latest sets of the most modern design.

With the exception of a few booths devoted to the exhibition of various radio publications, all the rest of the space was devoted to radio receivers and parts

New York Exhibition.—

During the past twelve months American manufacturers seem to have concentrated upon the improvement of existing apparatus, rather than upon attempts to produce something revolutionary. This policy is, perhaps, the best in the long run, from the point of view of the stability of the industry.

In previous years one has looked forward to radio shows as demonstration grounds for something new and



Completely screened six-valve set by the Federal Radio Corp.

sensational. With that sort of thing happening every few months, American manufacturers began to find that their industry suffered considerably as a direct result, for would-be buyers held back in the anticipation of something still more perfect and wonderful appearing on the market in a few months' time.

General Trend of Design.

The latest New York show appeared to reflect a realisation of these things, and the general policy, or slogan, would appear to have been: "Nothing new; only improvements." Thus the atmosphere was akin to that of a motor show, or the exhibition of some other well-established industry.

No new circuits have made their appearance this year. There is nothing new or sensational in design or construction. But there are improvements in plenty in all classes of receivers and components.

Broadly speaking, five-, six-, or even seven-valve tuned H.F. receivers predominated amongst the complete receivers, metal screening was almost universal, battery eliminators were to be seen everywhere, and power amplifiers and their associated loud-speakers seem to have received considerable attention during the past year.

The metal screening idea has been carried to great lengths by several manufacturers. In some cases all components are mounted on a metal chassis. Each section of the receiver is then either individually screened by a separate metal "can," or the entire set is enclosed in a metal box sectioned to isolate components such as tuning condensers at different H.F. potential.

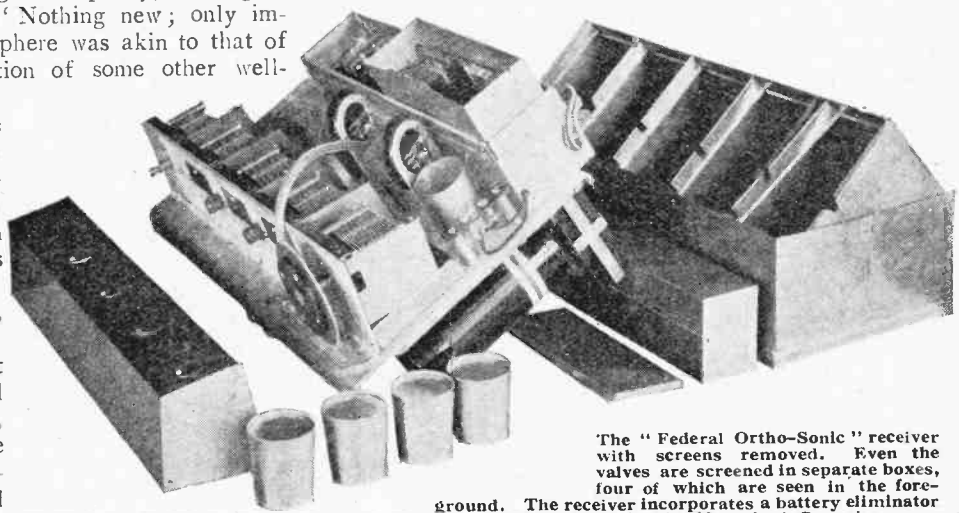
In many cases even the valves are individually screened by small metal boxes, and the entire set, thus screened, is, in some cases, still further protected by being enclosed in a metal-lined cabinet or console. The advantages claimed for such elaborate screening are much greater selectivity without the necessity for cutting side-bands, greater stability, and entire freedom from disturbances set up by electrical machinery operating in the near vicinity of the set user.

A certain amount of sensitivity is lost by absorption due to the metal screening, but this has been compensated for by the addition of a third stage of H.F. amplification. Stability throughout the three stages is assisted by the screens, which prevent interaction between circuits, and, in some cases, elaborate filter systems in the detector circuits make the generation of unwanted H.F. oscillations an impossibility.

Alternative Frame Reception.

Almost all the sets on view were designed for operation on an outside aerial-earth system, with provision in some cases for alternative frame aerial reception. With three and, in some cases, four stages of completely stable H.F. amplification available, there is no lack of power in the 1927 model to make up for any losses due to screening, or the use of the alternative frame aerial, and the additional stage or stages give greatly enhanced selectivity for cutting through local stations when the reception of distant stations is desired.

It has at last been recognised in America that anode-bend rectification gives much greater purity than the more popular leaky grid-condenser method, and several of the new models are equipped with this type of detector. The main objection to the method—lack of sensitivity—is more than compensated for by the added power delivered



The "Federal Ortho-Sonic" receiver with screens removed. Even the valves are screened in separate boxes, four of which are seen in the foreground. The receiver incorporates a battery eliminator designed for 110-volt, 60-cycle A.C. mains.

to the detector circuit by the additional stages of H.F. amplification.

Contrary to what one would naturally expect, the addition of the extra stages of H.F. amplification has not complicated the system of tuning controls. This is due

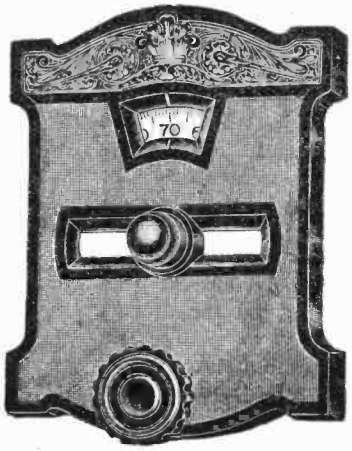
New York Exhibition.—

to the recent development of what are termed in America "gang condensers," which are simply a series of variable condensers mounted in a straight line on a single shaft.

Simplification of Controls.

In some cases these condensers are arranged to be controlled by two dials, both of which work independently. The more advanced method, however, involves the mounting of the condensers behind the panel so that the shaft is parallel to the panel, and a system of drum control is fitted. The periphery of this drum just projects through the front of the panel, in which a slot is cut. In some cases all the condensers are moved simultaneously by turning thed rum, but generally the drum is split into two or three milled edges, so that, for rough tuning, all condensers can be moved at once by using two or three fingers of one hand. For fine tuning, or for compensating for slight differences in coil values, individual condensers can be tuned by turning the appropriate milled edge of the drum.

Many of the sets shown still retain the older two- and three-dial systems of tuning, but these styles seem definitely to be on the wane. Simplicity of operation is the new keynote, and everything possible has been done to attain this end. The accompanying illustrations show clearly the simple appearance of the modern panel, and also the details of some of the screening methods used.



Vernier dial by the Brooklyn Metal Stamping Corp, with friction drive giving a ratio 50 to 1.

Tuning condensers themselves have also been greatly improved since last year. Sturdier and more reliable bearings have been fitted, and better contact with the rotor is now assured. A compromise has also been effected between the straight-line wavelength, straight-line capacity, and straight-line frequency condensers, the outcome being a condenser of better mechanical balance and good all-round efficiency.

Improved and More Powerful Reproduction.

The demand in America to-day is for more power, coupled with still further improved reproduction, and the L.F. sides of the equipment shown at the Fair amply reflected the manufacturers' reaction to this latest requirement. Gone for ever are the skimpy little L.F. transformers of yester-year. Their place has been taken by large, heavy instruments with windings of suitably high impedance and low ohmic resistance. The cores are of ample dimensions, and they are made of carefully selected steel of the highest quality. The American L.F. transformer has now definitely become a precision instrument which can be relied upon to give a straight-line amplification curve over a very wide range of audio frequencies.

The high ratios of former years have been discarded, the average ratio to-day being around 3 to 1. In the cases of some of the receivers shown at the New Madison Square Garden, three stages of transformer-coupled L.F. amplification are fitted, the ratio of the first transformer being 2 to 1, and that of the other two 1 to 1. In this way the demand for increased volume combined with greater purity is being met.

The recent introduction of a new power valve (UX 171) has also assisted in the development of greater volume with improved quality, and practically all the 1927 models have provision for the introduction of one of these valves in the last stage.

Mains Receivers.

When it is considered that these power valves require from 135 to 425 volts on the plates, the reason for the greatly increased use of H.T. battery eliminators and complete light socket operating devices becomes apparent. Several of the 1927 receivers operate directly from the electric light socket or wall plug, doing away entirely with L.T., H.T., and grid bias batteries.

Many others of the new sets are equipped for operation with an H.T. battery eliminator in conjunction with an L.T. accumulator, which is kept constantly charged by means of an automatic trickle charger. The development of battery eliminators is a much easier problem in America than it is in this country on account of the fact that an A.C. lighting supply at 110 volts, 60 cycles is almost universal throughout the entire country.

One extremely interesting receiver is the Garod, employing the neutrodyne principle under licence from the Hazeltine Radio Corp. This receiver and its associated H.T. battery eliminator form a single self-contained unit, the most novel feature being the method of heating the valve filaments. The H.F. and L.F. valves obtain their filament current in the form of raw A.C. through a step-down transformer. Valves with heavy one-ampere filaments are employed, so that the temperature inertia to a great extent absorbs the current variations. The detector valve is of the 60-milliampere class, and its filament is connected in the negative H.T. lead of all the other valves, so that all the H.T. current passes through the detector filament.

Cabinets and Loud-speakers.

The cabinets housing the sets at this year's show were extremely varied in design, but of well-defined classifications. The ordinary cabinet receiver, though still popular, was in the minority, most of the sets being housed in handsome consoles, antique cabinets, highboys, treasure chests, and, in one or two instances, miniature grand pianos. One or two manufacturers made a feature of cheap but extremely handsome consoles of that class of furniture known as "knock-down." Expensive lacquer cabinets were also much in evidence, as was also period furniture.

Many different materials were used by different manufacturers for the actual control panels of their sets. Whilst bakelite and mahoganite were retained by many, a large number now employ tastefully lacquered and en-

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graved metal panels. Others are using wood, and here and there the writer found panels of a peculiarly mottled emerald green material, which, on enquiry, he found to be made of *sour milk* mixed with chemicals and hardened under hydraulic pressure! This material is pleasing in appearance and practically unbreakable, samples of it when dashed on to a concrete floor bouncing up again unharmed. Nothing could be learned of its dielectric qualities.

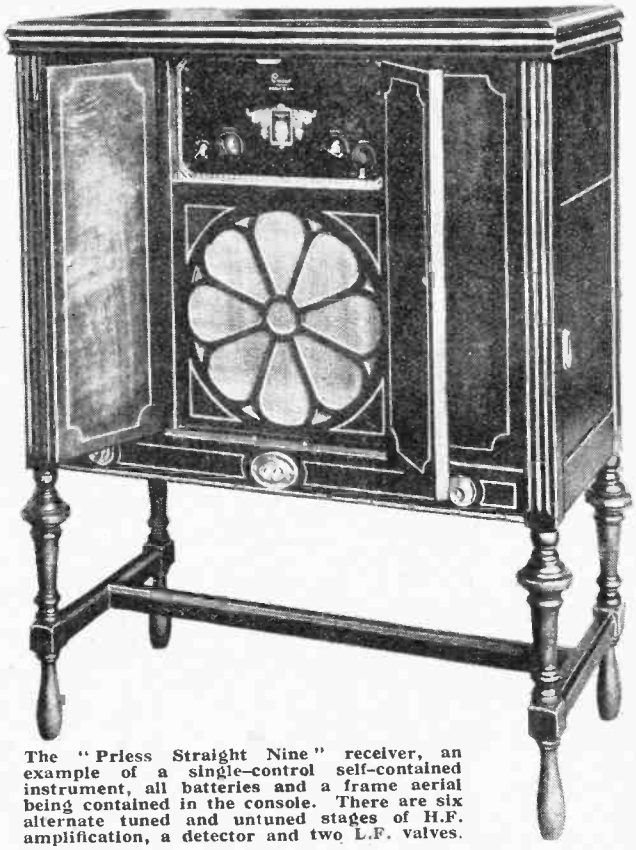
Whilst a few exhibitors still displayed loud-speakers of the horn type, by far the majority of those on view were of the cone type, ranging in diameter from a foot to 36 inches. The modern cone speaker and the modern power amplifier have been designed expressly to work with each other, so that a very high degree of quality is assured. The only new feature in connection with cone speakers is the tendency now to mount them on stands, like standard lamps, or, in some cases, like stand microphones in a broadcasting studio. In another design they are arranged to hang on the wall like pictures.

Components and Accessories.

Strangely enough, the display of component parts was very poor indeed, although many thousands of American radio enthusiasts are still keen on making up their own sets. For the most part, such components as were on view were done up in complete kits, a tendency in component selling which seems to be growing. It can at least be said of kits that one can buy all one requires for a particular set at one shop instead of, as previously, having to shop all around town in order to collect all the necessary parts.

Carefully matched coils of much better design and construction are a feature of the kits on sale this year, and, as already mentioned, variable condensers have been improved. Vernier dials of various ingenious and efficient designs are available very cheaply

One new feature in the kit line is the appearance this year of separate and combined L.T. and H.T eliminator



The "Priess Straight Nine" receiver, an example of a single-control self-contained instrument, all batteries and a frame aerial being contained in the console. There are six alternate tuned and untuned stages of H.F. amplification, a detector and two L.F. valves.

kits for both A.C. and D.C., so that the experimenter can make up his own eliminator to suit his own individual requirements as regards output required, and, where his power supply is non-standard, as regards input voltage and frequency

This development has led to the improvement and cheapening of choke coils and smoothing condensers of high values, built to withstand the much higher H.T. voltages now prevailing. Rectifiers of all kinds have also received a considerable amount of attention, one of the most popular being the new Raytheon tube, a form of two-electrode rectifier.

The display of accessories was not very great, and amongst them the writer did not observe a single pair of head telephones. but he may have overlooked them. Accumulators and H.T. batteries were fairly numerous, but easily outnumbered by eliminator units. In connection with accumulators a device called the Ga-Jit was shown which is designed to take the place of messy hydrometers. Connecting it across the battery terminals causes a strip of metal to pop up which reads "Low," "Medium," or "Charged Full," according to the state of the battery.

The only new departure in valves was a new design called the "QRS Redtop." This valve has a separate grid and plate encircling each leg of a U filament, the

The "Perlesy Concert Eight" screened receiver in full console cabinet. Note the four "gang" condensers controlled by single geared dial on left.

New York Exhibition.—

advantage claimed being perfect symmetry in emission and control electrons.

The old valve socket of the bayonet-holder type seems to have entirely disappeared. In its place there is a new socket of a type very similar to that now in use in this country, well sprung and cushioned. The valve base to fit this socket has four pins set at the four corners of a square, confusion and damage when inserting the valve into the socket being avoided by making two of the pins much thicker than the other two. All the 1927 receivers are fitted with this new socket.

General Observations.

It is interesting to note that not one single crystal receiver was observed at this year's show, and amongst valve receivers nothing less than a four-valve set was seen. Reaction did not appear to be fitted on any of the 1927 models.

Whilst the superheterodyne was in evidence, its popularity seems to have suffered considerably, for it was outnumbered many times by receivers using balanced or stabilised straight H.F. amplification.

The general appearance and workmanship of the vast majority of the receivers was of a very high order indeed. It is apparent that America still leads the way in H.F. design, lay-out, and tuning methods. Up till now, though we lagged behind America in H.F. amplification, we could always point with pride to the L.F. end of our receivers

This year, however, might well be styled "L.F. year" in America, for such rapid strides have been made in the past twelve months that the reproduction of the majority of the sets shown at the World's Fair leaves very little to be desired, both as regards purity and volume.

Whilst a few of the 1927 models have built-in loud-speakers, this practice seems to be dying out, the majority of manufacturers favouring the independent loud-speaker method of reproduction. The reason for this is not far to seek The powerful reproduction of this season's set makes it extremely difficult to tune-in and adjust the volume control to the best advantage, from the point of view of the audience seated some distance away, when the operator is situated right up against the speaker.

The introduction of the new anti-vibratory type of valve socket has completely done away with the objectionable microphonic noises previously associated with American receivers.

As regards prices, this year's models can only be described as expensive. Sets were shown ranging in price from about $100 (£20) to about $1,500 (£300), the average run being around $500 (£100). It should be pointed out, however, that most of the money goes in expensive furniture in which to house the receiver.

Such are the impressions made upon the writer by the Third Annual Radio World's Fair. He was further impressed by the fact that the process of the survival of the fittest has apparently got well under way in America. Whereas three years ago there were three sets of a given type, there is now only one. Competition has forced out those whose financial standing, or manufacturing standards were not up to scratch, so that the public has the assurance to-day that the apparatus available is of the highest quality.

In other words, the radio industry in the United States is rapidly achieving stability.

Calls Heard.

Extracts from Readers' Logs.

London, E.C.3.

(August 23rd to September 26th.)

U.S.A. :—U 1LW, 1UW, 1CH, 1BZP, 1BQT, 1AM, 1DA, 1CJ. 1FL, 1ICI. 1II, 1CM, 1CT. 1GR. 1CTP, 1AIR, 1AWE, 1AC, 1BCN, 1CLV. 1MV, 1AUD. 1XAA, 1RD. 1CKP, 2GK. 2FP. 2ARQ. 2EV, 2AIB, 2BYG, 2CVO. 2CKK, 2CMK, 2CRB. 2KH, 2CS. 2TK, 2AM. 2ARV, 2APV, 2AEV, 2RS, 2FF. 2AH. 3JW, 3RF. 3MV, 3MU, 3CJN. 3CDK, 3AFW, 3ACL, 4DD, 4LL, 4JK. 4RM. 8CDU, 9OD, 9WI. Brazil :—BZ 1AR, 1BI, 1BC. 1QA. 1AN, 1AM. 1AD, 1AQ, 1AK, 1BG, 1AI. 2AM. 2AB. 9QA. Australia :—A 3XO, 2YI. 2SH. Argentine :—R BA1. New Zealand :—Z 3AI, 4AA, 4AM. Miscellaneous :—Y 1CX, TJ CRJ, PR 4JA, HIK, PRS, KTC, Y 1BR.

(0-v-1) On 30-40 metres.

F. G. Pratt.

Zaria, Nigeria.

(June-August.)

U.S.A. :—U 1AIR, 1AMD, 1AXA, 1CK, 1CKP, 2AFN, 2AP, 2APV, 2BNT, 2CIB, 2CJ, 2CRB, 2CXL. 2GK, 2GUJ, 2LS, 2OR, 2UO, 2XI, 2XAF, 3KD, 3ZO, 4IZ, 4OA, 4SB. 6XI, 8AMB, 8AMI, 8JZ, 8KF, 8VX, 8PL, 8ZO, 9AA, 9ADK, 9AEK, 9BFF, 9DNG, 9DPL, 9EAG, 9KF. 9TG, KDKA, WIR, WIZ. NAL, NKF, WNP. Great Britain :—G 2AHM, 2CC, 5DH, 5JD, 5NV. Tripoli :—1TA. France :—F 8GK, 8IX, 8JN, 8KF, 8QRT, FFQ, OCDJ, UIZ. Holland :—PCLL, PCMM, PCRR, PCTT. Italy :—I 1CJ, 1GW, 1DO. Somaliland :—OCDB. Russia :—R CRL. Argentine :—R AA3. Brazil :—Bz 1AD, 1AP, 1AT, 1BI, 2CO, 3KP. Uruguay :—U83. Sweden :—SMUK, SGL. Miscellaneous :—A 1AX, B82, B5A, AGC, AGB, CRJ, DCN, F2, GBM, GLQ, K8T, P80, PU 1CO, PU 1CK, PC 2P, PC 3K, SQ 1Q, OCZ1, OGU, U EAVET, WJIPP V 4J, VIR, 8QQ.

(0-v-1) On 30-100 metres.

Capt. G. C. Wilmot (KM1).

Pirbright, Surrey.

(September 1st to 23rd.)

Austria :—O GP. Denmark :—D 7ZG, 7XF. Finland :—S 2CO. Italy :—I 1CE, 1EAY, 1BD, 1SS, 2AN. Germany :—K CZ4, 4GA, I2, U3, W9, 4MCA, 4MFL. Poland :—T PAI, MU. Spain :—EAR6, EAR26. Sweden :—SMTO, SMYG. Norway :—LA 1A. Luxembourg :—L 1AG. Q27. U.S.A. :—U 2JK, 2KDU, 8AHC, 8BPQ. Below 30 metres :—AGB, AGC, GBK, WLL (17 m.). 2XSA (16 m.).

E. H. Robinson (G 5YM).

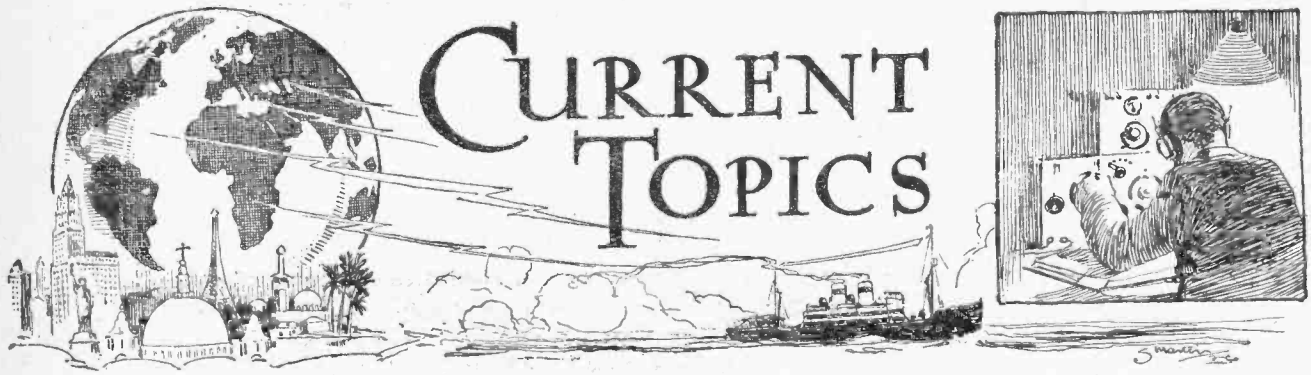
Belfast, Northern Ireland.

(Aug. 22nd to Sept. 14th.)

Great Britain :—G 2AFN, 2CS, 2JB, 2JJ, 2NH, 2NM, 2OG, 2OQ, 2QV, 2SW, 2WN, 2WW, 5AD. 5AR, 5BI, 5LF, 5LU, 5PO. 5SI. 5TD, 5TZ, 5UQ, 5US, 5UW, 5WC, 5WQ, 5XD, 5ZA, 6AH, 6CJ, 6CL, 6DA, 6GG, 6HF, 6HT, 6IA, 6IW, 6IZ, 6KO, 6KK, 6LJ, 6NU, 6NX, 6OO, 6OX, 6OU, 6OH, 6PU, 6QO, 6UW, 6UV, 6XG, 6YC, 6YU, 6YD, 6YQ. 6 YV, 6ZA. N. Ireland :—GI 2IT, 2BX, 5NJ, 6HI, 6YM, 6YW, 6MU. Irish Free State :—GW 18B, 13C. France :—F 8LZ, 8KK, 8BU, 8TIS, 8FMG, 8FBH, 8PR, 8PRD, 8LP, 8UT, 8TT, 8JR, 8JRT, 8CA, 8MB, 8BD, 8DA, 8UD, 8DI, 8XH, 8WZ, 8YOP, 8GI, 8QW, 8VK, 8PJ, 8EI, 8BW, 8WR, 8JY, 8WEL, 8OAK. Belgium :—B E1, H5, 4Q, 4AA, N3, K5, M8, K44. OH, 7E, 8E, 4YY, 2NP, O8. Holland :—N OMJ, OAM, OGT, OPM, OUS, PB2. Germany :—K 4SM, I2, 4MFL. Italy :—1ACE. Denmark :—D 7ZG, 7XF Spain :—EAR19, EAR24, EAR26. Portugal :—P 1AE. Porto Rico :—PR 4SA Various :—TMU, WIZ, POW, GLQ.

(0-v-1 Reinartz) On 40-50 metres.

Leslie Marshall (GI 2BNR).



Events of the Week in Brief Review.

LABOUR SAVING.

New houses at Surbiton Hill, Surrey, are equipped with a charging set for wireless and car batteries.

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LIVERPOOL SHOWS THE WAY.

Multi-valve wireless receivers, all of Liverpool make, will be used for the reception and distribution of broadcast music at the Liverpool Industrial Exhibition, which opens on Friday next.

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IRISH RADIO TRADERS UNITE.

Wireless manufacturers and dealers in the Irish Free State have formed the Irish Radio Traders' Association, Ltd., which was registered in Dublin on September 29th.

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NEW DANISH BROADCASTING STATION.

The Danish Office of Works and Public Buildings has accepted a tender for 202.000 kroner for the erection of a broadcasting station at Kalundborg by the Western Electric Distributing Corporation.

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SHORT WAVES AT SEA.

The Cunard liner, *Carinthia*, has been fitted with a short-wave transmitter. On October 1st, says the *Manchester Guardian*, the ship transmitted the first commercial short-wave radio telegram ever sent from a ship to this country.

If ships meet with the same success as amateurs in their use of the short wave, a new era should be opened in long-distance communication at sea.

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AMATEUR LOW POWER TESTS.

An interesting series of special low-power transmission tests is to take place during the week, November 1st-8th inclusive, under the control of the T. and R. section of the Radio Society of Great Britain. Transmission will take place between the hours of 2300 and 0800 G.M.T. Amateurs interested in the tests should make immediate application for particulars to the Hon. Secretary, T. and R. Section, Radio Society of Great Britain, 53, Victoria Street, S.W.1. It is understood that entries cannot be accepted after Friday next, October 15th.

"RAFFLING" A WIRELESS SET.

For attempting to "raffle" a wireless set, Clifford Howarth was recently fined 5s. and costs at Preston under the Lottery Act of 1823.

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WIRELESS COURSES IN LONDON.

Radio-telegraphy is included in the winter curriculum of the Northampton Polytechnic Institute, 280, St. John Street, London, E.C.1. Full particulars are given in the Institute's Handbook of Announcements for the ensuing session.

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GERMAN APPARATUS IN IRELAND.

A correspondent in the Irish Free State, describing a recent visit to a little country town, informs us that it contained only one wireless shop, and this exhibited German apparatus only. There were five German receivers in the window.

RADIO WHO'S WHO.

A "Radio Who's Who" Section has been inaugurated by the *Daily Chronicle*. Brief biographical details are given of celebrities who figure in the broadcast programmes.

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THE RADIO ANTELOPE.

A silver replica of an African springbok, a variety of small antelope, and the national symbol of South Africa, has been offered by the *Rand Daily Mail*, of Johannesburg, as the prize to the United States, Canadian, or Hawaiian amateur who has effected the greatest number of two-way contacts on short waves with South African amateurs during September and the present month.

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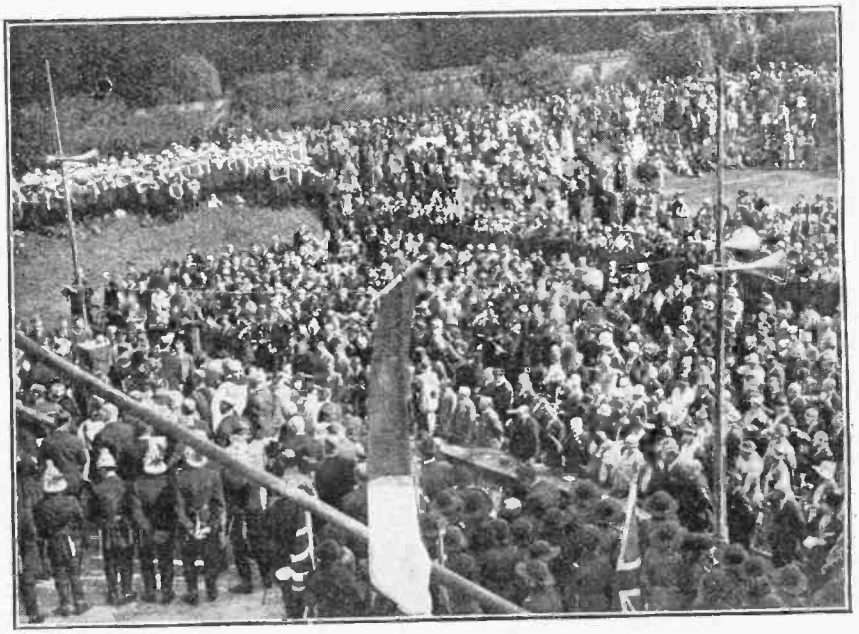
FREE LICENCES FOR THE BLIND.

When the House of Commons re-assembles, Captain Ian Fraser, chairman



THE UBIQUITOUS LOUD-SPEAKER. When Twickenham received its charter recently, the large crowd at the ceremony were enabled to hear the speeches clearly by means of amplifiers and loud-speakers. The microphone occupied the place of honour and was covered with a blue ensign.

of the Executive Council of St. Dunstan's, will introduce a Bill "to facilitate the use of wireless telegraphy by the blind." The Bill will propose that licences should be issued to the blind free of charge as recommended last year by the Broadcasting Committee.

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PHILIPPINE-CHINA CHESS MATCH BY WIRELESS.

An all-night international chess match was held recently between Manila, in the Philippine Islands, and Shanghai, the Filipino chess champion playing a match from a local amateur radio station against a combination of Chinese champions located in Shanghai. The various moves were transmitted by amateur stations in each country, with Mr. Manuel Felizardo, Philippine 1AU, handling the transmissions from Manila. The match was won by the Chinese players.

Local enthusiasts are now arranging with Mr. Felizardo and other Manila amateurs to conduct a match with players in America through stations of the American Radio Relay League.

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LICENCES IN INDIA.

Licences for experimental stations in India are in great demand, but few are granted, writes a correspondent. During the present year about 500 experimental licences have been issued, chiefly to European officials.

In British India 2,700 broadcast reception licences were granted during the six months ending in August. There are 165 licensed traders.

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SHORT WAVES FOR BELGIAN CONGO.

A short wave wireless service is to be inaugurated by the Belgian Railway, Post, and Telegraph Administration for public communication between Belgium and the Congo. The authorities will make use of the 20 kW. station at Uccle, says a correspondent of *The Times*, and messages will be received from Uccle by the principal centres in the Congo, such as Kinshasha, Stanleyville, and Elisabethville, and delivered by them to their destinations.

According to the wireless station at Saigon, French Indo-China, the short-wave transmissions from Uccle are received there better than those of any other European station.

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LONGITUDE BY WIRELESS.

Work has begun on the calculation of exact longitude by means of wireless time signals. Three places have been chosen for this purpose, viz., the United States Naval Base at San Diego, California; the Algiers Observatory in North Africa, and the Shanghai Observatory in China. By means of time signals transmitted from each of these points it is hoped to check their exact longitude and thereby map out the longitude at intermediate points. The three stations are approximately the same distance from each other, being separated by about eight hours.

A TRINIDAD WIRELESS DEAL.

The Legislative Council of Trinidad is considering the sale of Government wireless stations to the Pacific Cable Board. The Finance Committee advises that the price should be raised to £7,000, failing which a minimum royalty of £1,000 per annum should be paid by the board for five years.

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WIRELESS DICTIONARY FOR THE POCKET.

Many amateurs and experimenters will welcome the publication, in handy pocket form, of a "Dictionary of Wireless Technical Terms," compiled by Mr. S. O. Pearson, B.Sc., A.M.I.E.E., containing definitions of terms and expressions commonly used in wireless telegraphy and telephony. The dictionary is based on that which appeared week by week in *The Wireless World* at the beginning of this year. It contains 254 pages, and includes many useful diagrams. Copies are obtainable, price 2s., from the principal booksellers, or can be supplied direct from the publishing offices of *The Wireless World*, Dorset House, Tudor Street, London, E.C.4, price 2s. 3d., post free.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 13th.

North London Experimental Radio Society.—Ordinary Meeting.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School Tetherdown, Muswell Hill, N.10. Lecture: "Impressions of Broadcasting on the Atlantic Coast of America," by Mr. Gerald S. Sessions.

THURSDAY, OCTOBER 14th.

Southport and District Radio Society.—At Boot's Café, Lord Street. Opening of Season. Whist Drive and Social

FRIDAY, OCTOBER 15th.

Radio Experimental Society of Manchester.—Visit to Messrs. Radion's works at Bollington.

MONDAY, OCTOBER 18th.

Croydon Wireless and Physical Society.—At 8 p.m. At Phœnix House, 128a, George Street, Croydon. Lantern Lecture: "The Art of Broadcasting," by J. H. A. Whitehouse, of the B.B.C.

Taunton and District Radio Society.—Lecture: "Home Construction," by Mr. E. Scott Setterington.

[News from the Clubs will be found on page 522.]

WIRELESS AMATEURS AND THE FLORIDA DISASTER.

With the work of relief and reconstruction proceeding at a rapid rate in the hurricane-stricken regions of Florida, the part played by amateur radio operators in rendering assistance is just becoming apparent, according to a report issued by the headquarters office of the American Radio Relay League.

No sooner had news of the disaster begun to spread than large numbers of amateur stations began to "call" Florida in an endeavour to get in touch with the isolated cities of Miami, Moorehaven, and Pensacola. Chief among these was Mr. W. P. Moore, operating station 4IZ at Tampa, Florida, who immediately went on continuous watch with his station and operated day and night for several days handling emergency traffic. Early on the morning of the second day Moore got in communication with J. V. Heisch, operating station 4KJ at Miami. 4KJ gave out bulletins of the extent of the damage, sent requests for supplies and first-aid materials, and personal messages of assurance of safety to relatives in the rest of the country. All of these were received by 4IZ at Tampa and rushed by other amateur stations and regular wire lines to northern points.

Outside of Florida hundreds of amateurs held themselves in readiness day and night to help the Florida amateurs. Chief among these was station 4RM, operated by J. G. Cobble, at Atlanta, Georgia, who maintained regular schedules with 4IZ at Tampa, and furnished the chief northern outlet for all messages from the Tampa station. In addition, this station acted as a concentrating point for hundreds of inquiry messages from relatives and friends in the northern and western States, which were relayed from all over the country by other member stations of the American Radio Relay League.

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CHURCH SERVICE AT 50 M.P.H.

A striking wireless experience was described last week by Mr. G. H. Ponder, financial manager of the New Zealand Rugby League "All Blacks" Touring Team, who stated to an official of the Canadian National Railways in London that while crossing Canada the team joined in a church service which was being held in New York, 3,000 miles away.

The team was sitting in the observation car of one of the Canadian National Railways wireless-equipped expresses, gazing at the undulating prairies of Alberta, when a church service was tuned in from New York with remarkable clarity, every word being heard, including the responses of the congregation.

The service was followed to the end, the team joining in the hymns and responses just as naturally as if they had been in the church itself.

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DUBLIN'S WIRELESS EXHIBITION.

Many British firms, it is expected, will be represented at the Dublin Wireless Exhibition, to be held at the Mansion House, Dublin, from November 1st-6th inclusive.

Special attention will be given to wireless receivers suitable for ordinary home use, though it is probable that there will be much to interest the experimental amateur.

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NEW INDIAN BROADCASTING CHIEF.

The B.B.C. announce that Mr. Eric C. Dunstan, of the headquarters staff, has been appointed general manager of the Indian Broadcasting Company, which has lately been formed. The appointment was made as the result of an application by the directors of the Indian Broadcasting Company to Mr. Reith, managing director of the British Broadcasting Company, to recommend a member of his staff who was familiar with all branches of broadcasting work and who would be competent to fill the new position.

READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

TESTING WIRING.

The following method of testing the wiring of a receiver for wrong connections in the H.T. or L.T. circuits will be found very useful in the absence of a testing voltmeter.

When the set is ready for testing insert the valves and connect the low tension battery to the H.T. terminals. Turn on the rheostat, and if the valves light a false connection is indicated.—J. S.

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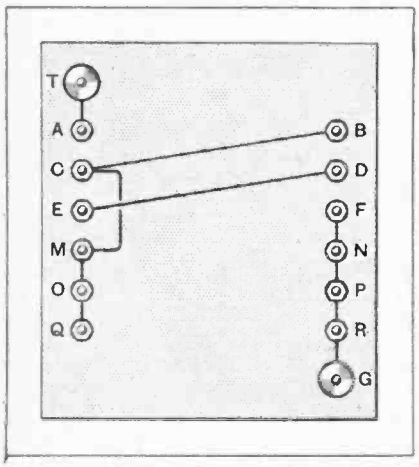
GRID LEAK PANEL.

Readers who are prejudiced against variable grid leaks on the ground of unreliability and who prefer to use a series of fixed grid leak resistances for experimental purposes will find that a wide range of values may be obtained with only three grid leak resistances by means of the arrangement shown in the diagram, which represents the underside of an ebonite panel carrying six pairs of grid leak clips represented by A B, C D, E F, etc.

The underside of the panel is wired as shown, G and T representing the output terminals. G is connected permanently to the grid of the detector valve, and T may be joined by means of a flexible connection either to the aerial side of the grid condenser or to a point of suitable potential in the filament circuit. With fixed leaks of 1, 2 and 3 megohms respectively the following range of values in megohms is available :—

1. Leaks used separately across M N ... ... 1, 2 or 3
2. Two in series across C D and E F ... ... 4 or 5
3. Three in series across A B, C D and E F ... 6
4. Two in parallel across M N and O P ... $\frac{2}{3}$, $\frac{3}{4}$ or $\frac{5}{7}$
5. Three in parallel across M N, O P and Q R ... $\frac{6}{11}$
6. One across A B in series with two in parallel across M N and O P $2\frac{1}{2}$, $2\frac{3}{4}$ or $3\frac{2}{3}$
7. Two in series across C D and E F in parallel with one across M N $\frac{3}{8}$, $1\frac{1}{3}$ or $1\frac{1}{2}$

The clips A B when not occupied by a leak must be short-circuited.—K. M. C.



Wiring diagram of panel for obtaining various grid leak values from different combinations of a series of three fixed resistances.

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ACCUMULATOR LEADS.

The spade terminals at the end of L.T. leads, if made of brass, soon become corroded by the action of acid spray from the battery.

This trouble can be avoided by using connecting spades cut from thin sheet lead.

A rectangular strip of lead $\frac{1}{2}$in. wide and $1\frac{1}{4}$in. long is turned over at one end and clamped to the L.T. lead by pressing the lip so formed over the end of the wire with a strong pair of pliers. The other end of the lead strip is then slotted to fit the accumulator terminal. It will be found that the lead effectively resists the action of the acid and no corrosion takes place.—G. L.

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A SOLDERING HINT.

It sometimes happens that panel bolts and screws work loose after soldering on account of the excessive heat to which they have been subjected during soldering having damaged the ebonite.

A very simple manner of overcoming this difficulty is to have handy a small bottle of methylated spirit (which, of course, should be protected from an open flame) and a paint brush. Then, as soon as the solder has run on this part, it should be dabbed with the spirit, which not only cools the part immediately by its spontaneous evaporation, but removes any traces of acid flux if such has been employed.—R. C.

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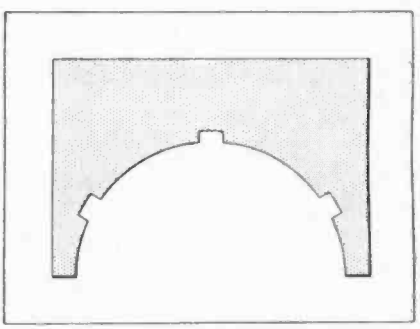
SPACING TEMPLATE.

When building H.F. transformers of the type used in the "Everyman Four" receiver some difficulty is often experienced in spacing the ebonite strips at equal intervals round the secondary winding.

A simple jig for the purpose may be cut from cardboard to the shape shown in the diagram, the positions of the rectangular recesses being carefully marked out with dividers or a pair of compasses. When setting the dividers for the radius of the semi-circle the radius of the coil former must be increased by an amount equal to the thickness of the Litz wire constituting the secondary winding.—W. P.



Cardboard jig for assembling spacing strips on H.F. transformers.

THE AERIAL-EARTH SYSTEM.

Half-wave Tuning with Potential Rectification.

By A. G. WARREN, M.Sc., M.I.E.E., F.Inst.P.

THE primary requisite of any wireless receiver is an efficient oscillator in which currents are induced by the impinging electromagnetic waves. This oscillator is tuned so that its natural frequency is the same as that of the signals it is desired to receive. There is then one point (under exceptional circumstances there may be more than one) at which the current is a maximum; at this point the voltage is zero. At the open end or ends of the oscillator the current must necessarily be zero; the potential is there a maximum (Fig. 1*a*). The detector is usually connected to the point at which the *current* is greatest, and it is essentially operated by this current. This may, for convenience, be called "current" detection to distinguish it from "potential" detection, more fully described later, in which the receiver is connected to the open end of the oscillator where the *potential* is a maximum.

The earliest oscillators consisted of a long insulated conductor, with or without added capacity at its ends, and loaded by an inductance at its centre. For this system the distribution of current and voltage is shown in Fig. 1 (*a*). The tuning of such an oscillator may be called half-wave tuning. The detector is connected across the points AB. The conditions obtaining when the more usual type of oscillator is employed with a *perfect* earth are indicated in Fig. 1 (*b*). The aerial behaves as if it were extended by an amount equal to its reflection in the earth. A half-sized loading coil only is required, the lower half *v* being supplied by the reflection of *x*. This may be called quarter-wave tuning. Clearly, the voltage available for detection between A and C is only one-half that available with half-wave tuning. Quarter-wave tuning is that usually attempted, though, in practice, as is indicated below, there are often considerable deviations.

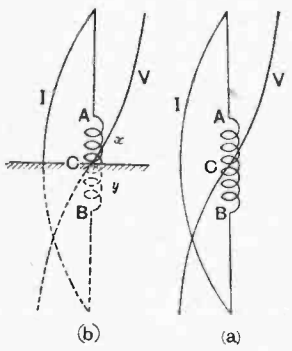


Fig. 1.—Distribution of current and potential (a) in half-wave oscillator and (b) in quarter-wave oscillator.

Effect of "Earth" Resistance.

The earth is often far from being a perfect conductor. Were it non-conducting, the oscillator would terminate at the lower end of the aerial. A certain lack of symmetry might be introduced by the proximity of a medium of different dielectric properties to those of the air, but the distribution of voltage and current would not differ greatly from that indicated in Fig. 2; the current would necessarily be zero at the foot of the aerial. Though these conditions are not approached in practice, they indicate the deviations we may expect from the ideal state of Fig. 1 (*b*). The "reflection," if such it may be called, is only a stunted image of the aerial; the distribution of voltage and current is approximately represented in Fig. 3. Rather more than a quarter-wave stands upon the aerial, and a bigger loading coil is required the more imperfect the earth. Ohmic losses are introduced at the earth connection, reducing signal strength and selectivity. The wavelength is shortened by a variable amount depending upon changes in the condition of the soil. The earth connection is not at zero potential, and effective shielding is rendered more difficult. The loading coil is not in the most effective place for detection.

The ill-effects of earth resistance may be minimised by improvement of the earth connection and sufficiently wide distribution of the earth currents, but they cannot be entirely eliminated except by eliminating the earth itself. Improvement of the earth connection is effected by running long copper leads over a considerable area, the use of earth mats and other similar means. The amateur is often confronted with difficulties of space and expense, and usually has to be content with fair-sized buried plates. These are sometimes far from effective, in a well-drained gravel soil, for instance. Under such circumstances a counterpoise may often give better results. This may consist of a low resistance network of wires extending over a considerable area below the aerial. This arrangement is simply an earth screen, and acts as a more perfect reflector than the soil itself. Though often called a counterpoise, it is really nothing of the sort. Referring to Fig. 1 (*b*), the loading coil employed consists simply of the portion *x*, *y* being more or less contained in the "reflection." Quarter-wave tuning is employed. The true counterpoise consists of a circuit possessing the same oscillation constants as the aerial itself, and is often conveniently represented by a length of insulated wire supported below the aerial. It does not act so much as an earth, but rather as the other half of the oscillating system. The whole system is a half-wave, rather than a quarter-wave, oscillator. Hence, for the same loading coil the wavelength is shortened by substituting a counterpoise for an earth, as is well known. When a counterpoise, forming a good balance to the aerial, is employed, the electrical centre of the system is brought to the instrument point. Earth losses are reduced, but not entirely eliminated, since it is usually impossible to raise the counterpoise sufficiently without sensible reduction of the reception factor.

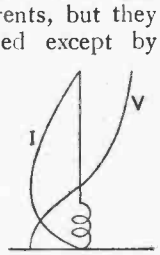


Fig. 2.—Current and potential distribution with "insulated earth."

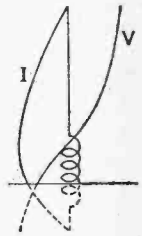


Fig. 3.—Current and potential distribution with imperfect earth.

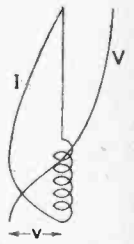


Fig. 4.—Distribution of current and potential for "end-loaded" half-wave oscillator.

The Aerial-Earth System.—

Detectors are essentially voltage-operated devices. The voltage required to operate them is usually obtained by connecting the detector between the ends of a high-impedance (the tuning coil and its condenser), which is placed in the oscillator at or near the region of maximum current. If an earth is used, considerable ohmic losses occur unless the contact is particularly good, since the maximum current flows through this poor contact. These losses are considerably reduced by the use of a well-designed counterpoise.

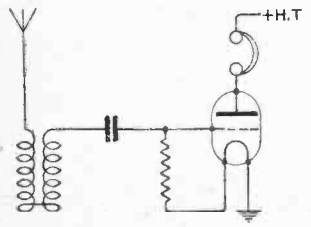


Fig. 5.—Connections of half-wave oscillator with potential rectification.

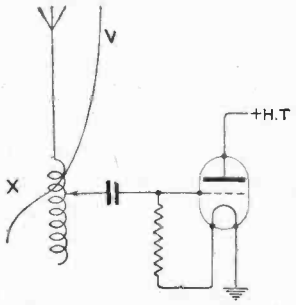


Fig. 6.—Method of exploring distribution of potential on half-wave oscillator.

Difficulty of obtaining a really good earth suggested to the writer another method of attacking the problem. If we dispense with earth or counterpoise as part of the oscillator, we may, by adding inductance to the *home end* of the aerial, tune it to resonance with the impinging waves. It will then be oscillating with half-waves of current and potential standing upon it (Fig. 4), the only damping being due to the resistance of the oscillating system itself. We have now an antinode of potential at an available point upon the oscillator, viz., the open end of the loading inductance, and to detect the signal all that it is necessary to do is to apply this potential V to the grid of the first valve, there being no circuit (other than that required for maintaining the average grid potential) between grid and filament. The connections in the case of a valve detector are given in Fig. 5. Reaction can, of course, be applied to the loading coil in the normal way.

Using this circuit the signal strength from 2LO at a distance of thirteen miles was much greater than that obtained with the usual circuit employing a condenser in series with the aerial and a coil between grid and filament. The strength closely approximated to that usually obtained with detector and L.F. amplifier. On attempting to tune in distant stations, trouble was experienced with noises. They were, however, easily eliminated, at the expense of a small reduction in signal strength, by connecting a rejector circuit between grid and filament. For the local transmissions a rejector was unnecessary except on very bad nights.

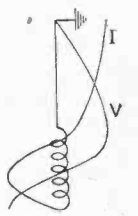


Fig. 7.—Three-quarter wave oscillator with remote end of aerial earthed.

The general principle of the circuit was well illustrated by using a solenoid as the loading inductance and connecting the grid to a slider (Fig. 6). As the slider was moved upwards from the open end the signal strength steadily diminished, becoming zero at the node X, whence it steadily increased again until the aerial connection was reached.

As a final experiment, the far end of the aerial was connected to earth, and the loading increased until strong signals were again obtained with three-quarters of a wave standing on the aerial (Fig. 7).

TRANSMITTERS' NOTES AND QUERIES.

General Notes.

Mr. C. Bedford, Gildersome, near Leeds, states that he is still receiving communications intended for G 5SW. He has not used this call-sign for two years. We shall be glad if the present holder of 5SW can give us his QRA.

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Mr. S. Clarricoats (G 6CL), 107, Friern Barnet Road, N.11, tells us that on Sunday, September 26th, he worked with LIT 1B, a new station in Kovno, Lithuania, from 21.05 to 21.35 G.M.T., and believes he is the first British transmitter who has been in communication with that station. The wavelength was about 43 metres, raw A.C.

On the same day, at 15.55 G.M.T., Mr. Clarricoats also worked KJOE, s.s. "W. M. Irish," owned by the Atlantic Refining Co., Philadelphia, outward bound from Hamburg to San Pedro, California, the wavelength being 42 metres.

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Mr. G. A. Jeapes (G 2XV) has, during the past few weeks, been in two-way communication with five different New Zealand stations, one Australian, one Brazilian, and a number of North Americans, using an Osram T 50 valve, the H.T. supply being obtained from a small ex-R.A.F. generator with a rated output of 600 volts, and transmitting on wavelengths of 32 and 45 metres. He considers that his recent tests on short waves prove that world-wide communication can be obtained under ordinary atmospheric conditions without awaiting the arrival of a "freak" period. The comparatively low anode voltage used in these tests is worthy of notice, as the valve was designed for a potential of 1,500 volts.

Mr. Brian W. Warren (G 6CI), 19, Melville Road, Coventry, has also been successful with the use of low anode voltage on short-wave transmission. During low-power experiments on a wavelength of 45 metres the voltage applied to the anode of the transmitting valve was 15, with a current of 2 milliamps, and communication was established with GI 5NJ (who reported signals as R5 on a two-valve receiver, the distance being about 240 miles), G 5FQ, G 5IIJ and G 5XD.

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Mr. F. A. Mayer (G 2LZ), Wickford, writing on 27th September, states that he received the whole ringside transmission of the Dempsey-Tunney fight through the American station U 2XAF, using a super-heterodyne six-valve set with Osram valves, the loud-speaker strength being as strong as that usually obtained from 2LO on a three-valve set.

Mr. F. R. Rawlings, Clapham, also heard every word from the ringside, using an O-v-2 receiver and Igranic short-wave coils. Afterwards he heard dance music from U 2XAF at good loud-speaker strength.

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Transmissions from Singapore.

We understand from a correspondent that Mr. R. E. Earle, Keppel Harbour, Singapore (SS 2SE), is now transmitting on 23 metres every day at 05.00, 10.00, 11.00, 12.00 and 23.00 G.M.T., and will welcome reports. He hopes later to obtain leave to transmit on 44 metres.

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New Call-signs Allotted and Stations Identified.

BG 1JT	J. Tasker, 61, Hadfield Street, Georgetown, British Guiana.
D 7AF	H. Chr. S. Nielsen, 25, Vendersgade, Copenhagen K.
GH 1FG	Mission Eitaliana, Sione Street, Aliana, Quinto, Ecuador, transmits on 35 metres.
K 4YAE	R. Horkheimer, Rottenburg-au-Neckar.
K W9	— Massenbach, Antonienstrasse 3, Munich.

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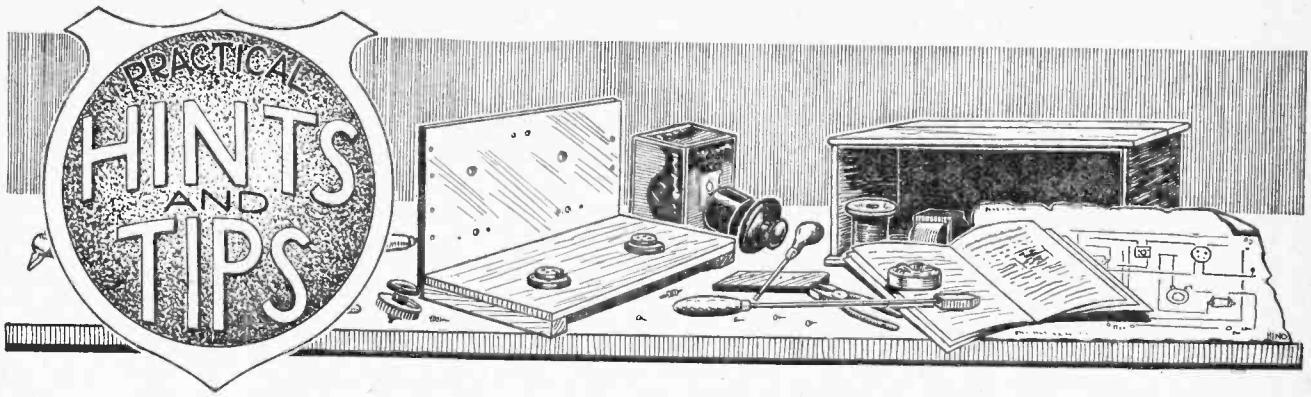
QRA's Wanted.

G 2KT, 2QX, 2ZF, 5SW, 6IW, 6PA, 6RO, GXAN, HM (on 20 metres), LA 1E, N PODC, N ONAA.



A Section Mainly for the New Reader.

ADJUSTING DETECTOR BIAS.

Although the practice of obtaining a "free" source of negative grid bias by using the drop of voltage across a filament resistance is not generally recommended in these pages, there are occasions where this method may be usefully employed without the troubles resulting from the inclusion of another variable factor into the circuit. This is possible when a fixed resister is used instead of a rheostat. A good example of this arrangement, as applied to anode rectification, is that adopted in the "Everyman Four-Valve" receiver, where two resistances are connected in series, the drop in voltage across one of them being applied to the grid. The bias thus obtained will be correct with the valve, resistances, and under the general operating conditions as specified by the author.

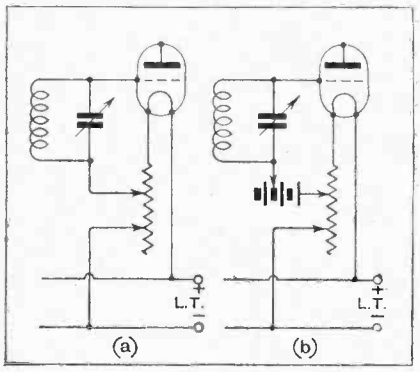


Fig. 1.—Connecting a filament rheostat to control grid bias.

Where a somewhat different valve is used in this circuit, it may be necessary to try experimental alterations of bias, and the arrangement shown in Fig. 1 (a) may be used. A variable rheostat of suitable type is used instead of fixed resistors. The negative side of the L.T. battery should be connected to a point on the resistance wire winding which is found by experiment to pass the correct current. A permanent connection, by soldering or otherwise, is then made at this point. The low-potential end of the tuned circuit is now connected to the slider of the rheostat, movement of which will vary the grid potential from zero (when it is at the filament end) to the maximum voltage dropped across the rheostat, which, in the case of the receiver in question, is over 4 volts.

With other types of valves, it may be necessary to insert a small bias battery as shown in Fig. 1 (b). This is most likely to be necessary where the voltage dropped across the resistance is small—in other words, where the working voltage of the valve is only slightly less than that of the L.T. battery which feeds its filament. With this method of connection, rough adjustments of bias are made by varying the tapping connection on the battery, final control being obtained by moving the rheostat slider. It may be pointed out that these adjustments should always be made when listening to a really weak signal; clearly a variation of a volt or less will make little difference when the voltage due to a strong signal may easily amount to three or four volts.

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CHOOSING VARIABLE CONDENSERS.

Amateurs who are using variable condensers already in their possession for the construction of up-to-date receivers, are often uncertain as to where these components may be used to best advantage. They should be guided by the fact that tuning is always sharpest (and therefore there is the greatest need for a good condenser) in a circuit which is lightly damped.

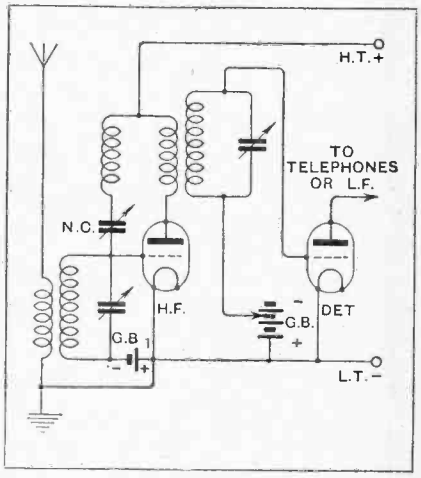


Fig. 2.—An H.F. and detector combination with lightly damped circuits.

Referring to Fig 2, which shows a popular and modern arrangement of H.F. amplifier and "bottom bend" detector valve, with damping reduced everywhere to a minimum, it is not difficult to see that both the tuning condensers should be of such a design that fine control of capacity is obtainable. Moreover, their electrical efficiency should be high, as it is of course assumed that low-resistance coils are used. There will, however, be a little damping in the grid circuit of the H.F. valve, due to the aerial, which is coupled to it. If, therefore,

two condensers of slightly different quality are available, the better one should be used for tuning the H.F. transformer.

If we modify the circuit somewhat, and change from anode to leaky grid condenser rectification, conditions will be entirely changed, and the secondary of the H.F. transformer will be damped, so our best condenser should be used for the aerial-grid circuit. Again, if a further change is made by coupling the aerial to the grid coil of the H.F. valve (incidentally, a practice which cannot be recommended), it will almost invariably be found that damping is highest in this circuit, and we should revert to the original arrangement of condensers.

Where condensers are used for reaction control, as in various modifications of the Reinartz arrangement, it should be realised that we are dealing with superabundant energy, and electrical losses are of comparatively small importance. Good mechanical control is still highly desirable, however, and in the majority of circuits a high insulation resistance is necessary, as the H.T. battery may be connected in effect across the condenser.

In a superheterodyne receiver, with a leaky grid first dectector, it will generally be correct to use the best condenser for tuning the oscillator circuit.

A word may be added for the benefit of those who wish to use, in the construction of a set described in a technical publication, a tuning condenser of a maximum value different from that specified. A smaller capacity will have the result of reducing the wavelength range covered, and will generally be quite unsuitable. The use of a considerably larger condenser may be permissible, particularly if it has a low minimum capacity, but tuning will be more difficult, as a given movement imparted to the plates will make a greater change to the wavelength of the circuit. This trouble may generally be overcome by the use of a slow-motion dial giving a large reduction.

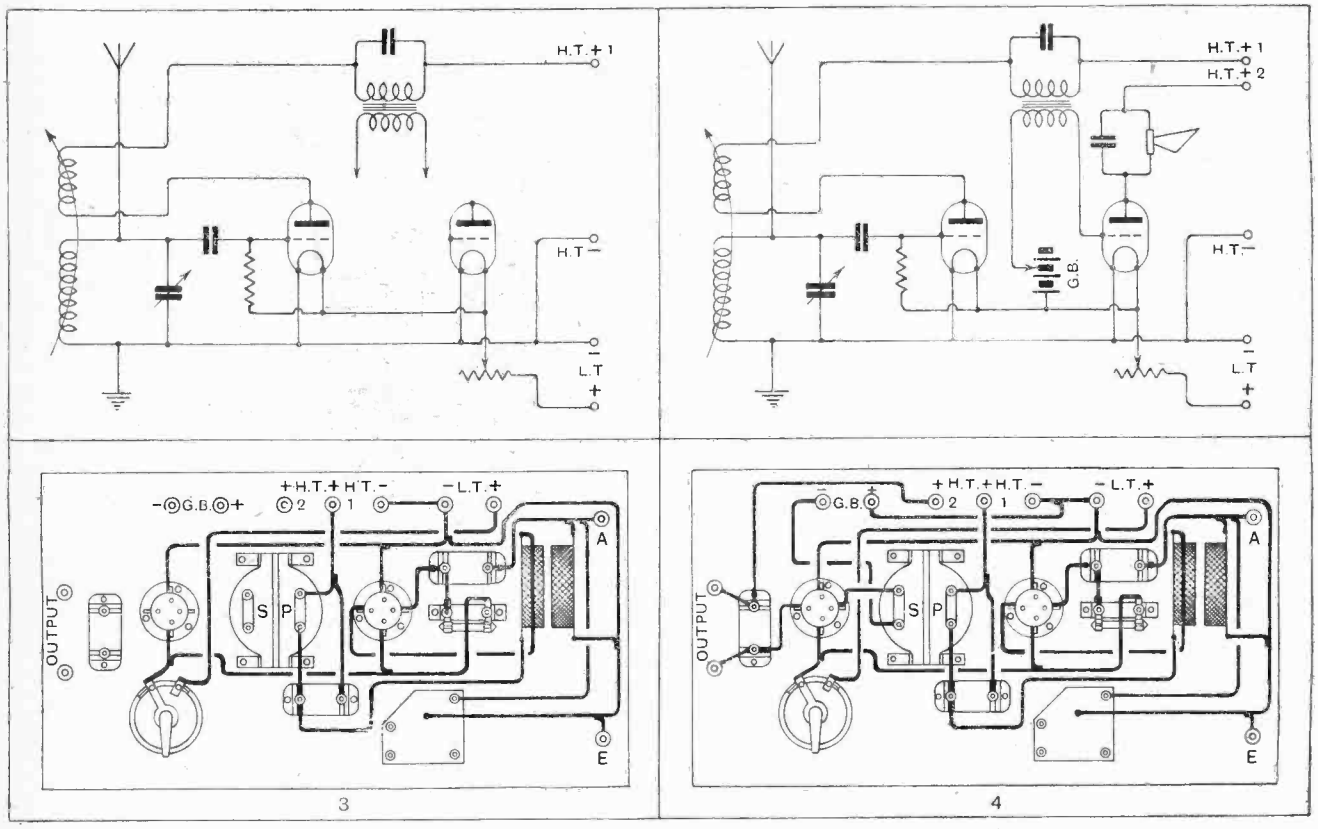
DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 45 (b).—A 2-valve Detector-L.F. Receiver.

(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 receivers. The circuit shown below comprises a detector valve with reaction, directly coupled to the aerial, with one L.F. amplifier, and provides one of the simplest possible loud-speaker receivers. It is a good set for the beginner, but is not particularly selective.



The plate circuit of the detector valve is completed through the reaction coil, the primary of the L.F. transformer, and the H.T. battery.

The transformer secondary is joined to grid and filiament of the L.F. valve through a bias battery. Its plate circuit is completed through the loud-speaker.

SUPERHETERODYNE INTERFERENCE.

Changing the Intermediate Frequency to Avoid Local Jamming.

By P. D. TYERS.

THERE has recently been considerable discussion concerning the respective merits of the superheterodyne and neutrodyne receivers, particularly from the point of view of selectivity. In mentioning the subject of interference and the superheterodyne no attempt is made either to revive this controversial subject or to add further comment. This short note merely relates to a form of interference which may be experienced with the normal superheterodyne under certain conditions, and, further, a means of readily eliminating this source of trouble.

Essentially, the system of superheterodyne reception consists in receiving a signal at its natural frequency and beating the received currents with those from a locally produced source of slightly different frequency, rectifying the resultant beat note, which is then amplified and re-detected so as to produce audio-frequency signals. The beat note is the simple arithmetical difference between the frequencies of the received and local oscillations. The usual practice in modern superheterodyne construction appears to be that of building a multi-stage amplifier which will amplify currents at frequencies extending over a band of which the beat frequency is a mean; that is, a band-pass intervalve coupling is employed. Selectivity is obtained by using a sharply resonant selector or filter somewhere in the system, the filter usually being placed at the beginning or the end of the long-wave amplifier. The beat frequency which is chosen is usually governed by a number of factors peculiar to the receiver, the fundamental wavelength over which it is desired to operate, and other conditions, but frequencies of the order of 30 to 100 cycles are frequently employed on a receiver intended to operate on the usual broadcast band, 50 kilocycles, perhaps, being the average value. Thus, suppose it is desired to receive a wavelength of 300 metres, representing, roughly, a frequency of 1,000 kilocycles, it is necessary to arrange a source of local oscillations at a frequency either of 1,050 or 950, so that a difference of 50 kilocycles is obtained. Thus, if a frequency of 1,050 is chosen, it corresponds to a wavelength of 288 metres. In other words, to receive signals on a wavelength of 300 metres necessitates using a local oscillator operating on a wavelength of 288 metres.

Selectivity with Frame Aerials.

The manner in which the local oscillations are combined with the received oscillations is of little importance, the resultant beat note being dependent upon their relative intensity. For example, a fairly weak source of oscillations may be employed with very tight coupling, while a more powerful source may be used with much looser coupling. It is usual to employ a closed aerial in the form of a loop or a frame, chiefly on account of the localised field existing round it, so as to minimise the interference with neighbouring receivers owing to the use of a somewhat powerful source of local oscillations coupled to it. The use of a frame aerial introduces considerable selectivity, partly because the damping is low and partly owing to its directional effect. If, however, a rather flatly tuned loop were employed for receiving a signal on 300 metres, and a somewhat stronger signal was occurring simultaneously on 288 metres, then it is possible that the latter signal would produce sufficient potentials across the loop to give a beat note with the 300 metres signal, at a frequency, of course, equal to that of the predetermined beat note. Hence the arrangement would be totally unselective, both signals being received simultaneously. Usually, however, the sharpness of the tuning of the loop is sufficiently great to prevent any appreciable potential being produced across its ends when out of resonance with any other signal. Only when the interfering signal was of a very great magnitude, due, perhaps, to the proximity of the loop to a powerful broadcast station, would interference of this nature be obtained.

Open Aerial Reception.

Many superheterodyne receivers, however, are used with open aerials, and in practice the selectivity is frequently insufficient to avoid this effect. It has been previously mentioned that the normal superheterodyne practice consists in using a band-pass amplifier with a critically tuned and fixed selector circuit. If this

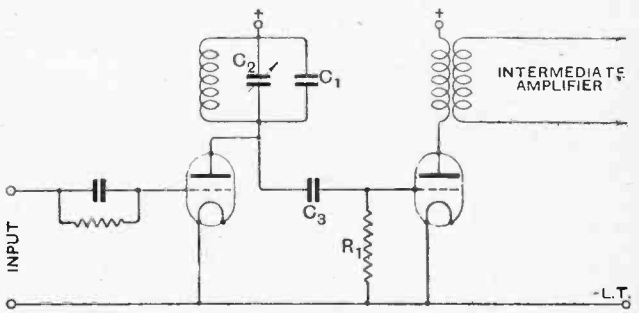


Fig. 1.—Connections of tuned-anode circuit with auxiliary condenser for changing the intermediate frequency.

arrangement be employed under the conditions just mentioned interference will be inevitable, and, moreover, the interference will be of a type which is not dependent upon the sharpness of tuning of any circuits in the receiver itself, but by a very simple modification in the design of the amplifier it is really quite possible totally to eliminate this effect.

Now, it is obvious that if the interfering frequency to which the filter is tuned and at which the amplifier gives maximum amplification is a few cycles greater or less

Superheterodyne Interference.—

than the frequency corresponding to the beat note between the desired and interfering signals, then the interference will be non-existent. This can easily be accomplished simply by using a very sharply resonant filter controlled by a small variable condenser connected in parallel, which thus alters the frequency at which the selector becomes operative. It is very important, however, that the form of coupling used between the successive stages of the intermediate frequency amplifier shall not be sharply resonant at any particular frequency, as otherwise they will tend to amplify at a frequency equivalent to the beat note between the desired and undesired signals. Some form of band-pass transformer or a transformer which has no sharply resonant peaks must be used. Thus it will be seen that if we desired to receive the 300 metres signal and we were obtaining interference from a 288 metres signal, with this arrangement it would only be necessary to alter the condenser controlling the filter circuit, making the appropriate alteration of the local oscillator frequency. In this way a new beat frequency would be obtained, to which the filter would be adjusted, and no interference would be obtained from the 288 metres signal, since the amplifier would not amplify to any appreciable extent at this frequency.

This is a very simple refinement, which the reader will find to be exceedingly efficient and useful. It is very important, however, that a non-resonant form of coupling be employed in the various stages of the amplifier, all the selectivity being confined to the filter or selector circuit. Two suitable arrangements of the filter and intermediate amplifier are shown in Figs. 1 and 2. The filter in Fig. 1 simply consists of a low-loss coil, tuned by a fixed condenser C_1 and a small variable condenser C_2, and acts as an ordinary tuned anode circuit, being coupled to the next valve by C_3 and a grid leak R_1.

The second arrangement (Fig. 2) shows what is, in fact, two loosely coupled resonant circuits consisting of inductances L_1, L_2, tuned respectively by fixed condensers C_1, C_2, and variable condensers C_3, C_4. This arrangement, of course, gives considerably greater selectivity than is obtained with a simple tuned anode arrangement, and is undoubtedly preferable from every point of view, except, of course, the complications of an additional tuned circuit. Readers, however, will find that this addition, which, after all, is only the insertion of one or two variable condensers, according, of course, to the type of filter used, adds very greatly to the utility of any superheterodyne, and is well worth the extra trouble and expense.

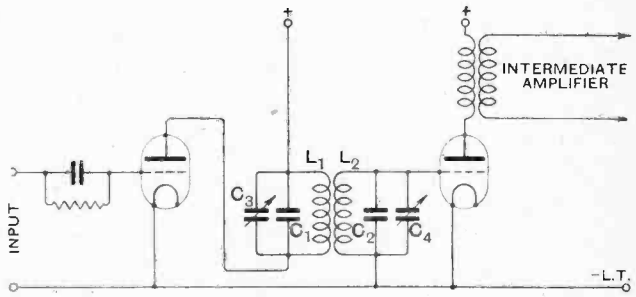


Fig 2.—Tuned transformer for coupling valves in the intermediate amplifier with auxiliary frequency changing condensers.

NEWS FROM THE CLUBS.

Enthusiasm at Southport.

Favourable comment on the manner in which the Southport and District Radio Society maintained its activities during the summer months was made at the recent business meeting. The hon. secretary explained that interest had been sustained by the preparations for the society's exhibition, which is to be held on October 28th, 29th and 30th at the Temperance Institute, London Street.

During the present session special attention is being paid to the more advanced side of wireless technique, but this department will be kept entirely separate from the elementary classes which have become so popular.

The society has a very attractive syllabus for the current quarter. Full particulars of membership may be obtained from the hon. secretary, Mr. T. Godfrey Storry, 67, Virginia Street, Southport.

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Croydon Plans Ahead.

Probably few clubs are in the enviable position of the Croydon Wireless and Physical Society, which is able to publish a syllabus, more or less complete, covering the period from October, 1926, to June, 1927. The regular fortnightly "lecture" evenings are to be alternated almost throughout the session by "Practical" evenings, which proved so successful last session. The Council express the hope that these practical evenings, which are of an informal kind, will enable members to bring forward points for discussion.

On October 18th Mr. J. H. A. Whitehouse, of the B.B.C., will deliver a lantern lecture, entitled: "The Art of Broadcasting."

Hon. secretary: Mr. H. T. P. Gee, Staple House, 51-52, Chancery Lane, W.C.2.

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Popular Lecture at Taunton.

Mr. W. N. Settle ("Uncle Norman" of the Cardiff B.B.C. station) gave a very popular talk on programme preparation to members of the Taunton and District Radio Society on October 4th.

On October 18th Mr. E. Scott Selterington will give a lecture on "Home Construction."

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Barnsley Society's New Transmitter.

The Barnsley and District Wireless Association holds its annual meeting this evening (Wednesday) at 22, Market Street. Various suggestions will be made for rendering the winter programme attractive, and it is understood that a number of interesting events are already arranged for. The association's new transmitter and receiver will be on view for the inspection of members.

The hon. secretary, Mr. W. Peacock, 28, Park Grove, Barnsley, will be pleased to supply particulars of membership to anyone interested.

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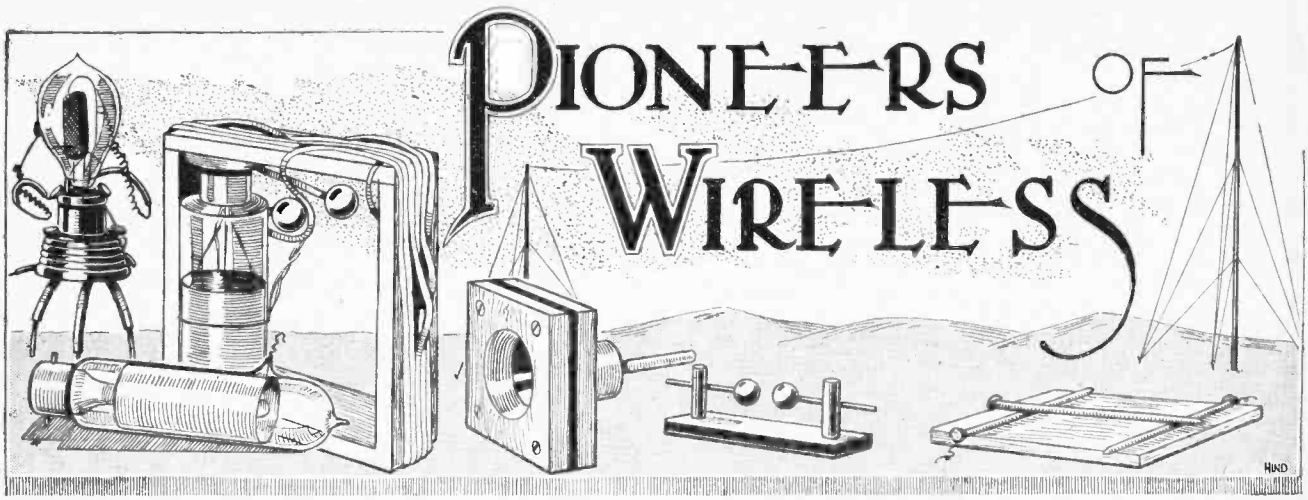
A New Society.

The inaugural meeting of the North London Experimental Radio Society was held on September 29th, when the following officers were elected:—President, Mr. S. Painton; secretary and treasurer, Mr. Wilfred J. L. Parker-Ayers; committee, Messrs. Clarricoats, Halden and Buckingham.

The society is intended to appeal to those interested in experimental wireless rather than to those concerned solely with the perfection of broadcast reception.

Rules have been drafted and will be settled in committee, to be laid before the society at the next meeting; the annual subscription is provisionally fixed at 10s., and part of the Society's service is to consist of the provision of instruments for the use of members in their experimental work.

The next meeting of the society will be held this evening (Wednesday). Enquiries regarding membership should be addressed to the hon. secretary at 61, Carey Street, Lincoln's Inn, W.C.2.



32.—Marconi Comes to England.

By ELLISON HAWKS, F.R.A.S.

LOOKING back to the closing years of the nineteenth century we see clearly how the work of the pioneers of wireless was gradually leading to a grand climax. Clerk Maxwell and Hertz had applied the match, and the scientific world had taken up the torch. In Italy, Onesti; in France, Branly; in England, Lodge; in Russia, Popoff—all had devoted thought to the subject, and had contributed to the common cause in endeavouring to find a solution to the problem. Progress had been slow, but soon the great labours of the earlier investigators were to bear fruit, and wireless telegraphy — the dream of the preceding century— was to become an accomplished fact. As all the world knows, the first to apply the latent possibilities of Hertz's discoveries in such a manner that they became a commercial success was Marconi.

Marconi: Pupil of Righi.

Guglielmo Marconi was born at Villa Griffone, Bologna, Italy, on April 25th, 1874. His father was a wealthy landed proprietor of Italy, and his mother a member of an influential and well-known family of Dublin. Educated at Bologna, Florence, and Leghorn, Marconi had many advantages that probably influenced him considerably in shaping his career. From early boyhood he showed a particular interest in electricity. Later, he was fortunate in being able to devote a good deal of time to experimenting. It was unnecessary for him to spend many years in a struggle for a bare existence, which is so often the lot of scientists and inventors.

As a boy, Marconi was of a shy and retiring disposition, and when nineteen years of age he was described as having been a quiet, studious youth, talking little but thinking a great deal. He was possessed of a quiet determination to overcome any difficulty that presented itself, and no doubt it was this spirit that was responsible to a large extent for his later successes.

The possibility of transmitting messages from one place to another without wires was first suggested to him by an account of the properties of Hertzian waves, which had been discovered when he was but twelve years of age. At this time Marconi was a pupil of Augusto Righi, Professor of Physics at Bologna University.

Guglielmo Marconi during the days of his earlier experiments.

Improves on Existing Methods.

Righi, who was born at Bologna on August 27th, 1850, and died there on June 8th, 1920, was a scientist of some distinction. Soon after Hertz had announced his discovery he commenced an investigation of the Hertzian waves, paying particular attention to their optical properties. He effected a considerable improvement in Hertz's "exciter" by placing the two metal balls in an ebonite frame and by filling the spark gap with vaseline-oil. This prevented oxidisation, and rendered it unnecessary frequently to clean the knobs, as was previously the case. Irregular action was eliminated, and solid balls instead of hollow spheres enabled the oscillations to be transmitted over double the distance.

Hertz had only been able to produce waves of many metres in length, and never less than 30 cm., but by employing the smaller balls Righi obtained waves of 2.5 cm. in length. He also introduced what he considered to be an improved detector. This consisted of

Pioneers of Wireless.—

thin bands of quicksilver, as used for mirrors, and rendered discontinuous by cross-lines lightly traced with a diamond.

There is no doubt that Righi's enthusiasm had a marked influence on young Marconi, his pupil, and caused him to turn his attention to the Hertzian waves. Even at this early age Marconi repeated all the published experiments. His practical mind was quick to grasp the commercial possibilities of the waves, but he could not believe that he was alone in this. The discoveries of the pioneers—the resonator, the aerial, the coherer and the tapper—were ready to his hand, but they were equally at the disposal of others, older than he, and with a better scientific training. He thought every other scientist in the world would be studying the problem and would have come to the same conclusion as himself. "I was deeply impressed," he has said, "with the value of the etheric waves. . . . I could scarcely conceive it possible that their application to useful purposes could have escaped the notice of eminent scientists." In this he resembled the great Frenchman, Jacquard, who feared to claim the reward for his loom because he believed that so many others must already have devised a similar machine.

Marconi Experiments at his Father's Farm.

Marconi, therefore, watched for some announcement of the practical application of the Hertzian waves. He searched the technical papers and reviews for a twelvemonth, but nothing of interest appeared. Astonished, he set to work on further experiments to improve his apparatus, which, at that time, was capable only of transmitting from one side of a table to another.

His experiments commenced in 1895, and were carried out at his father's farm in Bologna. In the garden of the farm Marconi erected a short pole at one side with a vertical wire attached to the top. To this he connected the transmitting apparatus by insulated wire. At the other side of the garden a second pole was erected, and another wire stretching to the top of the pole was connected with the receiving apparatus.

As a result of his first experiments he was able to signal across the garden. As he constantly improved his apparatus, the distance was increased until, in 1896, he succeeded in transmitting over two miles. Then he packed up and came to England, applied (on June 2nd, 1896) for provisional protection for his invention, and during the following month obtained an introduction to Sir William Preece, chief engineer of the Post Office Telegraphs, who (as we have already seen) had himself carried out many experiments in wireless. In his official capacity Sir William eagerly interested himself in the new system, and greatly aided Marconi in its development.

In his system Marconi embodied the inventions of several pioneers. By improving them in detail, and by adapting them individually to his requirements, he was able to bring them together, so that collectively they formed a practical working system. His "wave-exciter" was Righi's "three-spark exciter." His receiver included a coherer similar to, but considerably more sensitive than, those of Calzecchi-Onesti, Branly, and Lodge. The metallic filings were returned to their normal state, after cohesion, by the hammer of an electric bell, a similar principle to that introduced by Popoff, but again improved in detail.

The "Secret Box" Comes to England.

In combining these ideas of earlier workers Marconi showed himself to be possessed of far-seeing initiative. He alone was sufficiently alert and practical to bring into operation a concrete scheme, whereas other scientists, who might have forestalled him—but did not—continued to engage in laboratory research. Of his achievement the master Righi said, "Marconi carried into the domain of practical reality that which had only floated indistinctly before the minds of others, or had served them for modest experiments."

There is another aspect of looking at the matter, which was so well expressed at the time by Sir Oliver Lodge that we cannot do better than quote his words: "An enthusiast in Italy," he wrote, "having learnt from Professor Righi about the production and transmission of Hertz waves across space, and their detection by the cohesion which they caused in a group of metallic filings, and being gifted, doubtless, with a sense of humour as well as with considerable energy and some spare time, proceeded to devise a suitable form of coherer, to put it inside a sealed box and to bring it to England as a secret device adapted to electric signalling at a distance without wires. Being influentially introduced to the chief engineer of the Government Telegraphs, who, presumably, was too busy to remember what had recently been done in the Hertz-wave direction, the box was announced as containing 'a new plan' which had been 'brought to England.' Lectures were given on it at both the Royal Institution and the Royal Society, and trials were made by the experienced official staff with their usual skill.

"Mr. Marconi is to be congratulated on the result of his enterprise; the newspaper Press of this and other countries have taken the matter up, popular magazine articles have been written about it, and so now at length the British public has heard, apparently for the first time, that there are such things as electric waves, which can travel across space and through apparent obstacles to a considerable distance, and can there be detected in a startling fashion. Thus the public has been educated by a secret box more than it could have been by many volumes of Philosophical Transactions and Physical Society Proceedings; our old friends the Hertz waves and coherers have entered upon their stage of notoriety, and have become affairs of national and almost international importance. Every daily paper now has bulletins concerning the progress of the practical application of the invention, except in so far as it is still being privately worked by uninfluential individuals!"

How strange all this reads to-day, when the use of the wireless Press service is a routine matter, when our evening's entertainment consists of broadcast concerts, and when photographs of a prize fight in America are transmitted by wireless, and published in the daily paper a few hours later, without exciting any but a passing interest!

NEXT INSTALMENT.

Sir Oliver Lodge, the Pioneer of Tuning.

MARCONI REVISITS THE SCENES OF HIS YOUTH.

Senatore Guglielmo Marconi was born at Bologna, in 1874, and carried out his first experiments in wireless at his father's house, the Villa Grifone at Pontecchio. The friends of his youth recall how, in the attic of the villa, he toyed for ten hours out of the twenty-four with certain mysterious instruments which appeared to be devised to make the whole house lose patience. As the years passed, these singular toys became more complicated and costly, so much so that it is said that on one occasion his father threatened to throw out of the window all these useless toys which distracted him from serious things.

Nothing, however, would induce him to give up his experiments, and one day he confidently announced that he had discovered a system of transmitting telegraph signals over great distances without the need of wires. He then left for England, taking with him his great idea. This year, Senatore Marconi, now illustrious and world famed, has been revisiting the scenes of his youth, and during a round of visits, celebrating the thirtieth anniversary of his first patent in wireless telegraphy, he gave the following address reviewing the progress of his inventions.

Speech by Senatore Guglielmo Marconi at Archiginnasio di Bologna.

SINCE February, 1896, the date of my departure from Bologna after my first experiments in wireless telegraphy —which were carried out at the Villa di Pontecchio—my life has been spent far from my dear Bologna.

My remoteness has been caused by the force of circumstances and not by any diminution in my affection for my native place.

Radiotelegraphy, which from the beginning appeared to me to be destined to form a connecting link for the thought of all the peoples of the world, required for its development a very great space, and I chose for my first laboratory the Atlantic Ocean.

Debt to the Pioneers.

From my youth, I would almost say from my boyhood, the experimental discovery of electric waves made by Hertz in confirmation of the mathematical hypothesis of Maxwell regarding the electromagnetic theory of light, and the brilliant pursuit of such researches made by our great Bolognese physicist, Augusto Righi—to whose memory I always bow with devout admiration—had fascinated my mind and I soon had the idea, I might almost say the intuition, that these waves might, in a not distant future, furnish mankind with a new and powerful means of communication utilisable not only across continents and seas, but also on board ships, bringing with it a vast diminution of the dangers of navigation and the abolition of the isolation of those crossing the sea.

The happy results obtained over noteworthy distances by means of electric waves were, in my opinion, due in great part to my discovery, made in Bologna in 1895, of the effect of the so-called "antennæ" or "raised aerials" connected with both transmitting and receiving apparatus. Such a device was naturally the consequence of a happy inspiration, and our mind never forgets, however great the absence, the place where a first happy inspiration was born.

But during my forced absence from Bologna the memories of my native city often invaded my mind; often enough during the eighty-six times I crossed the Atlantic, during the long periods of time spent in the solitudes of Canada and of Ireland my thoughts, which to many seemed fixed on the study of the apparatus which I had before me, flew far away instead, flew to my dear Bologna, to which I am bound by the most sacred affections and the dearest memories.

Guglielmo Marconi (left) as a child with his mother and elder brother, Alfonso.

Since I left Bologna in 1896 and obtained my first patent of invention on June 2nd of that year, immense difficulties have had to be surmounted to attain the purpose which I had set myself and in which my faith was never shaken, even when illustrious scientists had to express the most discouraging opinions.

It had been objected that the curvature of the earth would inexorably hinder communications over distances greater than a few tens of kilometres, but I did not believe this, and I was soon able to prove by experiments conducted between the Lizard and the Isle of Wight in England, across a distance of 300 kilometres in which the curvature of the earth intervenes rather considerably, that it did not offer any obstacle to radiotelegraphic transmission.

First Transatlantic Tests.

It was then affirmed that transmissions over still greater distances were the dream of a visionary, but after the experiments I carried out in December 1901 between England and Newfoundland in North America, during which I succeeded in communicating for the first time across the Atlantic Ocean, everyone began to be convinced that very probably there would no longer be any distance in the world which could obstruct the propagation of electric waves.

The happy result obtained by those first experiments of mine

Marconi Revisits the Scenes of His Youth.—

between Europe and America encouraged me in the prosecution of my studies to face the solution of a difficult problem—commercial radiotelegraph communication between Europe and America and with so many other distant countries where the practical object to be reached would justify the risk of the expenditure of a huge capital for the execution of experiments.

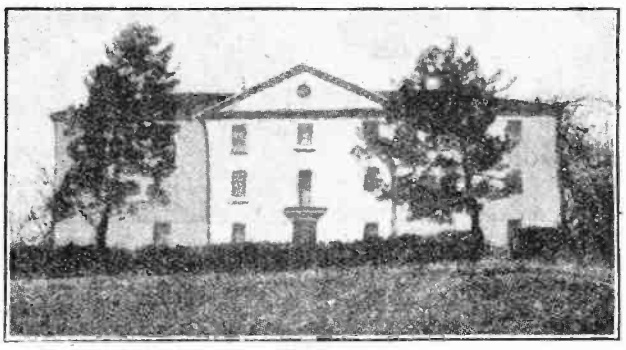
Discovery of Fading.

In the experiments I conducted in the Atlantic during the winter of 1902 I found myself impeded by an unforeseen difficulty caused by the effect of solar light on radiotelegraphic transmissions, a phenomenon I discovered during a voyage made on board the s.s. *Philadelphia*. In consequence of the effect of the light I found that at a distance of more than 700 miles all reception became impossible when the sun rose; but with the increase of wavelength I found that this difficulty also could be overcome.

Then all students of radiotelegraphy devoted themselves to the use of longer and longer waves, and thus from those of 1,000 and 2,000 metres there was a gradual transition to the use of waves which reached the length of even 30 kilometres.

Other difficulties presented themselves as a result of interference between neighbouring stations, a difficulty which, it seemed, would cause a very great limitation in the practical application of radiotelegraphy. But with new tuned circuits, which I patented in 1898 and 1900 and experimented with on the south coast of England, the greater part of such difficulties also disappeared. It was then proved for the first time that many neighbouring stations among those tuned on different waves could communicate simultaneously without interfering with each other.

Following my first long-distance experiments over the sea, it was affirmed that communications across mountainous continents would be impossible. But with the wireless experiments carried out during the voyage of the Royal vessel *Carlo Alberto*, which was placed at my disposal by H.M. the King of Italy, I was able to demonstrate that the Alps and the Pyrenees were easily surmounted by the electric waves I was utilising.



The Villa Grifone at Pontecchio, Marconi's birthplace.

But there always remained inexplicable periods of interruption; there also always remained great difficulties occasioned by the low sensitiveness of the receivers then used; and there also always remained the enormous obstacles produced by atmospheric electric discharges.

It was then said that at that point the development of radiotelegraphy was finished; that its employment might be useful at sea for the safety of human life during navigation, but that its employment would be rather limited and rather difficult between distant continents.

The Advent of the Valve.

It was stated that radiotelegraphy would never be in a position to compete with other rapid means of communication over long distances, such as that carried on by cables.

But even in the face of such observations often made officially in the Parliaments of the great nations, I was never discouraged. We Bolognese often smile in the face of the most difficult situations.

In fact, by means of the use of thermionic valves—a brilliant conception of Fleming perfected by De Forest, Langmuir and Armstrong in America, by Meissner in Germany, and by Round and Franklin in England—and by means of the use of balanced tuned circuits, of electric filters, of power amplifiers, and finally, of directional radiators, I succeeded in obtaining results such as to ensure a regular radiotelegraphic service by day and night between Europe and America; and thus, in 1918, I was able for the first time in history to communicate from England to Australia, *i.e.*, almost as far as the Antipodes, over a distance of about 20,000 kilometres.

But to obtain such results huge and very costly installations were required, based on the use of many hundreds of kilowatts of electrical energy radiated almost equally in all directions; so that the object I had set myself, of finding a means of rapid communication more economical than that afforded by the ordinary wire or cable telegraph, seemed to a great extent frustrated.

I then thought again of my first experiments at Pontecchio. I again remembered all I had then proposed to pursue by means of the radiation of electric waves concentrated in a beam by means of suitable reflectors.

The First Beam Station.

Thus, in 1917, at Genoa, where I devoted myself to particular studies for military purposes, I made numerous distance experiments with the first beam ("a fascio") apparatus, using short waves, that is, of two or three metres length.

Yes! "Beam system" ("Sistema a Fascio").

I do not now use any of these words because I am a Fascist and because Fascismo, for the fortunes of Italy, is triumphant.

I always claim for myself the honour of having been the first Fascist in radiotelegraphy, the first to recognise the desirability of uniting in a beam (fascio) the electric rays, as the Hon. Mussolini has first recognised in the political field the necessity of uniting in a "Fascio" the best energies of the country for the greatness of Italy.

But long waves were no longer suitable owing to the use of my beam system, which system, instead of radiating the waves in all directions, concentrates them in the desired direction almost like a beam of light projected from a reflector, a system which the British Government has officially decided to use on the widest scale for direct communications between the most important British Dominions and the Mother Country.

And yet I was responsible for having caused the expenditure of hundreds of millions on long-wave stations. A certain courage was therefore necessary to say "Let us turn back." But the Bolognese, after building at Bologna one of the highest towers in Italy, did not hesitate to build near it another much lower one.

In this respect I fortunately had no uncertainty. Near the longest wave stations I was the first to have constructed very short-wave beam stations.

Experiments on the "Elettra."

In the practical study I carried out in the Atlantic for several months with the yacht "Elettra" in 1923 on the practical ranges of transmission of such waves, I was able to discover some of their very valuable properties unknown to science before that time.

I thus gathered that by using short waves in installations of very low power with reflectors it was possible to carry on the most regular, rapid and economical service by day and night between the antipodes of the globe, that is between England and Australia.

With such short-wave installations I was able in May, 1924, for the first time in history to cause the human voice, transmitted from England, to be heard and understood in distant Australia.

To-day there are thousands of ships equipped with radiotelegraphy for the safety of human life at sea and to maintain the daily activity of the countless persons who cross the oceans; to-day wireless communications between Europe and America, the Far East and South America handle a huge traffic to the advantage of the growing demands of civilisation; to-day millions of radiotelephonic receivers scattered in the most distant countries carry on continuous communication with the greatest

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centres radiating news of everything of interest to mankind; to-day, by means of circular radiotelephonic diffusion (so-called "Broadcasting"), public opinion can be kept calm during any popular disturbance which interferes with the peace-making work of the Press, as was proved on the occasion of the recent General Strike in England; to-day many hundreds of thousands of people find occupation, study and work in the new industry created by radiotelegraphy; to-day aerial navigation is possible and safe up to the farthest bounds by means of radio communication, as has been recently demonstrated by the great triumph of Italian boldness and technics obtained in the glorious "Norge" expedition.

The field of radio transmissions is continually getting wider, thus the radio transmission of photographs over long distances is already an accomplished fact, and even now the practical solution of the great problem of television is seen to be possible in the near future.

Before concluding, I would like to send a respectful greeting to the numerous bands of efficient scientists, seekers after the truth, and humble workers scattered all over the globe whose work has contributed to make realisable the progress obtained; I wish once more to record with deep admiration and reverent affection the great figure of Augusto Righi, who, with his genius and his indefatigable effort, did so much for the study of electric waves and to wrest secrets from Nature.

The clever and classical work on the optics of electrical oscillations accomplished here at Bologna by Augusto Righi led to results which, from the walls of his laboratory, became the admiration of the students of physical sciences throughout the world to the permanent benefit of mankind.

Bologna, cradle of Art and Science, which gave birth to Galvani and Righi, is always the chosen home of him who has a reverence for study and progress.

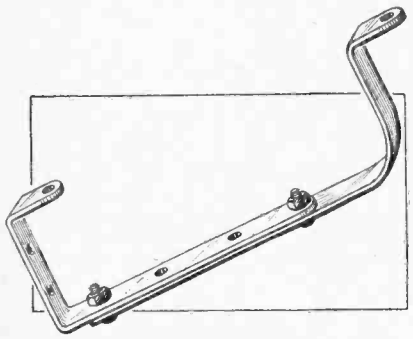
If my work, carried on during the thirty years which I have spent far from Bologna, may have made me in any way a worthy son of this city no greater prize could be conferred than the pride of having been born among you, in our beloved Bologna.

MANUFACTURERS' NEW APPARATUS.

A Review of the Latest Products of the Market.

DECKO SUB-PANEL BRACKET.

One of the best forms of receiver construction makes use of a vertical front panel secured to a base which carries all components except those actually operated from the front. When a compact set is required it will be found better to elevate the baseboard so that apparatus can be secured to both sides, a practice which often provides an improved wiring layout.



Adjustable bracket for securing the panel and baseboard and arranged to support an elevated platform.

An adjustable bracket for supporting an elevated sub-panel is now obtainable from A. F. Bulgin and Co., 9-11, Cursitor Street, Chancery Lane, London, E.C.4. One end attaches to the panel and serves as a bracket, and the strip, which gives support to the sub-panel is adjustable, so that a baseboard varying in width can be accommodated.

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NON-CORROSIVE PLUG CONNECTORS.

Users of accumulator high-tension batteries must have observed how rapidly brass connectors corrode when inserted in the lead connecting bars for tapping off suitable potentials. The brass is so rapidly acted upon that a high resistance connection soon results, and to overcome this difficulty the Edison Swan Electric Co., Ltd., of Ponders End, Middlesex, are now manufacturing plug connectors made of hard lead alloy. These can be plugged tightly into the lead connecting bars of the battery making a reliable non-corrosive contact. It is worth while, however, to smear the plugs with a thin layer of vaseline before bringing into use.

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CROXSONIA PANELS.

Many substitutes have been introduced from time to time for ebonite, particularly when used for the construction of instrument panels. Ebonite is a very variable substance, and unless known to be the product of a particular manufacturer may be of very doubtful composition and possess poor electrical properties. It is when using the cheaper grades that the amateur runs a risk of impairing the operation of his set by creating an obscure fault caused by poor insulation.

Croxsonia panels are not made of ebonite, and apparently contain no india-rubber. The surface, although black in colour, does not possess the rich matt appearance of ebonite, and thus when first examined one feels a little prejudiced in adopting it for the construction of a set in spite of its exceedingly low price in comparison with ebonite. The principal property looked for in any panel is good insulation. The substance itself must be of infinite resistance and free from surface leakage, and when tested in these respects the Croxsonia panel was found to be entirely reliable, which is perhaps explained by the fact that oil is probably used in its construction.

A clean hole can be made through the panel, using a sharp drill, though if the drill is blunt there will be a tendency for the surface to fray slightly and the turned-up edge can be easily cut away with a sharp blade or rose bit.

When a really cheap panel is required the use of a Croxsonia panel can be recommended, though one does perhaps sacrifice a little as regards good appearance. The panels, which are about $\frac{3}{16}$in. in thickness, can with advantage be used for setting up an elevated base behind the instrument panel, and, being exceedingly strong and not liable to warp, can be used for the support of heavy components.

This panel is a product of the Croxsonia Company, 10, South Street, Moorgate, London, E.C.2.

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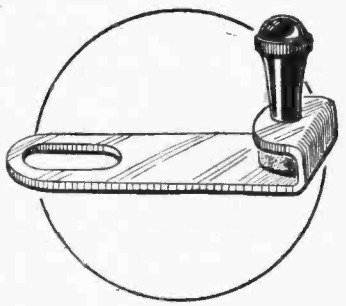
VERNIER CONDENSER CONTROL.

One of the cheapest vernier controls on the market is produced by Johnson Company, 125, Rectory Road, Redditch, Worcester. It comprises merely a bracket carrying an india-rubber face pinion, and it is its extreme simplicity which contributes largely to its reliable action.



An inexpensive vernier control which is easily attached by clamping the bracket down under a one hole fixing nut.

The small wheel is merely made to engage friction-tight on the edge of the condenser scale, the extent of friction being adjustable. It is attached to the condenser by clamping down under the one hole fixing nut, for which a slot is provided. This vernier control is prac-

tically free from backlash, gives a positive drive, and is as reliable in its operation as the majority of more elaborate and expensive vernier dials.

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THE ONEMETER.

In order to verify the correct operation of a receiver a reliable measuring instrument is essential. Apart from experimental work, there are many determinations which it is necessary to make in maintaining a valve set such as filament and H.T. potentials, anode current and simple

A popular precision measuring instrument which by means of shunts and series resistances is suitable for making all the current voltage and resistance determinations met with in experimental work.

tests of resistance. A new measuring instrument which is particularly suitable for carrying out practically all the tests associated with wireless apparatus is obtainable from Electradix Radios, 218, Upper Thames Street, London, E.C.4.

The instrument consists of a reliable moving coil meter combined with a range of series resistances and shunts for making current determinations over a range of 20 microamperes to 20 amperes, voltage from 1 millivolt to 2,000 volts and resistance tests from 50 ohms to 50 megohms.

The moving coil movement is of good design and is fitted with sapphire bearings. A current of 2 milliamperes is required to give a full-scale deflection, and the figure of merit is 500 ohms per volt. The needle is of light construction and has an exceedingly fine knife edge where it passes over the scale.

A novel constructional feature is the provision of double contacts under the press button which throws the meter in circuit, an additional resistance coming into operation on first pressing the key. Should a full-scale reading be obtained on first touching the key a lower resistance shunt or a larger series resistance will be needed for making the determination, and by this means the instrument is to a large extent protected against damage. Assuming the deflection to be very small, with light pressure the contact key may be pressed home, making direct contact so that the exact reading can be taken.

A range of 28 shunts is supplied, and with the smallest 1 division on a 50-division scale represents 0.05 mA., and with the largest the full-scale reading is 20 amperes. By means of series resistances one division of a 75-division scale represents 2 millivolts, whilst with the largest multiplier a full-scale reading of 2,000 volts is given.

The instrument is supplied with a booklet of instructions describing a number of typical measurements met with in experimental work; the details are very complete and the determinations are worked out by means of simple examples.

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NEW CRYSTAL.

What would appear to be a new type of crystal detector is now marketed by N.M.C. Detectors, 30, Princes Parade, Finchley, London, N.3.

Although making use of a well-known and well-tried crystal, the detector is novel in that a phosphor-bronze spring blade contact is supplied together with an under-contact plate on which the crystal rests. This form of crystal requires to be clamped down under a hard contact, and is therefore particularly robust and will not readily lose its adjustment. A good detecting point is easily found, and the need for critical adjusting screws can be entirely dispensed with. The resistance of the contact is higher than that of many other crystals, whilst the detector is not rendered insensitive when subjected to a moderate applied voltage. It would therefore appear to be useful in reflex valve receivers making use of crystal detection.

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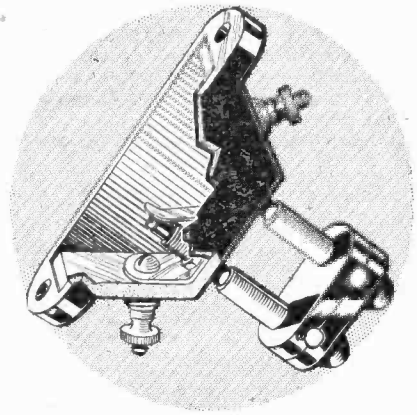
ATHOL EARTHING SWITCH.

It is often considered advisable as a precaution against damage by lightning not only to earth the aerial but to entirely disconnect the receiving apparatus from the aerial system. This is accomplished in the new Athol earthing device manufactured by the Athol Engineering Company, Seymour Road, Crumpsall, Manchester, by combining a two-pin connector with an automatic switch.

As is the practice with all Athol products, the insulating material used is porcelain and is shaped with a recessed base to accommodate the switch action, protecting it from moisture and corrosion. The aerial and earth wires are brought to a pair of terminals which join to a pin and socket and to which connection is made by a porcelain-mounted connector. The plug on the base piece is not rigidly mounted but acts as a plunger, and is pressed home when the instrument plug is pushed into place, and by this means the aerial earthing switch is moved to the "off" position. Withdrawal of the connector lifts the movable plug and earths the aerial.

The device forms a convenient method for earthing the aerial, and the danger of leaving the aerial connected through to the receiver is overcome because it is readily apparent that the plug connector must be withdrawn. Being under 1in. in width the switch is easily accommodated on a window frame and is quite inconspicuous. Although the design of the connector might suggest the use of a twisted flexible lead for connecting up with the receiver it might be mentioned that the use of two single rubber-covered flexibles is preferable.



Athol aerial earthing switch fitted with plug-in connector for the instrument leads.

This accessory has other applications, and, in particular, may be employed as a terminal point for loud-speaker extension, the several extension points being series-connected. The switch action is of simple construction, and, as can be seen from the accompanying illustration, only a very small insulating bush is provided to break the circuit.

TRADE NOTES.

No Connection.

The Oxford Wireless Telephony Company, Limited, of Queen Street and New Road, Oxford, have asked us to state that they are in no way connected with the "Oxford Wireless Co.," of London. The former company was registered at Somerset House as a private limited company in November, 1922.

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New Premises.

Messrs. Hambling, Clapp and Co., Ltd., the wireless specialists, are now occupying new premises at 21, Garrick Street, W.C.2.

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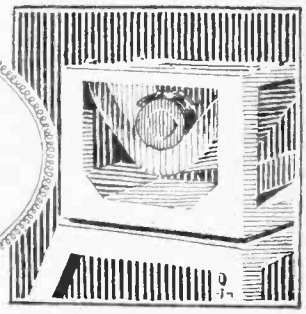
A Showroom Fire.

Messrs. Priestley and Ford, the wireless manufacturers, advise us that the fire which occurred in their Carrs Lane Showrooms, Birmingham, on September 25th has not interfered with the conduct of business, and that large stocks of all lines advertised in their catalogue are available.

Broadcast Brevities



News from All Quarters: By Our Special Correspondent.

Delay over Geneva Plan—The "Shadow Cabinet"—Spotlights in the Studio—A Question about Chamber Concerts—B.B.C. in Financial Straits.

Geneva Plan Again Postponed!

The introduction of the new Geneva wavelength scheme is again postponed, probably until the end of November. Several stations appear to be having trouble in making the necessary adjustments.

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Birmingham Heterodyned by Frankfort.

The wavelength changes will be welcomed with special heartiness by listeners to Birmingham, who have recently been troubled by heterodyning from Frankfort. A Birmingham correspondent informs me that a strong heterodyne note is observable every evening after 8 p.m., and a similar experience is reported by listeners to 5IT in various parts of the country.

The trouble has been caused partly by the fact that Frankfort recently increased its power to 5 kw.

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The New B.B.C. Chairman.

The appointment of the Earl of Clarendon, now an Under-Secretary for the Dominions, as chairman of the new corporation, brings to an end a most interesting period of "intelligent anticipation," during which nearly everybody with any claim to public recognition was "named" in connection with the new post.

It is understood that Lord Gainford will be a member of the corporation, and that the services of Mr. Reith will be retained.

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"Shadow Cabinet" at Work.

I hear that the "Shadow Cabinet," as the board of the new corporation has frequently been called, has begun budgeting for a period as long as ten years ahead, *i.e.*, the corporation will have a mandate for ten years and will try to map out its probable revenue and expenditure for the whole of that period. The indication that Lord Clarendon's appointment took place three months ago suggests that the Shadow Cabinet has been in existence for a considerable time.

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The Leningrad Station.

The Leningrad broadcasting station has undergone great changes recently, and is now carrying on experimental transmissions on 940 and 1,400 metres. Its aerial power has been increased, and there is every prospect that the new station will be eventually one of the most efficient in the north of Europe. Listeners in Scandinavia report excellent reception of the tests at present being made from Leningrad.

THE NEW CHAIRMAN. The Earl of Clarendon, appointed by the Government as chairman of the British Broadcasting Corporation, which will take over control of the broadcasting service on January 1st.

Silent Mondays at WGY.

WGY, the Schenectady station, now signs off every Monday evening at 11.30 p.m. G.M.T. in order to allow listeners an opportunity for experimenting in long-distance reception.

A Dazzling Idea.

If a motorist were to state that he enjoyed being caught in the full glare of another man's head light we should know what to call him. And yet, strangely enough, the variety artist in front of the microphone so enjoys being dazzled that the B.B.C. has begun experiments with spot lights!

The idea was carried into effect a fortnight ago and again during the variety turn at 2LO on Thursday last. It is said that the performer benefits from the atmosphere of the theatre which the spot light creates.

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That Theatre Atmosphere.

The B.B.C., I am told, intend to pursue the idea of manufacturing a theatre atmosphere by darkening the portion of the studio occupied by the skeleton audience.

This is all very well, but it seems to leave the ordinary listener in the cold. Steps should be taken to introduce the theatre atmosphere into the home.

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Appropriate Devices.

A beginning could be made by issuing a variety of ingenious contrivances to all listeners who care to apply for them. Among these would be the "Iron Heel," a weighty piece of apparatus which the listener would apply to his toes, five minutes after the opening of the play, to represent the advent of the late-comer. A hat squasher would also be desirable, while the height of realism would be provided by an electric fan sending a draught down the listener's neck. But, of course, if the B.B.C. really wished to develop the idea conscientiously, it could engage a fleet of express vans to deliver suitable refreshment for consumption during intervals.

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News from Sweden.

Interest in broadcasting is steadily increasing in Sweden. No fewer than 25,000 new listeners have taken out licences during the summer months, and the total in that country now amounts to round about 210,000.

Diabolo!

If you wish to pick a quarrel with Senor Calles, President of Mexico, just breathe into his ear the word "broadcasting." And then look out!

President Calles, I learn, is baffled and infuriated by the activities of a secret broadcasting station which transmits a daily denunciation of his political policy. So far all efforts to locate it have failed. Which is very annoying.

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Chamber Concerts and the Public.

Does the B.B.C. take a risk in admitting the general public to chamber concerts of the intimate kind provided last week by the Hungarian String Quartet at the Grotrian Hall? A friend who attended the concert tells me that the microphone was suspended only a few feet above the heads of the audience, and if it had occurred to any of these worthy people to speak an encouraging word to their listening acquaintances nothing could have prevented them from using the microphone for the purpose.

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An Interesting Comparison.

In view of the fact that I listened to the same concert *via* wireless, our experience afforded an interesting subject for comparison. In the hall itself annoyance was caused not only by chattering in the stalls, but by the strains from a pianoforte in an adjacent room which seriously intruded on the quartet's pianissimo passages. Neither form of disturbance was noticeable by wireless, which seems to suggest that the microphone is agreeably selective! From the listener's point of view the Grotrian Hall appears to be admirably suited to broadcasting, with just sufficient echo to give a pleasing resilience of tone.

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Oscillators, Please Note!

"A Quiet Evening" is the title of a play to be broadcast from Newcastle on October 18th.

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Programmes Criticised.

The latest tale of woe reaches me from a little boy who missed his bedtime story one day last week owing to the last minute postponement of the Children's Hour in favour of a speech by an eminent divine on a topic far beyond my little friend's comprehension.

No thinking person, of course, expects the B.B.C. programmes to give *universal* satisfaction, especially when we are still unprovided with regular alternative transmissions, but at the present moment there appear to be more than the usual number of complaints.

It is noticeable at the moment that unusual economy is being practised by the programme directors.

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A Question of Cash?

"It is entirely a question of money," I was told at Savoy Hill. "While the Post Office persists in limiting B.B.C. expenditure to £500,000 per annum, monetary considerations will always be an incubus where anything ambitious is concerned."

FUTURE FEATURES.

Sunday, October 17th.

LONDON.—The Cherniavsky Trio; Helen Henschel; Children's Service from Westminster Abbey.

BIRMINGHAM.—Ethel Fenton (contralto), Mary Abbott (solo pianoforte).

CARDIFF.—The Royal Welsh Gleemen, Herbert Tree (tenor).

Monday, October 18th.

LONDON.—Easthope Martin Programme; "The Piper," Lyric Drama in one act.

CARDIFF.—Recital of "My Favourite Songs" by Frank Titterton (tenor).

MANCHESTER.—A Token to Cambria.

NEWCASTLE.—"Nuit Napolitaine."

GLASGOW.—Scottish Towns Series—Glasgow Programme.

BELFAST.—Play: "The Doctor Calls."

Tuesday, October 19th.

LONDON.—Plunket Greene "Interpretation in Song," with illustrations.

BOURNEMOUTH. — British Programme.

CARDIFF.—The Bubbles Concert Party.

ABERDEEN.—Station Revue Company present "Bon Accord Nights."

Wednesday, October 20th.

LONDON.—"Grey Ash."

BIRMINGHAM.—Popular Music of Four Countries.

Thursday, October 21st.

LONDON.—Second B.B.C. National Concert, conductor Albert Coates. Frederic Lamond, solo pianoforte. Broadcast from H.M.S. "Victory," relayed from H.M. Dockyard, Portsmouth.

LIVERPOOL.—Civic Week, Sir Archibald Salvidge, "The Future Development and Possibilities of Liverpool."

Friday, October 22nd.

LONDON.—Recital of Sir Landon Ronald's Songs. Contemporary British Composers interpreted by Gordon Bryan.

BOURNEMOUTH.—Violin and Piano Recital—Margaret Holloway and Vera Wise.

CARDIFF.—The Kiss, by George Paston.

GLASGOW.—Liszt Anniversary Recital, Francisco Ticciatti, piano.

ABERDEEN.—Liszt Recital, Julien Rosetti, pianoforte.

Saturday, October 23rd.

LONDON.—"My Programme," by a Professional Footballer.

GLASGOW. — Humorous Sketch, "There and Back."

The Truth about "Highbrow" Programmes.

Incidentally, do many people realise that it is generally cheaper to engage a classical quartette for an evening of chamber music than a popular dance band? "Highbrow" programmes are not necessarily an indication that the programme directors are suffering from musical preciosity. They may mean something entirely different.

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An Old Favourite.

Gounod's "Faust" will be performed in the London studio on Friday, October 15th. Miss Mignon Nevada will be "Marguerite."

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A Gramophone Development.

How much the gramophone of to-day owes to the perfection of broadcasting was very clearly shown on Monday, October 4th, when I enjoyed the privilege of attending the first public demonstration of the "Panatrope," given at the Café de Paris by British Brunswick, Ltd.

The Panatrope is an ordinary gramophone—with a difference, viz., the mechanical vibrations imparted to the needle are translated into electrical impulses which are applied to a low-frequency valve amplifier; this, in turn, operates a Rice-Kellog loud-speaker. The net result of this arrangement is that practically every frequency originally recorded is reproduced with uncanny faithfulness, and when the record is one of the new electrically recorded type the effect is startling.

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Reproduction of Organ Pedal Notes.

The *pièce de resistance* of the demonstration was the reproduction of an organ solo as played by Mr. Herbert Dawson. Pedal notes, if they lacked the volume of the higher registers, were undoubtedly present to a degree never observable in an ordinary gramophone. Among the interested people who witnessed the demonstration I saw Captain Eckersley, who seemed considerably impressed.

Count Anthony de Bosdari, who conducted the demonstration, told me that the Panatrope is the outcome of experiments over a period of four years. It has occupied the attention of the Radio Corporation of America, the General Electric Co. of America, the Westinghouse Manufacturing Co., the British Thomson-Houston Co., and the Brunswick Balke Callinder Company.

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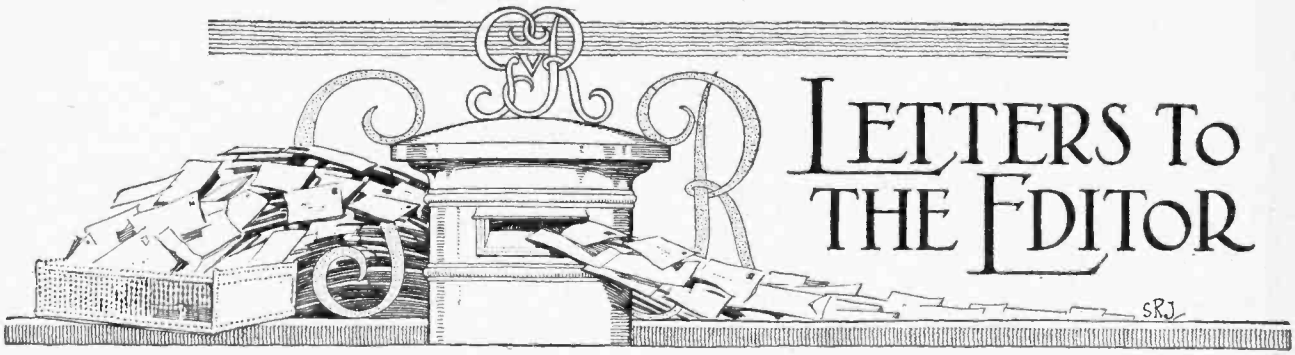
What the Channel Islands Think.

Which station is most popular with listeners in the Channel Islands? According to a recent plebiscite taken by an experimenter in Jersey, the following figures were obtained:—

33 per cent. listened to Bournemouth in preference to other stations;
17 per cent. listened to Daventry, while
50 per cent. listened to both Bournemouth and Daventry equally.

It would be interesting to compare these figures with other parts of the country.



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.

BROADCASTING AND GOVERNMENT CONTROL.

Sir,—I also am a Civil Servant, and, though not yet near the retiring age, I claim to know something about Government management as well as your correspondent signing himself "Behind the Scenes." It is well to let the public know that he does not voice the unanimous views of all Civil Servants in his exaggerated condemnation of alleged Civil Service "inefficiency."

It is well known that all organisations of any magnitude, whether Government departments, railway companies, or trading bodies under private enterprise, find a certain measure of uniformity of procedure is rendered necessary by their size and the ramifications of their undertakings. Organised propaganda has succeeded in persuading the public that this "red tape," as it is called, is confined to public departments, from which the inference is blandly drawn that private enterprise is in every way advantageous and is entirely free from abuses.

If "the regulations are constantly changing," it is in order to keep abreast of changing needs, and this argues the very flexibility which "Behind the Scenes" is so anxious to deny. As a member of a revenue department I know personally that this is the case, and I can only say that your correspondent is unfortunate in his departmental choice. His example of departmental rules is the vague and unconvincing kind so dear to the mind of those whose *bête noire* is the Civil Service. He does not state the reason for the prohibition of "lino" before a public counter, nor indeed any particulars needful for a critical examination of the case he cites. This is strange, as he would be required to set out his facts with the fullness and precision of a legal document if he made an allegation on any matter officially.

Speaking for my own department, I am proud of the efficiency of its *personnel* and the prestige it enjoys in general with the trading public. I do not feel a "Civil Service pawn," nor have I any difficulty in keeping abreast of instructions as well as doing my work. The assumption that responsible public officials who frame regulations are themselves incapable of bringing common sense to the task—an assumption which credits only the rank and file with any intelligence—is merely childish.

However, granted that the new control will be the commencement of an era of crass ineptitude and stupidity, is "Behind the Scenes" so illogical as to uphold the granting of a monopoly of broadcasting to a trading organisation? His opinions on Government control may command respect if he is prepared to follow them to their logical conclusion, and maintain that the ether should be free to all who wish to enter into commercial competition. On his own showing the preclusion of all competition ought by now to have reduced the B.B.C. to the very state of bureaucratic fatuity which he deplores in Government departments proper. ALSO BEHIND THE SCENES.

October 3rd, 1926.

AMERICAN RECEPTION.

Sir,—With reference to the letter of Mr. G. Goodwin in the October 6th issue of *The Wireless World* regarding American broadcast reception, I think it is very good for the 300 to 500 metres band. On October 1st, when I was listening in for some French amateurs on 40 metres, I heard a faint carrier wave on 32 metres. After I had got the station tuned in I found it was U 2XAF. The time was 10 p.m. B.S.T. (4 p.m. American time). I had him for an hour. He then said 2XAF was signing off, and would be working again on 32.79 metres on Monday, Tuesday, and Friday next, at 4 p.m. This is the first time that I have picked up American broadcasting when there has been daylight on one side of the Atlantic. I was using a two-valve receiver (0-v-1) at the time.

Windsor. ARTHUR S. WATFORD (2BVK).

Oct. 6th, 1926.

THE POLICY OF THE B.B.C.

Sir,—May I be permitted space in your columns to pass a few comments on points raised in the letter from Mr. G. Cheers Chaloner in your issue of September 29th?

SELECTIVE APPARATUS.—The existence of a paper such as *World Radio* testifies to the widespread interest in the reception of foreign stations, which naturally presupposes the widespread use of selective apparatus. The insistent demand for selectivity is also reflected in the constructional articles which appear in the leading wireless journals. The public is, therefore, fully prepared in the matter of selectivity for the changes which the B.B.C. propose.

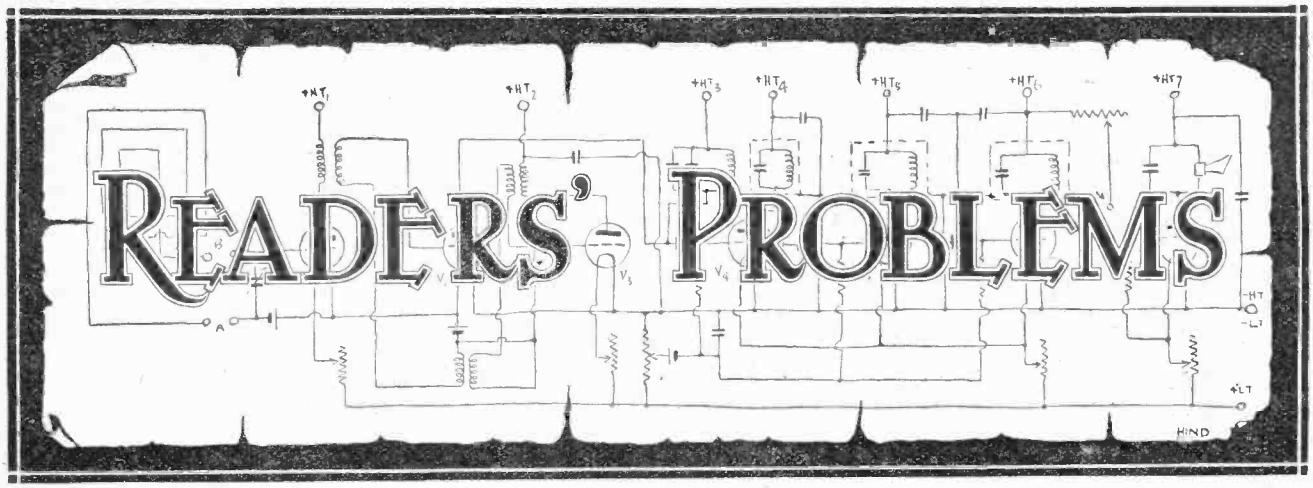
CRYSTAL RECEIVERS.—The cost of valve receiving apparatus is now within the reach of crystal users, who paid £4 10s. for a crystal set in the early days of broadcasting—when the B.B.C.'s "crystal" policy was first enunciated.

Are all crystal users living in a state of security and contentment? Most of them, I think, would gladly make the necessary change for the sake of the improved service they would receive, but obviously there is no object in making any change until there is actually an alternative programme to receive. When the time comes to scrap crystal receivers the loss will be infinitesimal, and will not involve "vast sums" if we are to believe Mr. Chaloner's statement in his second paragraph that "a very large proportion are constructed from the most crude apparatus."

DAVENTRY.—If your correspondent feels oppressed by the curses heaped by manufacturers on this station, he will find refreshing relief in a tour through Devon and Cornwall, or through Norfolk, where thousands of listeners blessed the advent of the long-wave station. This point turns out in favour of the B.B.C.; here they have evidently put the interest of the listener before commercial considerations.

INTERFERENCE.—It is too much to expect the B.B.C.—an entertainment organisation—to attempt to influence the network of marine communications which has been established on an international basis before broadcasting was thought of; and if it were to attempt this it would naturally have to apply to the appropriate authority, namely, the Postmaster General. This can hardly be described as sheltering behind the Post Office.

Oct. 6th, 1926. PER CRYSTAL AD VALVE.



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 Knotty Problem.

I recently constructed an L.F. amplifier consisting of one resistance coupled stage and one transformer coupled stage. Since I used a detector valve with a high amplification factor and an impedance of about 100,000 ohms, I made my anode resistance about five times this value in accordance with the instructions given in your article "Coupling L.F. valves" in your May 26th issue. My coupling condenser and leak had values of 0.1 mfd. and 0.5 megohm respectively. To my great surprise I got little or no increase in amplification over that obtained with a valve of half the amplification factor. On the advice of a friend, I raised the value of the grid leak. This had the effect of increasing volume very greatly, but distortion was very bad. Can you explain where I have gone wrong?
P. T. C.

It was perfectly correct to make the anode resistance five times the value of the valve impedance, and if this is not done and the value remains at the usual value of 100,000 ohms or so, there will be no increase in amplification whatever when using a valve of high amplification factor. Now your grid leak must be considered as being virtually in parallel with your anode resistance, and it is obvious, therefore, that this component must be kept at a much higher value than the anode resistance in order that it may have a minimum effect in the matter of reducing the effective resistance of the anode resistance. With an anode resistance of 100,000 ohms a grid leak value of 0.5 megohm is ample, but if the anode resistance is raised to 500,000 ohms it is necessary that the grid leak be raised to 2 or 3 megohms in value. This will give the required volume, but distortion will be caused owing to the fact that the large 0.1 mfd. coupling condenser will become charged up owing to the high value of the leak. It is necessary, therefore, to considerably lower the value of this condenser. Provided that such lowering is not carried too far, no loss of the lower musical frequencies will occur. This is fully gone into in two special articles published on page 395 and page 857 of our issues dated September 23rd, 1925, and December 16th, 1925, respectively.

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An Apparent Error.

In the article on the "Everyman's Four-Valve Receiver" it is specified that the detector valve be a "Cosmos S.P.18 Green Spot," which consumes 0.3 amp. at 1.6 volts. A six-volt accumulator is used, and it is specified that two fixed resistors of 7.5 ohms and 15 ohms be used in series. This gives a total of 22½ ohms in series with the valve, which is apparently an error, as it fails to agree with the formula recently given by you in reply to another reader for calculating the value of fixed resistors.
D. H. K.

The formula necessary for finding the correct value of resistance to interpose between valve and accumulator in order to regulate the filament current to the value specified by the valve maker is a perfectly straightforward one. It is $R = \frac{E}{C}$ where R = the required resistance in ohms, E the difference between the accumulator voltage and the specified valve voltage, and C the specified valve current. In the case of an S.P.18 Green Spot valve, therefore, which consumes 0.3 amp. at 1.8 volts, the value of R equals $\frac{4.2}{0.3}$, which equals 14 ohms. It would appear then that the values specified are excessive. It can be shown by Ohm's Law that with this high resistance in circuit the current flowing through the valve will be considerably below 0.3 amp. The result of this, of course, will be that the emission from the valve filament will be very low. Now a moment's consideration will reveal that it is quite in order for the emission to be low. It is obvious that since the anode resistance is 500,000 ohms and the H.T. voltage is not raised proportionately, then the normal plate current can only be a few microamperes and not a matter of milliamperes, as in the case of more customary arrangements, using a choke or low resistance in the plate circuit. This is, of course, purely a question of Ohm's Law. Since the plate current will be so small it is obvious that we require only a small electron emission from the valve filament. One great advantage of running the filament dimly in this manner is the enormous increase which will be obtained in the life of the valve.

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Loud-speaker Impedance.

I have recently purchased a loud-speaker, and upon examination I find that the magnets are wound to a resistance of 750 ohms. Must I employ a step-down transformer?
D. B. R.

If the loud-speaker is to be used after a modern type of power valve there is no need to interpose any transformer, but the loud-speaker may be connected directly in the plate circuit of the output valve. If the loud-speaker is of this comparatively low resistance the gauge of wire with which it is wound will be heavier than usual, and this will be of great advantage in eliminating the possibility of breakdown under the influence of the comparatively heavy plate current of the power valve. If the loud-speaker is to be used after a valve of comparatively high impedance, a step-down transformer will be necessary, but a special type will have to be purchased since the ordinary type is designed mainly for 120-ohm windings. Of course, even in the case of a low impedance output valve, a 1 to 1 ratio output transformer may be used if it is desired to keep the steady plate current out of the loud-speaker windings altogether. Alternatively, of course, a choke filter circuit may be employed.

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The Wireless World AND RADIO REVIEW

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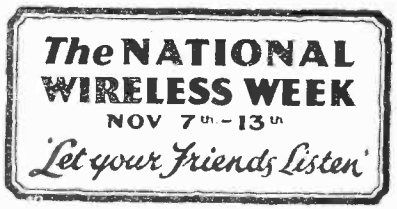
"LET YOUR FRIENDS LISTEN."

WHEN we consider for a moment what is the nature of broadcasting, we realise that more, perhaps, than any other public service it should be unrestricted in its distribution. Broadcasting will never have achieved its ultimate goal until every unit of the population is in a position to receive broadcasting, and not only receive it but to do so with a degree of perfection which leaves little distinction between the sounds broadcasted and those received, whether in the nature of speech or music.

It should be the aim of everyone of us to assist in bringing about the state of affairs where wireless is installed satisfactorily in every home. It is with the object of furthering this aim that the idea of a National Wireless Week has been put forward, and is receiving the support of the B.B.C. as well as every section of the wireless industry and the public concerned in the extension of broadcasting in this country.

National Wireless Week will take effect from November 7th to 13th inclusive, and during that period the Broadcasting Company will provide something very special in the way of programmes calculated to enhance the ever-growing popularity of listening-in. National Wireless Week is not promoted by any paper or concern for the purpose of self-publicity. It is a combined campaign where every firm or interest participating will do its best to stimulate public interest in broadcasting during that week.

Now, we want to explain what is expected of our readers during this period. If you are interested in the objects of National Wireless Week, and feel that it is worth while to devote a little time and trouble to encouraging your friends to recognise the interest and value attaching to broadcasting, then what we ask you to do is to "let your friends listen" during National Wireless Week to your own set. Choose from amongst your friends those who have not yet got broadcasting at home, and give them the opportunity of appreciating for themselves the enjoyment and interest to be derived from good reception. We feel particularly confident in the ability of our readers to produce encouraging results from their activities during Wireless Week because we can count on them to let their friends hear what good reception is like, and we have no fear that the new recruits will be entertained to anything which does not do justice to what may be regarded as the modern standard of quality in broadcast reception. As far as we can judge, there will not be much opportunity for the public to forget about National Wireless Week because on every hand they will be reminded of it. Frequent announcements on the subject will be made by the B.B.C., whilst the manufacturers are arranging to refer to it by devoting a corner of their advertising spaces for the inclusion of a panel of which we reproduce a facsimile at the side of this column.



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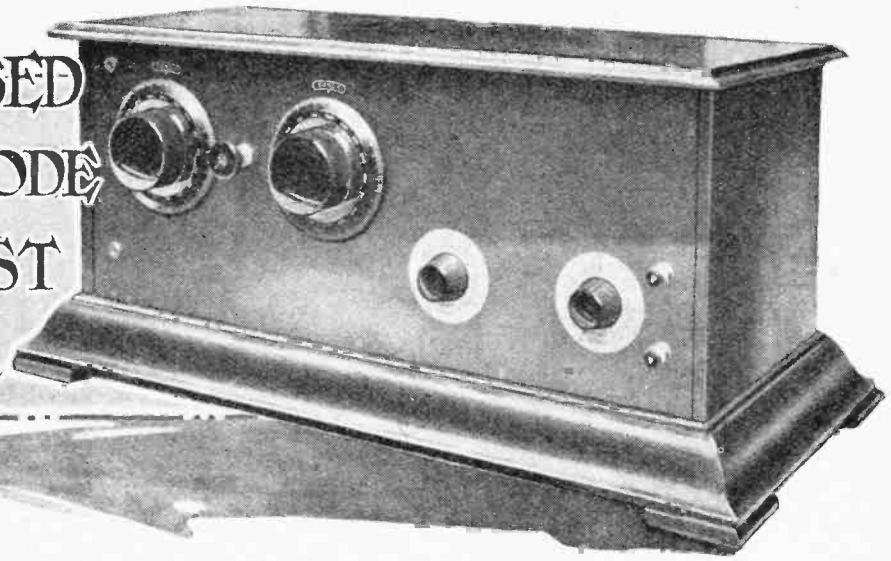
Neutralised Tuned-Anode Broadcast Receiver



By N. P. VINCER-MINTER.

An All-wavelength Long-range Receiver.

IF an edict went forth throughout the land that users of all forms of H.F. amplification (reaction excepted) were to be taxed, and the Chancellor of the Exchequer were to set out in person to collect the tax, he would probably find that at the end of his labours he had not collected enough to pay his 'bus fare back home, not through any reluctance on the part of the average wireless user to part with good money (for, indeed, the maintained high price of valves and wireless apparatus generally bears eloquent testimony to the ease with which wireless devotees are separated from their money), nor yet because the great majority of listeners prefer to stick to the local station or have a predilection for getting results on distant stations by reaction alone, for the large number of valves which would be found performing neither the functions of detector nor an L.F. amplifier would be silent witnesses to the contrary. Perhaps the gentlest method in which to reveal the horrible truth is to state that were the tax to be imposed on users of H.F. stages as distinct from uses of H.F. amplification, then the exchequer would benefit exceedingly.

The truth is, of course, that the average H.F. stage, whether on a high-priced commercial set or home-built "Whoopadyne," is of very little use—that is, as an H.F. amplifier, although as a provider of automatic reaction effects it has its uses. Several months ago the writer was employed in the task of designing a fool-proof receiver intended to give loud-speaker results from the Daventry station, and one or two of the nearer stations on the normal broadcasting band of wavelengths. He at first considered the inclusion of some form of variable reaction control, but decided that this was too difficult, as the set was intended for elderly people who were completely non-technical. It was eventually decided to incorporate in the receiver an arrangement which would give a satisfactory and unvarying degree of "automatic" reaction on the whole wavelength range over which the receiver was designed to tune. After many experiments it was found that a stage of tuned anode coupled H.F. "amplification" was the best way of doing this, and excellent results were obtained on several quite distant stations, albeit the actual H.F. amplification obtained was very small, except perhaps on the Daventry wavelength, although even then it was not great, most of the amplification being due to "automatic" regeneration. This is a point which most users of inefficient stages of H.F. amplification fail to realise. They normally attempt to prove the efficiency of their H.F. stages by stating that using their receiver as a detector (without reaction) and L.F. only, 2LO only can be received, whilst the addition of their H.F. stage at once brings in 3LO. Quite so, there are, of course, ways of applying the principle of regeneration other than by using a swinging coil or a throttle condenser.

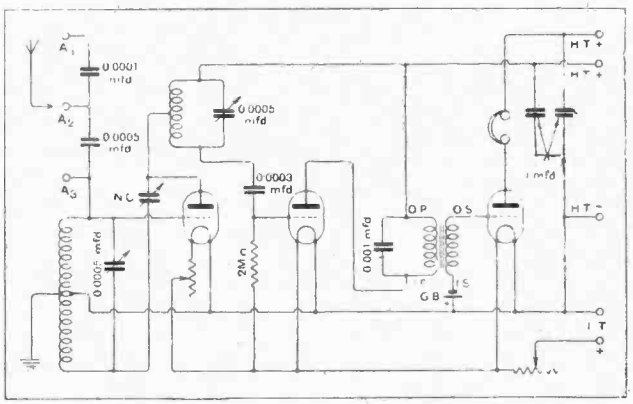
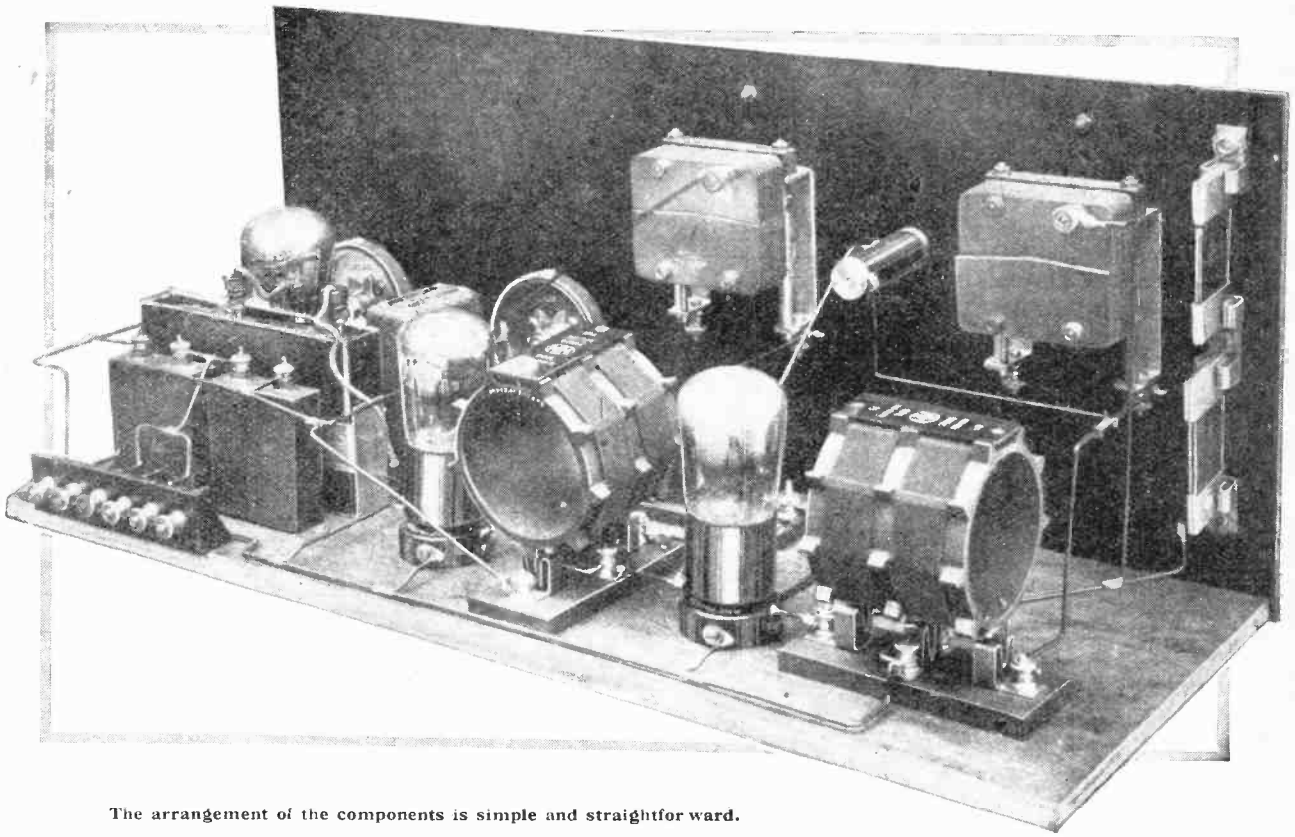


Fig. 1.—The theoretical circuit

Now, it may have been noticed that in all the receivers which he has described in the pages of this journal, the writer has deliberately kept off the use of H.F. amplification, and has mainly described re-

Neutralised Tuned Anode Broadcast Receiver.

ceivers which made use of regeneration naked and unashamed rather than decently concealed in the guise of valve and tuned anode. Now, however, he is about to describe a receiver using a stage of H.F. amplification and also a little regeneration. The H.F. stage, however, is intended to provide real genuine H.F. amplification, the regeneration control being mainly for the improvement of selectivity, although the writer is quite unabashed at admitting that without its aid many stations now receivable would not appear in the receiver's repertoire. The reason why the writer has decided to describe it is because not only is he convinced that the receiver is quite a good one, but also because he feels that the receiver will have a very strong appeal to a by no means small section of readers, namely, that section which desires one or two stations on the loud-speaker, and a very large number on telephones with a minimum of trouble.



The arrangement of the components is simple and straightforward.

Systems of H.F. Amplification.

Before proceeding, however, with the description of the receiver, it would not be out of place to run briefly over the different methods of H.F. amplification which have been attempted from time to time. Ignoring reaction proper, which is, after all, only a form of H.F. amplification, probably the most fundamental circuit for H.F. amplification is the resistance amplifier. Here we have a high anode resistance in the plate circuit of the valve, and, provided we make the resistance from five to ten times the valve impedance, we can obtain about 90 per cent. of the valve amplification factor, as was pointed out by the writer in a theoretical article on this matter in the May 26th issue of this journal. We can never obtain the full amplification factor of the valve unless we make the external resistance infinitely high, but still, 90 per cent. will give us very good results if we can get it. Unfortunately, however, the valve electrodes and the associated wiring of the valve have a certain capacity which must be considered purely and simply as a condenser shunted in parallel with the resistance.

Now, at frequencies round about one million per second corresponding to the broadcasting wavelengths, even a small condenser has not a very high impedance, and so we can therefore consider the resistance and condenser as being merely two resistances in parallel. Now, we know that when two resistances are in parallel the resultant resistance is lower than that of either constituent resistance, and the effect is the same, therefore, as if we had lowered the value of the anode resistance, thereby sacrificing a great deal of our amplification. A study of the curve published on page 702 of the May 26th issue of this journal will render this point clearer. Of course, on long wavelengths (*i.e.*, low frequencies) the impedance of this shunting condenser represented by the valve capacity is much greater, since the impedance of a condenser increases as the frequency decreases. We should expect, therefore, that an increased efficiency would be obtained on long wavelengths, which is, of course, exactly what does happen, and on lower frequencies still the impedance of the valve capacities is so high that the external resistance value is not lowered

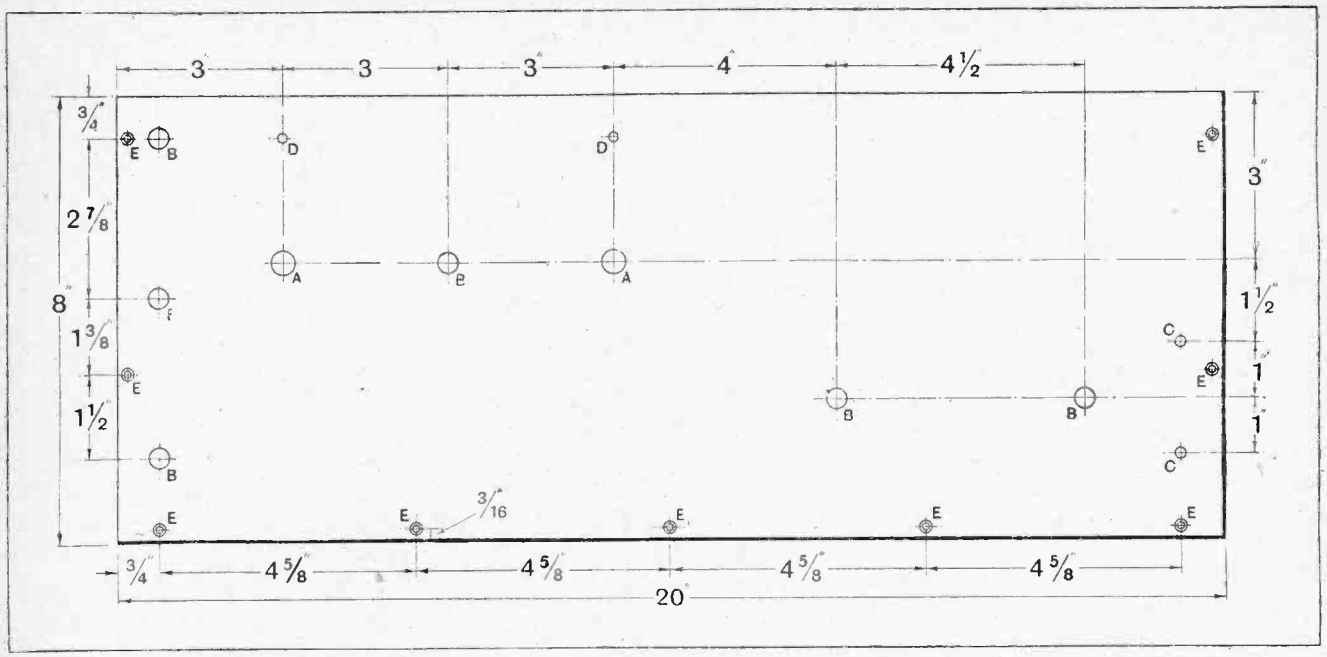


Fig. 2.—Dimensional details of the front panel. Drilling sizes are as follow: A, 7/16in. dia.; B, 3/8in. dia.; C, 3/16in. dia.; D, 5/32in. dia.; E, 1/8in. dia.; and countersunk for No. 4 wood screws.

at all, and consequently resistance coupling for low-frequency amplification is perfectly efficient.

Various attempts have been made from time to time to improve resistance amplification by employing low-capacity valves of the test tube type. In Germany special "valves" have now been produced in which the whole H.F. amplifier, *i.e.*, valve, anode resistances, coupling condensers, etc., are all mounted in the glass envelope of the "valve," thus eliminating long connecting wires and reducing stray capacity effects to the minimum. Very promising results have been obtained in this manner even down to 70 metres, but such "valves" are not yet generally available in this country, although they are on sale to the public in Germany.

The next logical development is the choke-coupled H.F. amplifier. Now, a moment's thought will make it clear that, if capacity effects are ignored, the *resistance* amplifier should be equally efficient on all wavelengths, since a pure, non-inductive resistance offers an equal impedance to all frequencies. The impedance due to an

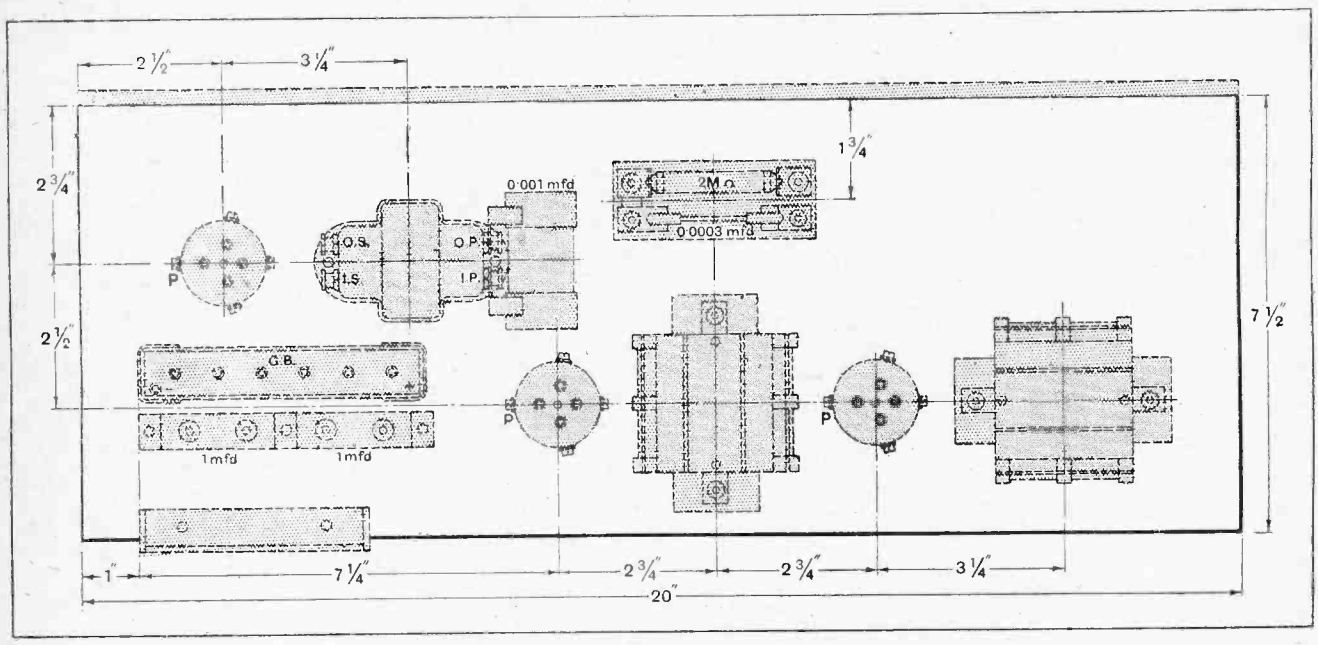
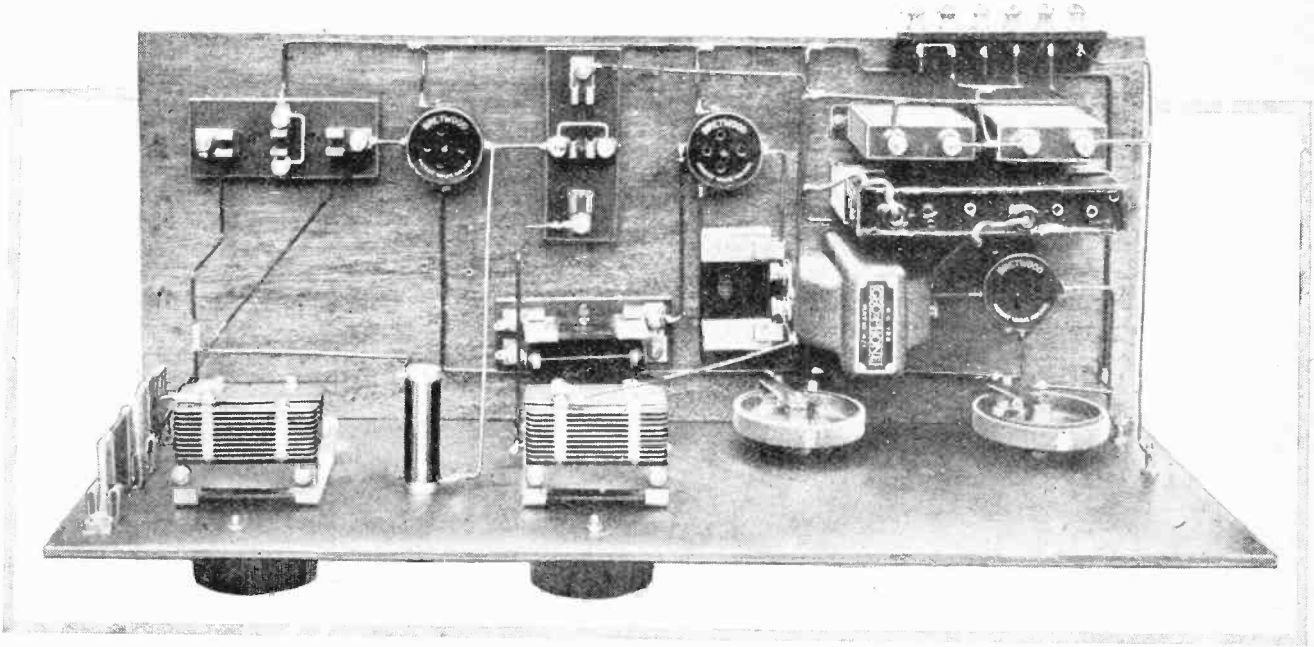


Fig. 3.—Details of the baseboard layout.

inductance, however, increases as the frequency increases, and we should expect, therefore, that the choke-coupled amplifier would be more efficient on short wavelengths than on long wavelengths, and so, indeed, it would be were it not for the effect of valve capacity, which exerts exactly the same effect as in the case of a resistance amplifier, so that actually the choke amplifier is more efficient on longer wavelengths than on shorter wavelengths up to a certain point, where efficiency again drops off owing to the inductance not being sufficient. This can be remedied by making the choke inductance higher by adding more turns of wire, but this, unfortunately, increases the self-capacity of the choke, and so efficiency on the shorter wavelengths becomes still less. It will be realised from the above that a choke is at a greater disadvantage than a resistance, because not only has it to contend with valve capacity, but also the added effect of the self-capacity of its own windings, which in a resistance (except in some poor specimens of the wire-wound type) is absent.



Plan view giving general idea of layout and wiring.

Tuned Anode Coupling.

Now, in a choke amplifier we depend on what may be called the impedance effect of a high inductance to A.C. currents to give us our results, and we have no use whatever for capacity, but essay to make the choke have as large an inductance as possible without appreciable capacity (by using a large number of turns of wire suitably wound). In the tuned choke system, or tuned anode system, as it is more commonly called, we do not depend for our impedance on a pure inductance effect, but depend upon a resonance effect, and we use a choke or anode coil of comparatively few turns and, therefore, of low inductance), and tune it to resonance by means of a parallel variable condenser. Now, since we already have a large capacity in shunt with our coil, it is obvious that stray capacities across the anode coil will not matter much, but will merely have the effect of slightly decreasing the setting of the variable condenser for a given wavelength over that which would be obtained without the self-capacity effect. Yet we all know how flat is the tuning and how poor is the amplification given by a tuned anode. What, then, is the cause of this? The trouble this time is the lowness of the valve impedance, which we can regard as being merely a resistance shunted across the anode coil. Now, the whole tuned anode circuit offers a very high impedance to the frequency to which it is tuned, and for the sake of illustration we may consider the tuned anode as being merely a very high resistance of several megohms value, except that it acts as a high resistance to one frequency or a narrow band of frequencies only, the impedance offered to other frequencies being, of course, only a few ohms. Since, therefore, our external resistance is so very much higher than the internal valve impedance, it is obvious that we ought to obtain almost the full amplification factor of the valve coupled with excellent selectivity, since the value of the external resistance should be very small for frequencies other than the narrow band to which it is tuned.

Effect of Valve Resistance.

Unfortunately, however, it will readily be appreciated that our high resistance of many megohms is of very little use to us, since in the case of a general-purpose valve we have virtually a 30,000 ohms resistance shunted across. It is well known that we often shunt a resistance across the secondary of a poor intervalve transformer in order to flatten out the peaks and get more or less even amplification at all frequencies. It is well known, also, how great is the loss of overall amplification which occurs

when such a resistance is used. This loss of amplification and flattening of the resonance peak (*i.e.*, flattening of tuning) is exactly what occurs in a tuned anode circuit. It is obvious, therefore, that if we are going to improve things we must either remove this resistance altogether or raise it to a very high value. We cannot remove it without removing the valve, but we can raise it a little by using a valve of higher impedance. Even the highest impedance valve we can get, however, has a very small impedance when compared to that of the tuned anode circuit. There are valves appearing on the market to-day with an impedance of 100,000 ohms or so, and we certainly can do better with them than with a 30,000 ohms general purpose valve, but still it is not good enough. What we want, therefore, is first of all a valve with as high an amplification factor as possible, but it is, of course, of little use having a valve with a high amplification factor if it has a low impedance, and so, therefore, we must also have a valve with as high an impedance as possible. A valve with an impedance of 1 megohm and an amplification factor of 100 would suit us admirably if we could get it, but at present no such valve is available, which is unfortunate, since the simplicity of the tuned anode with its great flexibility from the point of view of an all-wavelength receiver using plug-in coils has an undoubted appeal. At the moment, however, the ordinary tuned anode is almost useless, although the writer looks forward confidently to the day when the valve manufacturers will wake up to the possibilities of this simple and straightforward arrangement and give us suitable valves. The futility of attempting to use a low

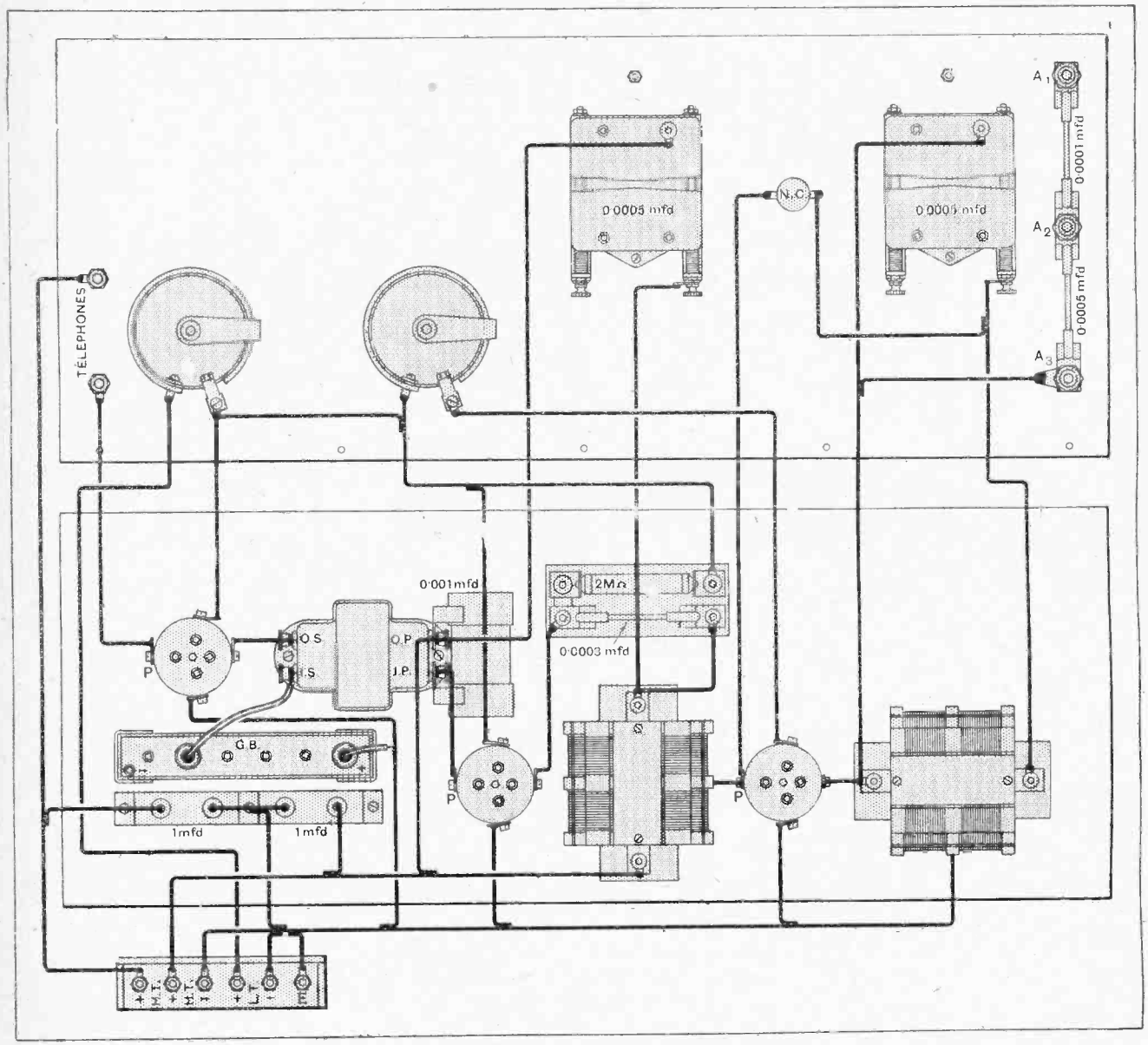
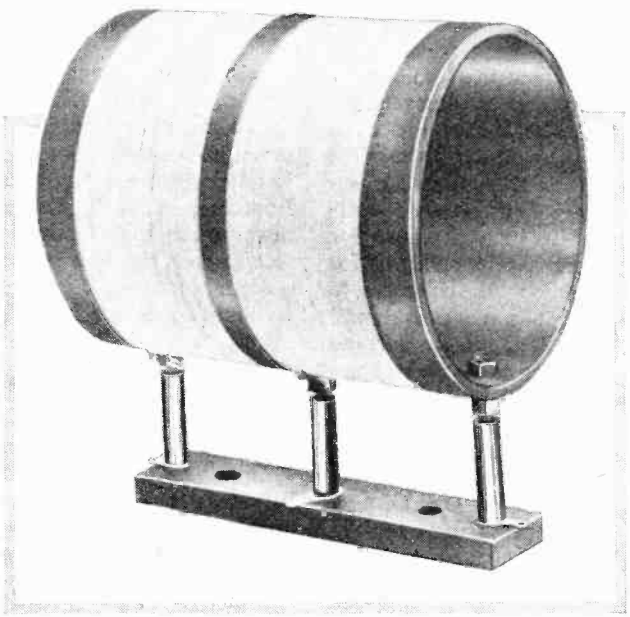


Fig. 4.—The practical wiring diagram.

impedance power valve in conjunction with the tuned anode system need not be stressed.

Before leaving the question of tuned anodes, two points require noting. The first is that in every choke coupled amplifier there is a certain frequency to which the choke shunted by its self-capacity and the self-capacity of the valve is resonant, and when it resonates, of course, it acts purely and simply as a tuned anode on the particular frequency to which it resonates. Many commercial H.F. chokes on the market resonate somewhere in the neighbourhood of the frequency corresponding to the Daventry wavelength, and quite reasonable amplification may be obtained on that station. The second point which requires noting is that the ordinary type of plug-in H.F. transformer with tightly coupled primary and secondary, one of which is tuned, acts purely and simply as a tuned anode.



Home constructed coils of this type can be used if desired.

Transformer Coupling.

It is, in fact, the tuned anode in disguise, the capacity coupling between the two windings being so strong that no true transformer action is obtained at all, irrespective of whether or not an attempt is made to provide a step up in voltage by means of putting more turns on the secondary than the primary.

Being thus baulked of getting much H.F. amplification or selectivity from the tuned anode, we must adopt various subterfuges to overcome the evil effects which we have discussed. Undoubtedly the best method is to wind a special H.F. transformer having a ratio between primary and secondary and having a minimum capacity coupling between primary and secondary. In this manner we can get a true transformer action to take place, and a real step up in voltage takes place between primary and secondary, and, moreover, we can get selectivity. A modern receiver employing such a system in which an actual H.F. amplification of about forty times can be obtained (as compared to the two or three times given by the average tuned anode) was described in last week's issue of this journal. Unfortunately, however, the H.F. transformers owing to the nature of their construction do not readily lend themselves to interchangeability, and even if a method were devised of overcoming this by a suitable plug and socket arrangement, the baneful capacity effects thus introduced between primary and secondary windings would probably set at nought all our efforts in designing a good transformer. We are thus rather limited in the application of the H.F. valve to more than one band of wavelengths. Having these things in mind, the writer considered it to be not unduly amiss to return to the tuned anode and see whether something could not be done to improve it and obtain reasonably good results without waiting for the valve manufacturer to better himself. The outcome of the writer's cogitations is the present receiver, which has more than fulfilled expectations. We will now proceed to examine it in detail.

Referring to Fig. 1, it will be seen that we at once throw away half the voltage set up across the tuned circuit by the incoming signal, since the grid-filament path of the valve is shunted across only half the tuned circuit, and therefore only half the voltage is applied to the valve. This looks like a bad start, but, fortunately, we get it all back in the anode circuit by connecting the plate-filament path of the valve (i.e., anode and H.T. +) across one half of the tuned circuit. The result is that the anode circuit gives us a step-up ratio of 2 to 1 as in a transformer, the top half of the coil acting as the primary and the whole coil acting as the secondary of an auto-transformer. We thus get back in the plate that which we lost in the grid circuit. But surely we are no better off than when we started. What have we gained by this circuit juggling? Just this; we have, as it were, taken the low resistance due to the low valve impedance which in the normal tuned anode circuit is shunted across the choke coil and applied it to only half the coil, thus enormously reducing its effect. In addition, of course, we are going to be sensible and use a high impedance valve for the H.F. stage. Thus both the H.F. amplification and the selectivity obtained is greatly enhanced.

Designing for Selectivity.

We are also out to get a little selectivity in the grid circuit, and so shall not make use of the brutal method of shunting the aerial and earth system across the whole of the tuned grid coil, and therefore the circuit will have to be neutralised to prevent perpetual oscillation. This is easily arranged for, and by mounting the neutralising condenser on the panel we can use it judiciously to provide us with a certain amount of regeneration, not so much for improving range, which is excellent without it, as for the purpose of improving selectivity. On the normal broadcasting wavelength the aerial should be connected to A_1, A_2 being used only for Daventry and similar long-wave stations, whilst A_3 should only be used with a short indoor aerial. The detector and L.F. portion of the receiver are perfectly conventional and need no elaboration. It will be noticed that the same system of volume control is used as in the case of "Everyman's

LIST OF COMPONENTS.

1 Ebonite panel, 20in. × 8in. × ¼in.
1 Baseboard, 20in. × 7½in. × ¾in.
1 Cabinet to match (Eunice).
2 S.L.F. Vernier condensers with verniers (Ripaults).
1 Neutralising condenser (McMichael).
2 "Dimic" coil holders (McMichael).
1 0·0001 mfd. fixed condenser, with clips (McMichael).
1 0·0005 mfd. fixed condenser, with clips (McMichael).
1 0·001 mfd. fixed condenser, with clips (McMichael).
1 Grid condenser and leak (McMichael).
1 4-to-1 ratio L.F. transformer (G.E.C.).
3 Valve holders (Bretwood).
1 Rheostat, 60 ohms (Burndept.)
1 Rheostat, 2 ohms (Burndept.)
2 1 mfd. condensers (T.C.C.).
1 2-volt grid battery (Hellesens).
1 Terminal strip (Edison Bell).
1 Pair telephone terminals (Belling Lee).
3 Plugs and sockets for aerial (Lamplugh).

Approximate cost - £7 0 0 (without coils).

Four-valve Receiver," recently described in this journal.

Probably the only point on which the set builder requires information is the two tuning coils. Either the commercial coils shown in the photographs of the set may be used, or home-made coils may be constructed in accordance with the photograph on page 539. If "Dimic" coils are used No. 1 coil should be used in both positions for the normal broadcasting wavelengths, No. 3 sufficing for Daventry and Radio Paris. If home-made coils are to be used the general design shown on page 539 should be used. Valve pins and sockets are used for the purpose of interchangeability. Do not forget to leave a gap between the two halves of the winding for the purpose of allowing space for the fitting of the centre contact valve pin. An ebonite or Paxolin former should be used, 3 inches in diameter and 3½ inches in length. For the normal wavelength band 60 turns of No. 24 D.S.C. may be used, 250 turns of No. 36 S.S.C. being used for the Daventry and Paris wavelength, a centre tapping being made in each case.

With regard to results, let it be said at once that the H.F. amplification obtained is not the same as that given by a receiver of the "Everyman's Four" type, but provided we use a high impedance valve it is very good indeed, far better than in any ordinary tuned anode set, and a number of stations can be easily tuned in without resort to the reaction control. The selectivity in the London suburbs is not, of course, sufficient to enable Bournemouth to be tuned in free of London without resorting to the reaction control. Actually, the writer recommends that the set be first neutralised in the normal manner and then slightly unbalanced in order to obtain a slight regenerative effect on all stations. The neutralising condenser need not then be touched again unless it is desired to receive a station within a few metres of the local station wavelength. By skilful juggling with the reaction control it is possible to go very close indeed to the wavelength of the local station.

With regard to valves, the writer has so far obtained best results with a D.E.5B in the H.F. and detector positions, and a D.E.5 output valve. In the two-volt class best results have been obtained using a Mullard P.M.1HF, P.M.1LF, and P.M.2 in the order named, and in the Cossor range with a "Point One," Red Band in the H.F. stage, a "Point One," Black Band as detector, and a "Stentor Two" for the power valve.

Calls Heard.

Extracts from Readers' Logs.

Rome.

Great Britain.—G 2OG, 2NT, 2NJ, 2BA, 2BZ, 2IT, 2JJ, 2OJ, 2VQ, 2VX, 2KT, 2CC, 2LZ, 5UW, 5HU, 5PM, 5SK, 5SZ, 5SD, 5WV, 5WT, 5QI, 5MA, 5KZ, 5IO, 5MB, 6IZ, 6KK, 6KO, 6MU, 6RD, 6RM, 6TY, 6TX, 6LR, 6QK, 6QW, 6PU, 6YK, 6YU, 6YV, 6VD, 6VP, 6ZA, 6ZC, 6UZ.

(O-v-2 Reinartz). Alfonso Marullo. (I 1CU.).

London, W.1.

(September, 1926.)

U.S.A.: U 1AAE, 1BHS, 1BJK, 1CCZ, 1CIB, 1CKP, 1DI, 1KK, 1RD, 1UW, 1WL, 1ZS, 1ZT, 2AMJ, 2APV, 2BL, 2BUY, 2CXL, 2CYQ, 2MD, 2WC, 3AY, 4DD, 4FT, 8ADG, 8AJ, 8ALY, 8AVD. Canada: C 1AR. Brazil: BZ 1AC, 1AD, 1AM, 1AO, 1AP, 1AR, 1BI, 2AB, 2AG, 2AO. Argentine: R AC5, AFI. Miscellaneous: NTT, OCRB, PTQ, VOQ.

M. W. Pilpel (G 2BZC).

Hammersmith, W.6.

(August 23rd to September 23rd.)

Australia: A 2LD, 5KN, 3BQ, 3BD, 3KB, 3LS, 7DH, 7CW, 7AA. New Zealand: Z 4AC, 4AS, 3AF, 3AM, 3AI, 3AA, 2BG, 2XA, 4AA. Argentine: R FH4, FH6, FA3, DH9, DM9. Uruguay: Y 2AK, 1CD. Brazil: BZ 1AF, 1AO, 1AR, 2AM, 2AF, 6IA, 6QR, SNI, PT4, PT5. Chile: CH 2LD, 3IJ, 2AR. Mexico: M 1N, 1K, 1AX, 1AY. U.S.A.: U 2APV, 2UK, 3CWP, 3ACB, 4RM, 4QK, 6OI, 6CTO. S. Africa: O A6N, A6L, A3Z. Morocco: OCRB, FM 8MA, 8MB, 1CW, 1TA. Java: ANJ, ANF, PKX. China: BXY, HVA. Egypt: SUC: Arabia: TJ CRJ. Austria: O AA, AB, AM. Yugo-Slavia: YS 7KK, 7XX. Various: SGT, SGC, LP1, AGC, CBF2, WGY, WNP, WVE, WVR, NKF, NITZ NTT (U.S.S. "Scorpion" at Constantinople), VOG, Q 8KP, RCRL, 7JO, A 7DE (?), VKP, PTR, A5X, BZH, SAB, GX 6MU, 3XP, NIDK, HIK, BN SK2. (O-v-1 Reinartz.) On 28 to 48 metres. H. E. Whatley.

London, S.W.11.

(August 14th to September 13th.)

U.S.A.:—U 1AAO, 1ADW, 1AEP, 1AJP, 1AVL, 1BHS, 1BOX, 1BQT, 1CH, 1CJC, 1CLV, 1CMX, 1DM, 1DU, 1FA, 1LC, 1LN, 1MY, 1QB, 1SZG, 1UW, 1ZK, 2AMD, 2ARM, 2ATE, 2AVD, 2BGZ, 2CRB, 2EF, 2GK, 2GY, 2H, 2MU, 2XAD, 2XAF, 2ZV, 2ZW, 3AFW, 3AJT, 3BCE, 3BZ, 3IZ, 3KF, 3PY, 3UV, 3WF, 3ZO, 4AM, 4IQ, 4PK, 4RM, 4NH, 8AVQ, 8BUY, 8KF, 8LP, 8PK, 9DNG, 9LN, WIZ. Belgium:—B B1, M8, O8, U3, Y8, K44, V33, 4AA, 4ZZ. Italy:—I 1AP, 1AU, 1BA, 1BE, 1CW, 1GW. Sweden:—SMUK, SMVI, SMXR, SMYC, SMZN, SGT. Holland:—N PB2, PB3, PCG, PCPP, PCRR, O LY, O PM, O TH. Germany:—K I2, K8, LO, P6, 4B, 4SM. Spain:—EAR4, EAR20, EAR26, EAR31. Finland:—S 2ND, 2NL, 2NM. Denmark:—D 7XF, 7XU, 7ZG. Brazil:—BZ 1AB, 1AC, 1AF, 1AI, 1AK, 1AW, 1BD, 1BI, 1AM, 1CA, 1QA. New Zealand:—Z 1AI, 3AO. Miscellaneous:—LA 1E, H 9XD, M 1N, O GP, HL, T PAV, R 1NN, R 1UA, Y 2AK, OCX, GLKY, VIM, VOQ, FM 8ST.

(O-v-1, Reinartz) 25-50 metres.

H. W. Rutledge.

HINTS and TIPS for NEW READERS

A Section Devoted to the Practical Assistance of the Beginner.

IMPROVING LOUD-SPEAKER REPRODUCTION.

Nowadays there is a distinct tendency to use "last stage" or output valves of greater power handling capacity than hitherto, in order to avoid the introduction of distortion due to overloading. Some amateurs effect a similar improvement in this respect by increasing the H.T. voltage even beyond the limit recommended by the manufacturers; this practice, unfortunately, will reduce the life of the valve, but generally not unduly so, provided that the excess voltage is not very great, and that anode current is kept down by a corresponding increase of negative grid bias.

There are, however, one or two drawbacks resulting directly from the passing of a heavy anode current, whether this is due to the use of high-power valves or to increasing the H.T. battery voltage applied to ordinary valves. In the first place, the life of the battery itself will be shortened, but this trouble must be inevitably faced if really good quality with considerable volume is to be obtained. A disadvantage more difficult to detect is that connected with magnetic saturation of the loud-speaker itself. If the steady direct current flowing through its windings is sufficient to give rise to saturation, it will be found that pulsations due to incoming signals will not have their proper magnetising effect, and reproduction will at the best be lacking in "crispness." It will be clear that when an iron core is magnetised nearly up to its limit by the passage of a current through its associated windings, any increase in this current cannot exert a proportionate attractive force on the diaphragm.

The magnetic systems of many loud-speakers designed some time ago, when even small-power valves were rare, will be found to saturate at quite low currents, while not a few of the later types are unsuitable for connection directly in the anode circuits of low impedance valves. Luckily, it is a fairly simple and comparatively inexpensive matter to prevent the occurrence of this trouble by using the so-called "filter circuit" shown in Fig. 1 (a). A low-

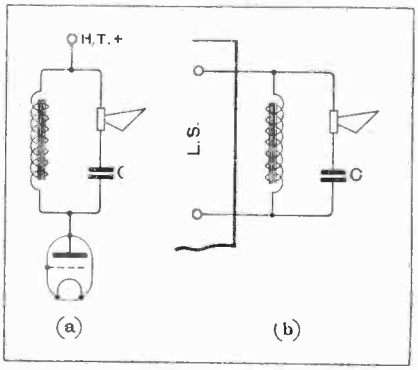


Fig. 1.—(a) A choke-capacity output circuit. At (b) its connections to the loud speaker terminals of an existing set are shown.

frequency iron core choke is inserted in the anode circuit of the output valve and across it are connected the loud-speaker and a large fixed condenser.

The impedance value of the choke is not critical, provided that it is several times greater than that of the loud-speaker windings; in practice, from about 20 to 30 henries is sufficient. A condenser of 1 mfd. is suitable; its function, of course, is to pass low-frequency impulses through the loud-speaker and to deflect the steady D.C. component through the choke.

This arrangement can usually be connected directly to the loud-speaker terminals of an existing set without any internal alterations, as shown in Fig. 1 (b); should there be a shunting condenser across these terminals, however, it will be as well to transfer it to the loud-speaker.

As the filter is used primarily to prevent the bad effects of saturation, care must be taken that the choke itself is beyond suspicion in this respect. Several manufacturers now specify the safe working current of their products, and the choice of a suitable value can easily be made after a study of the characteristic curve of an output valve which will show the current passing with a given H.T voltage, and grid bias.

The windings of a disused L.F. transformer will often serve as a choke, provided they have an iron core of large cross sectional area, and not too great a number of turns.

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SATURATION OF L.F. TRANSFORMER CORES.

When choosing an L.F. transformer, special attention should be paid to the manufacturers' statements regarding the type of valve in whose anode circuit it is to be connected. Generally speaking, a very much greater current will flow through the primary winding when a low impedance valve is used than will be passed by one of the medium-impedance type; if the transformer is primarily designed for the latter, it may be that the windings, iron core, and air-gap in this core are so proportioned that magnetic saturation occurs when quite a small current—even less than that taken in the anode circuit of a power valve—is flowing.

If the core is already saturated by the steady direct current from the H.T. battery, it will be fairly obvious that changes in this steady current due

to received signals will not have their full magnetising effect, with the result that voltages across the secondary will no longer be in proportion to changes in primary current, and distortion will be produced.

The best way of overcoming troubles due to this source, short of changing the transformer or valve, is to reduce the H.T. voltage, at the same time making an appropriate reduction in grid bias, and also in the amplification of preceding stages, to ensure that the valve, which will now have a smaller power-handling capacity, is not overloaded.

These changes should be made while listening carefully to signals, as saturation is generally indicated by a certain "wooliness" which is difficult to describe, but is fairly easily recognisable.

If a manufacturer refers to his transformer as being suitable for following valves of moderately high impedance, great caution should be exercised if using it in conjunction with any other type, and perhaps, before doing so, it would be advisable to obtain a definite expression of opinion as to its suitability for the proposed purpose.

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MEASURING H.T. VOLTAGE.

The cheaper types of "moving iron" voltmeters take a fairly heavy current for their operation, and are hardly suitable for measuring the voltage of a dry-cell H.T. battery. Indeed, very serious harm may be done to the cells if it is applied across the battery for any length of time

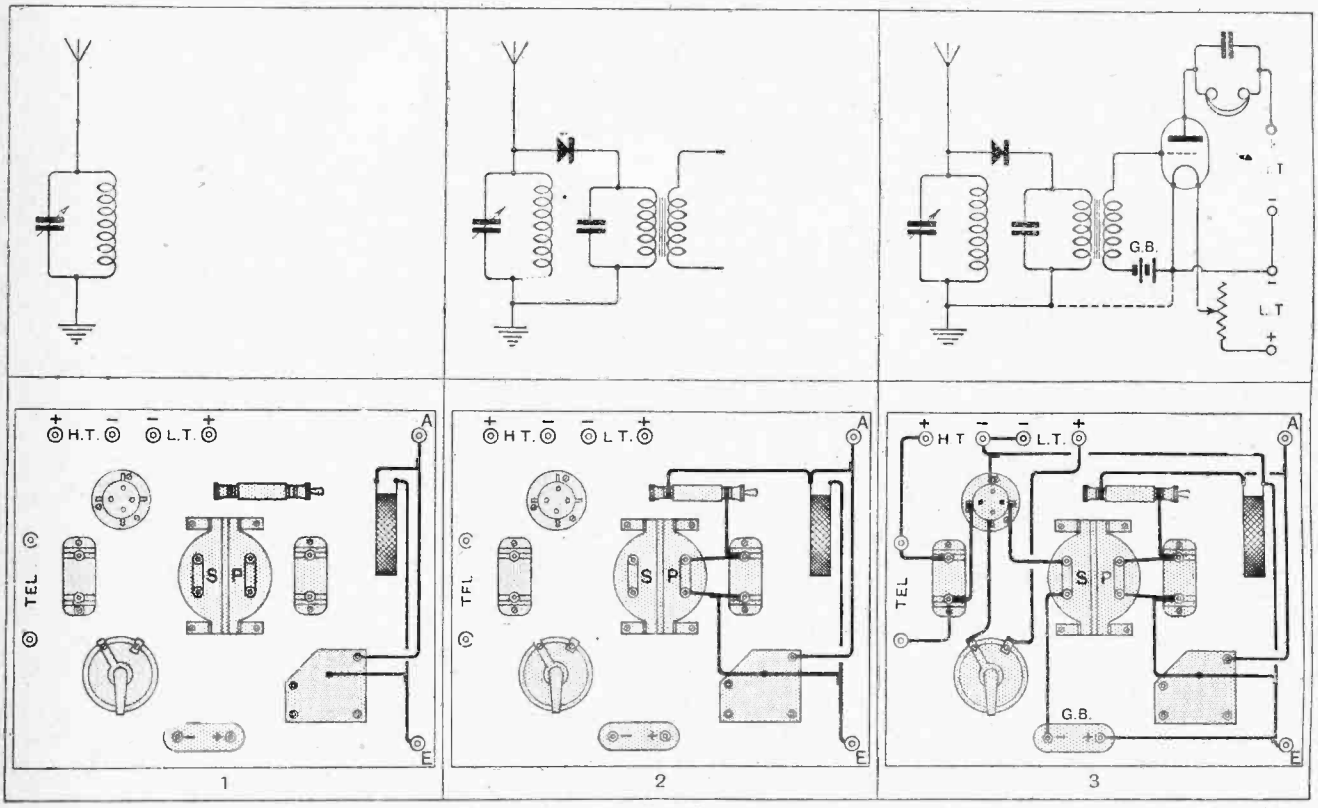
Users of this type of instrument would be well advised to measure the voltage of their batteries in comparatively small sections, making a note of the readings between the various tapping points, and then adding together these voltages to obtain the total. Although the meter may read up to 120 volts, it is best to take the pressure across a section only large enough to give a clear reading. By this method the current taken from the battery will be considerably reduced.

DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 46.—A Crystal Detector with L.F. Amplifier.

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. The circuit shown below is suitable for use at short ranges in cases where the volume given by a plain crystal set is insufficient. An earth connection for the batteries is often necessary, and is shown in dotted lines in Diagram 3.



1 Aerial and earth are joined to an inductance coil, across which is connected a variable tuning condenser.

2 Th crystal and transformer primary (with by-pass condenser) are connected across the tuned circuit. The transformer secondary—

3 —is joined to grid and filament, a bias battery being interposed. Anode and filament circuits are completed.

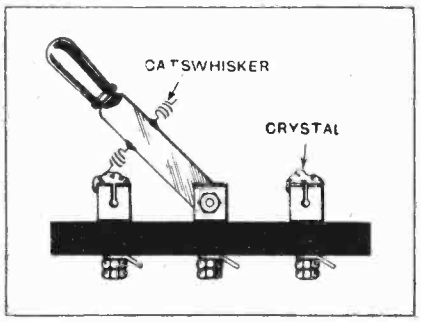
NOVELTIES FROM OUR READERS

A Section Devoted to New Ideas and Practical Devices.

CRYSTAL DETECTOR.

The diagram shows how an ordinary single-pole double-throw knife switch may be converted into a twin crystal detector.

Small fragments of crystal are forced into spring contacts on each side of the moving arm which may be opened slightly with a screwdriver if the gap should be too narrow for the crystal specimen which it is required to use. Spiral catswhiskers are soldered to each edge of the switch blade in such a way that they come in contact with the crystal when the blade is moved from side to side. Provided that the pivot is suitably adjusted to provide the requisite degree of friction to the movement of the switch arm, a very fine adjustment of contact pressure is possible, and since the switch blade is invariably provided with an ebonite handle, the hand need not come into contact with any metallic portions of the detector during adjustment.—C.H.W.



S.P.D.T. knife switch converted to a crystal detector.

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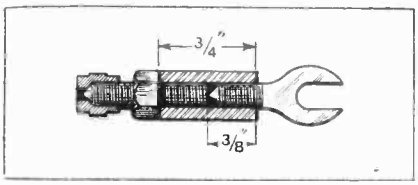
SECRET SWITCH.

It is often advisable to fit a secret switch in some part of the circuit to prevent an unauthorised person from operating the receiver.

The diagram shows a switch of this type incorporated in one of the spade terminals connected to the L.T. battery. A short length of $\frac{3}{16}$in. diameter ebonite rod is drilled and tapped No. 2 B.A. to take the spade terminal at one end, and in the other end a



Combined spade terminal and secret switch

tin. length of No. 2 B.A. screwed brass rod is held in position with a lock-nut. The L.T. lead is clamped to the end of this screw in the usual way by means of the small knurled collar provided. To disconnect the L.T. battery the spade terminal is unscrewed half a turn, which has the effect of introducing a small gap into the L.T. lead.

In order to camouflage the rather unusual appearance of the modified spade terminal it will be advisable to provide both L.T. leads with terminals of this kind to match, and the ebonite tube should be threaded from each end with a taper tap in order that the spade terminal may fit tightly and not give a clue to the existence of the switch device by reason of its slackness.—G.H.S.

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."

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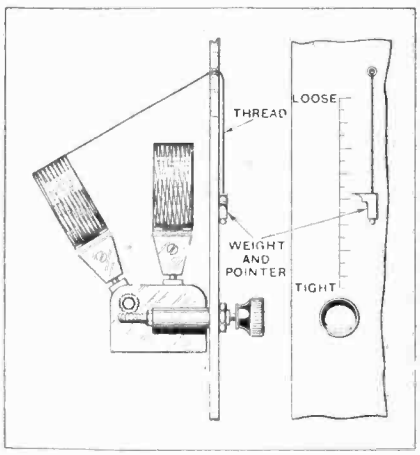
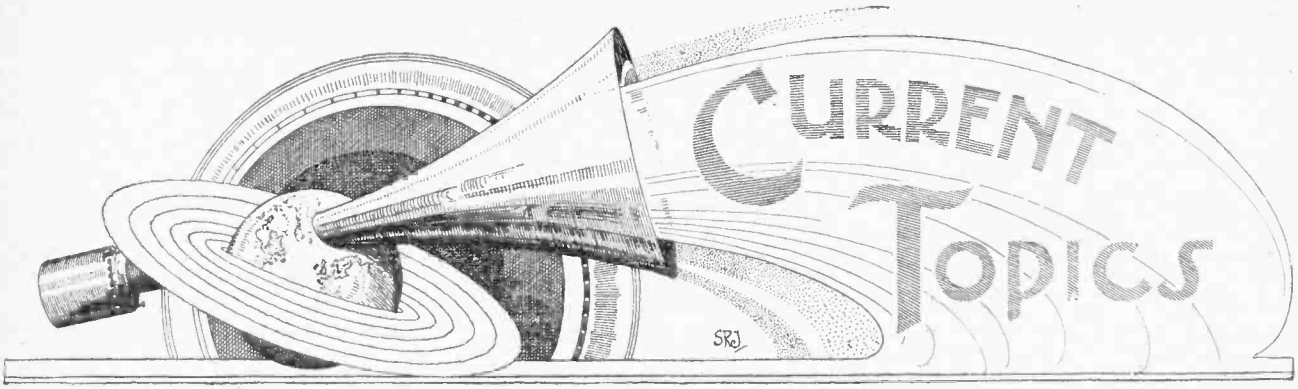
COUPLING INDICATOR.

Now that coil holders, together with valves, etc., have been banished to the back of the panel, some sort of indicator such as that illustrated in the diagram is necessary to enable the operator to tell the degree of coupling between the two coils without having to look inside the cabinet.

A small hole is drilled in the panel at a point a little above the top of the fixed vertical coil so that the thread will clear the top of this coil when the moving coil is horizontal. One end of the thread carries a small weight and pointer which moves up and down a scale engraved on the front panel as the coupling between the coils is varied. The hole in the ebonite panel through which the thread passes should be countersunk on both sides to prevent fraying of the thread.—A.F.F.



Coupling indicator for coils mounted behind the panel.



News of the Week in Brief Review.

"LET YOUR FRIENDS LISTEN."

Have you read about National Wireless Week, November 7th-13th? The subject is dealt with in this week's "Editorial."

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QUICK WORK.

Less than a month after the fund was started, all the money needed to secure wireless for every bed in the Finchley Memorial Hospital has been subscribed. The collection was organised by the *Daily News*.

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DEATH OF WIRELESS PIONEER.

The death is announced in Boston of Mr. George Davis, vice-president and general manager of the Tropical Radio Company. Formerly a director of the Radio Corporation of America, Mr. Davis had been an intimate friend of Marconi and Edison.

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MANCHESTER WIRELESS EXHIBITION.

Under the auspices of the *Evening Chronicle*, a wireless exhibition is to be held in the City Hall, Manchester, from Tuesday next, October 26th, until Saturday, November 6th. The speeches at the opening ceremony will be broadcast, and band music from the Hall will also be transmitted.

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"ELECTRIC NIGHT."

To-morrow (Thursday) thirty-five broadcasting stations in America will celebrate "Electric Night," marking the forty-seventh anniversary of Edison's invention of the carbon filament lamp. Special programmes suitable to the occasion have been prepared by leaders of the American electrical industry.

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RUGBY WIRELESS TRAGEDY.

Mr. Ralph Leary Oldfield, an engineer, was electrocuted at the Rugby wireless station last week through coming in contact with a high-tension terminal in the power house. The deceased was alone at the time, but subsequent inquiries showed that he had attempted to enter the high-tension enclosure without first shutting off the power.

This is the first fatal accident to occur in the history of the station.

NO MORE BRAIN WAVES?

Dr. J. H. Dellinger, the American research worker, is reported to have said that he does not expect any "new radical radio inventions."

He is not referring, of course, to broadcast weather forecasts.

FINLAND CALLING. A glimpse of the transmitting room of the Helsingfors military wireless station which now broadcasts concerts on 318 metres at regular intervals. A "radiojouket" microphone is used.

WIRELESS AIDS THE POLICE.

Wireless as an aid to the police proved its worth last week, when, principally through the agency of a broadcast appeal, Arthur Ernest Barker, a former Birmingham borough councillor, was arrested on a warrant charging him with false pretences. A minute description of the man's appearance was broadcast from 2LO. This is probably the first occasion in this country that broadcasting has been brought in to aid the police, though the practice is fairly frequent in America.

SENATORE MARCONI ON "RADIO COMMUNICATIONS."

On Tuesday next, at 6 p.m., Senatore Marconi will deliver the "James Forrest" lecture, 1926, at the Institution of Civil Engineers. His subject will be: "Radio Communications."

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D.F. IN THE MEDITERRANEAN.

A permanent wireless direction-finding service is to be opened at Port Mahon (Balearic Islands) for the benefit of ships. An experimental service is already in operation.

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ALL'S WELL THAT . . .

A reader who constructed the "Everyman's Four" wrote suggesting sweeping changes in the condenser values, grid bias, etc. Subsequently he explained that he had been working with the L.T. connections reversed.

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JAPANESE BROADCASTING MOVE.

Japan is evidently recognising the value of unity in broadcast control. The three independent broadcasting associations hitherto existing at Tokyo, Osaka, and Nagoya have been merged in the Shadan Hojin Nihon, Hoso Kyokai (Incorporated Japanese Broadcasting Association). The broadcasting service is at present being conducted from each station as before, under the title of the Tokyo, Osaka, and Nagoya Broadcasting Bureaux respectively.

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TALL STORIES FROM BOMBAY.

The Bombay wireless trade, writes a correspondent, is enjoying a boom at the present time. Ordinary crystal sets are much in demand in the Presidency towns and suburbs, where the low-power broadcasting stations of Bombay, Calcutta, and Madras can be heard within twenty or thirty miles' radius.

Several cases of freak crystal reception have been recorded, and some listeners even claim to have picked up KDKA in the early mornings.

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PLANE SPEAKING.

If, in the near future, your ear tingles at the gruff injunction: "Eat More Fruit," or "Use More Valves," don't

show too great a readiness to castigate the man at your elbow. The voice may not be his; it may proceed from the skies. Experiments are being conducted at Philadelphia with an advertising plane fitted with a gigantic loud-speaker and multi-valve amplifier. It is said that the amplified voice of the speaker in the plane can be heard by whole cities. It is understood that the Plane-speaker Corporation, which is controlling the invention, will shortly send a specially equipped machine to Europe.

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RATIO OF WIRELESS SETS TO POPULATION.

That the English-speaking peoples have led the world in the development of broadcasting is the summing-up contained in a recent report of the U.S. Department of Commerce. The United States is credited with more than three-fifths of the world's broadcasting stations. In the number of receiving sets per one thousand of the population the report puts the United States first with 48.3 sets, followed in order by the United Kingdom with 35.6, Sweden with 30.3, and the Union of South Africa with 26.7.

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BROADCAST ADVERTISEMENTS IN HOLLAND.

A Government wireless telephone transmitter for the use of business firms wishing to make announcements is the reported scheme of the Dutch telegraph authorities.

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WIRELESS TELEPHONY FOR FISHERMEN.

A regular service of broadcast news to fishermen is being conducted by the Swedish s.s. *Skagerak*, which works on a wavelength of 700 metres. The service is supplemented by a weather report from the Nya Varvet broadcasting station on the same wavelength.

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FREE STATE BROADCASTING BILL.

When the Dail meets in November it is understood that one of its first tasks will be the consideration of a Broadcasting Bill. The cutting down of the licence fee is regarded as an indication that this is to be made a basic feature of finance of the service, and the appointment of a temporary Advisory Committee heralds the statutory sanction of such a body.

Irish wireless amateurs would be well advised to put forward their suggestions for the broadcasting service as early as possible as delay may prove dangerous.

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THE "COUNTRY" THREE.

In connection with the "Country" Three receiver described in *The Wireless World* of October 6th, we are advised by Messrs. Siemens Bros. & Co., Ltd., that 20 mA is the *maximum*, and not the *economical*, discharge rate of their "Super-Radio" H.T. battery. An economical discharge would be of the order of 10 mA (the total H.T. current of the set in question), and under these conditions twelve months' service may be expected, assuming 0.80 hours per month.

SO SIMPLE!

Below is an illustration culled from a serious advertisement in a German paper which came into the hands of *The Wireless World* representative at the Berlin Wireless Exhibition.

The revolutionary theories put forward by the advertiser will be best understood by an examination of the translation, which runs as follow:—

"What is the use of flat coils having a large coupling surface if it is wasted?

"The most important advantage of the modern flat coil is its great coupling surface. Anyone who still uses a honeycomb coil for coupling and does not see the great advantage of flat coils is beyond advice or help. With honeycomb coils of few turns, only two or three turns are coupled. The energy of the two largest surfaces is quite lost.

A NEW THEORY! This clipping, taken from a German paper on sale during the Berlin Wireless Exhibition, reveals a manufacturer's conception of the operation of flat coils. A translation appears in this column.

"The accompanying diagram shows very plainly the disadvantage of the rocking coupler. Since the radiation goes out at right-angles to the coil (see the wavy lines in the figure), in the position shown *all the energy from the top of the coil and two-thirds of that from the bottom misses the other coil and is lost.* The coupling surface is thus reduced to a minimum; the result is weaker reception and a sudden breaking of the coupling. . . .

"Only a parallel coupling can be ideal and render possible the complete use of the coupling surfaces of all types of coils."

The italics are ours. It is only fair to remark that the above is not representative of current German research!

Books Received.

"A First Course in Wireless," by Robert W. Hutchinson, M.Sc., A.M.I.E.E. pp. 262, with 208 illustrations and diagrams, and frontispiece. Published by University Tutorial Press, Ltd., London. Price 3s. 6d.

"Safety Rules for Radio Installations." Handbook of the Bureau of Standards No. 9. Rules for the equipment of wireless installations in the United States, formulated and approved by a Sectional Committee organised according to the rules of procedure of the American Engineering Standards Committee. pp. 24. Published by the Department of Commerce, Bureau of Standards, Washington, D.C. Price 10 cents.

"Junior Technical Electricity" (second edition), by R. W. Hutchinson, M.Sc., A.M.I.E.E., a text book for First-year Students in Electrical Engineering for use in Technical Schools and Colleges and in the Universities. pp. 385, with 327 illustrations and diagrams. Published by The University Tutorial Press, Ltd., London. Price 4s. 6d.

"Establishment of Radio Standards of Frequency by the Use of a Harmonic Amplifier," by C. B. Jolliffe and Grace Hazen (being No. 530 of the scientific papers of the Bureau of Standards). pp. 10, with 4 illustrations and diagrams. Published by The Department of Commerce, Bureau of Standards, Washington D.C. Price 10 cents.

Catalogues Received.

W. & G. Foyle, 121-125, Charing Cross Road, London, W.C.2. Catalogue Dept. No. 7, relating to books on all technical subjects and applied science.

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Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17. Leaflets No. 812 and 813, describing "Benjamin Short-path" radio valves.

o o o o

V. Martin, 5, rue Lemercier, Paris, XVIIe. Catalogue of wireless sets, components and accessories.

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London Electric Wire Company and Smiths, Ltd., Playhouse Yard, Golden Lane, London, E.C.1. Catalogue of "Lewcos" radio products, including screened coils and transformers, instrument wires, etc., etc.

o o o o

Cambridge Instrument Co., Ltd., 45, Grosvenor Place, London, S.W.1. List No. 169, describing "Cambridge" Electrometers and Photo-Electric Cells.

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Wholesale Wireless Co., Quality House, 103, Farringdon Road, London, E.C. Trade catalogue of TWWC Wireless Components.

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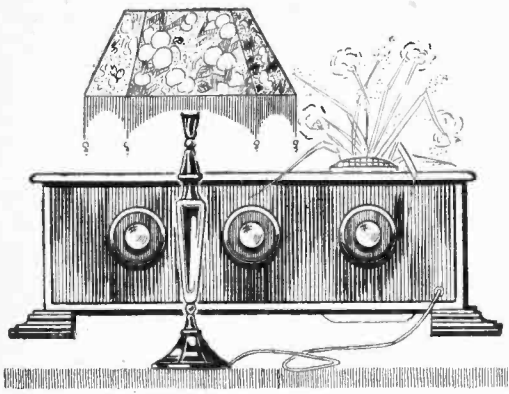
Burgess Battery Company, Madison, Wisconsin, U.S.A. Engineering Circular No. 11, containing paper by W. B. Schulte on "Estimating B Battery Service Life." Engineering Circular No. 12, describing a high-frequency driver and short-wave wavemeters.



By-pass Condensers IN REFLEX RECEIVERS.

By D. KINGSBURY.

Appropriate Values for Efficient and High Quality Reception.

THE incentive to write that which follows was provided by a recent article by Mr. Vincent-Minter[1] in which the desirability of using a small number of valves is pointed out and the possibility of an all-the-world-in-daylight super receiving set lightly touched upon. Reflex sets are more or less ruled out owing to the existence of by-pass condensers across the L.F. transformer terminals. Now, while unable, at the moment, to supply useful information on how to receive, say, 400-metre broadcasting from America in broad daylight, the author does feel in a position to discuss by-pass condensers in reflex sets. The purpose, then, of these few rather disjointed notes is, firstly, to show how these condensers may be kept down to practical limits and in certain cases dispensed with, and, secondly, to give a number of what appear to him very good reasons why general reception should be limited to 5,000 cycles on either side of the carrier wave and L.F. transformers designed accordingly.

Classification.

The three main classes of by-pass condensers which occur in a reflex set are as follow :—

(1) L.F. transformer secondary by-pass condensers which always occur in valve grid circuits.

(2) L.F. transformer primary by-pass condensers, one of which occurs in the detector circuit as a blocking condenser, and the remainder in the anodes of respective reflex amplifier valves.

(3) The output by-pass condenser, which occurs in the anode of the last reflex valve.

Circuits in which the H.F. variable tuning condensers occur across the L.F. transformer secondary terminals have not been taken into account as they represent, in the author's opinion, thoroughly unsound practice—in fact, a long series of careless and/or thoughtless tricks such as this are responsible for the present position of semi-disgrace in which the reflex now finds itself.

Experience indicates that if fidelity in reproduction is to be maintained, the grid or L.F. transformer secondary by-pass condensers require the greatest care in selection; next in importance are the anode or L.F. transformer primary by-pass condensers, and the one least affecting the output is the final anode or loud-speaker by-pass condenser.

The Grid Condenser.

Consider for a moment an ordinary three-electrode receiving valve mounted on a standard four-pin base. It has, amongst other things, a number of inter-electrode capacities, those concerning us being from grid to filament and from grid to anode. It is the capacity between grid and anode which is the cause of nearly all the troubles to which powerful H.F. amplifiers are prone, the reason being that a certain amount of energy from the output (anode) circuit is fed back to the input (grid) circuit through this capacity. This "feed-back" is, of course, reaction, and, the size and nature of the capacity being fixed, it will become increasingly severe as the frequency goes up, so that sooner or later the amplifier becomes unstable.

It is worthy of note in passing that Mr. Miller, of the Bureau of Standards of America, has shown that this instability can only occur when the anode circuit contains inductance. This subject has been dealt with very ably elsewhere.[2]

Of the many palliatives suggested for this instability two only concern us here. First, valves have been designed and constructed so that the leads from the electrodes are not brought out through a common pinch and their terminals are well spaced. The best known example of this type is the V.24, which has only about one-half of the grid-anode capacity and one-sixth the grid-filament capacity of an "R" valve. As will be shown later, a "power" valve of the usual 6-9 voltage amplification factor and 6,000-10,000 ohms A.C. resistance built on these lines would solve the grid by-pass condenser problem in the simplest possible manner. Secondly, there is the method, now in general use, known as stray capacity neutralisation, or, more popularly, neutrodyne. This scheme recognises the existence of "feed-back" through the inter-electrode capacity, and provides a reversed "feed-back" through a small condenser,

[1] "Universal Three-Valve Receiver," by N. P. Vincer-Minter. *The Wireless World*, Aug. 18th, 1926, p. 210.

[2] "The Perfect Set," Part VI, by P. K. Turner. *Experimental Wireless*, March, 1925, p. 344.

Reflex Receivers.—

known as the neutralising condenser, so that the nett stray capacity coupling between grid and anode is nil. The reversed "feed-back" is obtained from the anode circuit by true- or auto-transformer action.

In Fig. 1, which is part of Fig. 11 in a previous article[3] on reflex receivers, the transformer primary P and the neutralising secondary winding S have an equal number of turns, and are tightly coupled (to obtain a sufficiently tight coupling it would appear advisable that these windings should always have the same number of turns). It follows, therefore, that under stable conditions the value of the capacity AG and the condenser NC must be equal. There are obviously three capacity paths from G to earth :—

(1) By way of the capacity FG.

(2) By way of the capacity AG and transformer primary P.

(3) By way of the condenser NC and the winding Sn.

The capacity of C_2 is so much larger than those under consideration that its effect may be neglected.

Now, the very essence of the neutrodyne scheme de-

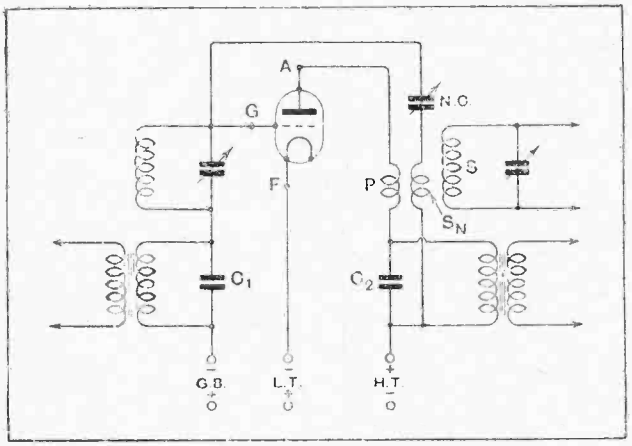


Fig. 1.—Single stage reflex amplifying valve with neutralised H.F. coupling.

mands that the windings P and Sn shall be oppositely wound or oppositely connected; thus the paths (2) and (3) are jointly non-inductive from G to earth. If neutralised tuned anode is used, as in Fig. 2, the same reasoning holds good, as AG and NC come at the opposite ends of a centre tapped coil. We may, therefore, consider all these capacities as one big capacity between grid and earth. This brings us to Fig 3, where F_1 G_1 represents the lumped capacity. By rearrangement and the omission of non-essentials we obtain Fig. 4, which shows clearly that the capacity F_1 G_1 and the condenser C_1 are in series across the input circuit, and that we can only make use of the volts drop across F_1 G_1. Since we cannot obtain all the available input (a change of connections to an unsound arrangement excepted), it will be necessary to compromise. The author has decided that if 90 per cent. of the H.F. input reaches the valve there is little cause for complaint. On two H.F. stages this means that 90 per cent. of 90 per cent. = 81 per cent. of the maximum is obtained, or, in other words, 19 per cent. is lost. It is generally accepted that the human ear cannot perceive less than a 30 per cent. reduction in sound volume, so we are well on the right side. To obtain 90 per cent. of the signal strength the volts drop across F_1 G_1 must be nine times as great as across C_1; in other words, C_1 must be nine times larger than the sum of the capacity between grid and filament plus twice the capacity between grid and anode.

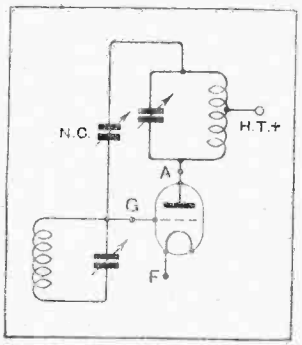


Fig. 2.—Neutralised tuned anode coupling.

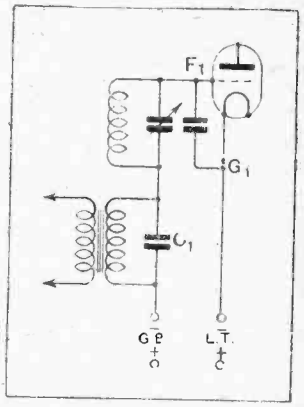


Fig. 3.—Grid circuit with lumped capacity F_1G_1.

The moral is very obvious—use low-capacity valves and rely on the self-capacity of the transformer windings to provide such by-pass as will be necessary. In practice, since low-capacity, i.e., V.24 type "power" valves are not available, we have to select the most suitable of the standard types. From figures already published[4] we find the total capacity F_1 G_1 to 17 micro-microfarads for a large power valve so that C_1 should be 150 micro-microfarads (0.00015 mfd.). Actually, the author has found appreciable variation between valves in this direction. The new Burndept L.525, which has a very clean pinch and base gives no greater output if C_1 is increased beyond 0.0001 mfd., the transformer being a Marconi Ideal 6 : 1; in fact, the drop in volume is so slight if the condenser is completely removed as to be negligible. On the other hand, another valve of the same class, but with larger electrodes and the usual metal band around the base, requires a by-pass condenser of 0.003 mfd. to give its best. The tendency to insert extra supports, blobs of glass, etc., to hold the electrodes together quite spoils valves from the reflex point of view.

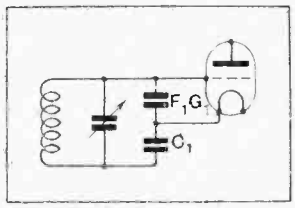


Fig. 4.—Rearrangement of circuit in Fig. 3 to show relation of essential capacities.

The Burndept valve, which will run without a by-pass condenser, is not a fluke—three others of the same make which were tried do as well. These tests were made on a one-valve reflex giving adequate loud-speaker strength (appreciably more than graniophone strength)

[3] "Reflex Receivers: Some Practical Considerations." By D. Kingsbury, *The Wireless World*, July 7th, 1926, p. 21.

[4] "The Inter-Electrode Capacities of Thermionic Valves," by L. Hartshorn and T. I. Jones, *Experimental Wireless*, February, 1925, p. 263.

Reflex Receivers.—

at nine miles from 2LO on a moderate aerial and without a trace of reaction.

Contrary to general opinion, once the reflex has been *correctly* stabilised, changing the value of the grid (L.F. transformer secondary) by-pass condenser, or omitting it altogether, or changing the L.F. transformer connections or even the make of transformer, makes no difference whatever to the stability of the H.F. portion of the set and very little difference to the tuning. A change of valve, of course, involves a readjustment of the neutralising condenser.

The "Throw-back" By-pass Condenser.

If, however, one removes the by-pass condenser across the *primary* of the "throw-back" L.F. transformer (the only one in a one-valve reflex, and the first in a two-valve "straight" reflex, and every one in an inverse reflex), serious H.F. oscillation may and generally does occur. The removal of this condenser lays the grid circuit of the valve receiving the L.F. throw-back open to H.F. energy from the detector circuit. As the detector will, in nine cases out of ten, be a crystal, this condenser should be there for rectification purposes (*vide* instruction sheet of the transformer makers), so we need not have any twinges of conscience about it.

The Anode By-pass Condenser.

There remains the anode by-pass condensers to consider. Unfortunately up to the present the author has not found a way of determining their correct value or of dispensing with them entirely, without departing from his standard circuit. Two theoretical methods of attack have yielded results which were not confirmed by trial, so that we have to fall back on experience.

On wavelengths below 600 metres no appreciable increase in signal strength can be noted either on the local or distant stations if these condensers are increased beyond 0.001 mfd. Now the tone lowering effect of a condenser of this size across a loud-speaker is quite unnoticeable even if the loud-speaker is only approximately matched to the low A.C. resistance valve which operates it, and a certain amount of imagination is necessary to hear the change of tone when such a condenser is applied to the primary of an L.F. transformer within the set, so very slight is it. For all practical purposes we may use 0.001 mfd. anode by-pass condensers in a broadcast receiver without detriment to quality. It would appear necessary to increase this value on higher wavelengths, but that is not a matter which need concern us greatly at the moment. There are, of course, alternative methods of intervalve coupling which could be brought into service.

Results with Reflex Circuits.

No doubt some very distressing results have been obtained with badly-designed reflex sets in the past, but the author would again state that the system has no fundamental shortcomings. Admittedly a few difficulties had to be overcome before a satisfactory design was obtained. He would like to take this opportunity to put in a plea for a sense of proportion in the matter of the use of L.F. transformers in these, or, in fact, any receivers.

Transformers.

We have now transformers with a straight line amplification-frequency curve to practically 10,000 cycles, but where will we find a detector so flatly tuned that its H.F. response curve is flat over a region 10,000 cycles either side of the carrier wave? Over the full range covered by the transformer, phase shift appears to be an enormously variable quantity. This is the generally recognised reason why rustling paper and certain "noises off" sound so unnatural when reproduced in our loud-speakers. To increase the frequency response range upwards would appear to be likely to make the reproduction of these noises even worse.

Assuming that we obtained a flat response curve over 10,000 cycles from a detector and L.F. amplifier, how are we going to turn it into sound? The response curve of what is probably the best loud-speaker available to the public as a separate article (anyway, the one to be found where "highbrows," both technical and musical, congregate) starts on its final decline at 3,500 cycles. At this point the curve is dropping practically vertically. This is the only loud-speaker which the author has heard that will reproduce the top two notes of the piano. Even so, 5,000 cycles is rather wasted on it, and 10,000 cycles would probably not be heard. How much more so in the case of a loud-speaker which can only reproduce the top few notes of the piano as wooden clicks.

The fifth harmonic of C^2, the top limit of a soprano's range, and, in the flesh, a pretty thin note, is only just over 5,000 cycles, and it seems fairly reasonable to assume that if the harmonics up to the fifth do not bring out what timbre the note may have, the inclusion of still higher harmonics will not. The higher harmonics of instruments which go well up the musical scale can be distinctly irritating; witness a violin or piccolo at close quarters.

Lastly, with stations' wavelengths pitched, according to the Geneva plan, exactly 10,000 cycles apart, how can we possibly separate two stations of comparable power which happen to be on adjacent wavelengths unless we limit the responsiveness of our sets to $\pm$ 5,000 cycles? It is realised that each foreign station of interest will not have another of equal power alongside it in the ether in the early stages of the new scheme, for the simple reason that all the stations have not yet been built, but in a year or so it will be a very different story.

Limiting the Response Curve.

Taking all the facts into consideration, if we concentrate on obtaining the best possible response up to 5,000 cycles and as little as possible beyond, we shall probably obtain the greatest degree of "general purpose perfection." If for any purpose a L.F. amplifier with a flat characteristic and a stable phase displacement between input and output circuits is required, a resistance-coupled circuit is indicated.

There would appear to be a distinct market for an L.F. transformer specifically designed to have as much rise in characteristic as can be obtained up to between 4,000 and 5,000 cycles, and a sharp cut-off after that frequency had been reached. Such a transformer would conceivably give more accurate results in any selective valve set.

Reflex Receivers.—

In discussing transformers it must not be forgotten that all credit is due to those manufacturers who, by careful design, workmanship, and selection of materials, have given us a full measure of low notes. These, in the author's opinion, are the mainstay of pleasant reproduction. At the same time, in getting down to "brass tacks" on the subject of quality of reproduction, it would not be out of place to remind ourselves that there are no published curves of the performance of transformers operated by crystal detectors. The writer has a shrewd suspicion that they would be considerably more humpy than the usual curve would lead one to imagine. Further, it has always seemed to him a little odd that one should expect a humble crystal to supply the magnetising current for a pound or more of transformer iron. The wonder is that it does it at all.

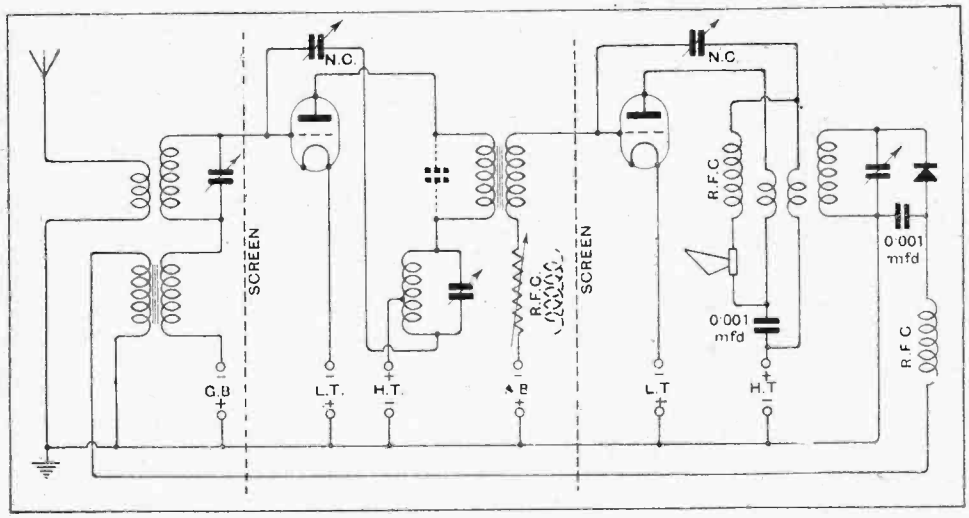


Fig. 5.—Schematic circuit diagram of a practical two-valve and crystal reflex receiver.

A Successful Circuit.

To show that it is possible to produce a reflex which does not unduly contravene the accepted rules for connecting L.F. transformers, Fig. 5 has been drawn. This is based on Fig. 11 of the author's previous article, and it will be noted that the intervalve coupling has been somewhat modified. The anode of the first valve now contains an H.F. rejector (tuned anode), the H.T. being taken from the mid-point of the coil so as to allow stray capacity neutralisation to be carried out. The L.F. transformer has been placed between the valve and the rejector, and so is "alive" at H.F. potential, and will therefore have to be set well apart from most of the rest of the apparatus. By virtue of the general strays within itself, the transformer replaces the usual grid condenser which follows a tuned anode stage, and to ensure that the H.F. does arrive at the grid of the second valve, a variable resistance or radio-frequency choke of some fairly critical value is inserted in the lead to the bias battery. The transformer suggested is that particular make which incorporates a 0.0003 mfd. condenser across its primary terminals (Ferranti). The earth terminal of the case could be connected to the lead going to H.T. + or the bias lead.

Alternative Detectors.

The by-pass condenser across the primary of the first transformer is retained, and is allowed by the transformer maker when crystal rectification is employed. If, however, one is prepared to use a valve detector, even this condenser may be reduced to a lower value than could possibly produce a noticeable (or, for that matter, measurable) change in tone. Fig. 6 shows what are probably the two best regenerative valve detector circuits in use to-day, adapted to the author's reflex scheme, and in particular to the circuit shown in Fig. 5. First, we have a crystal detector with the connections somewhat rearranged to allow of its replacement by one of the valve detectors. Next is shown the Hartley circuit, which only shunts the primary of the throw-back transformer, with its variable reaction condenser—a matter of some 0.00005 mfd. maximum—and finally comes the Schnell detector, which, while being an improvement on the Hartley from the operating point of view, shunts the L.F. transformer with a 0.0005 mfd. variable condenser as well as with a 0.00005 mfd. fixed condenser. The author has not yet found time to try these out, but at a first glance would favour the Schnell circuit, as the 0.0005 mfd. variable condenser is an additional safeguard against H.F. feed-back from the detector circuit to the first valve. The Hartley circuit could be made to work satisfactorily by giving sufficient care to the radio-frequency choke in the throw-back lead. In any case, both circuits tend to lower the value of the by-pass condenser across the throw-back transformer primary, which is our present aim. It should be stated here that in the author's experience a valve detector cannot be given full play on the local station at, say, ten miles, even on a single reflexed valve set, but additional range on weaker signals is to be gained. The economic limit of input for one valve of the L.525 class can be obtained on the local station with a good galena crystal for a rectifier. The output under such conditions may fairly be described as adequate sitting-room loud-speaker strength.

And so there remains the by-pass condenser across the loud-speaker, *i.e.*, output circuit which really does not seem to warrant criticism. However, could we but dispense with this condenser without running into other troubles, the last trace of justification for the argument that reflex sets and fidelity of reproduction cannot go hand in hand would be removed. Here, then, is a problem for readers to tackle, although prizes are unlikely to be given for a solution. In the author's experien-

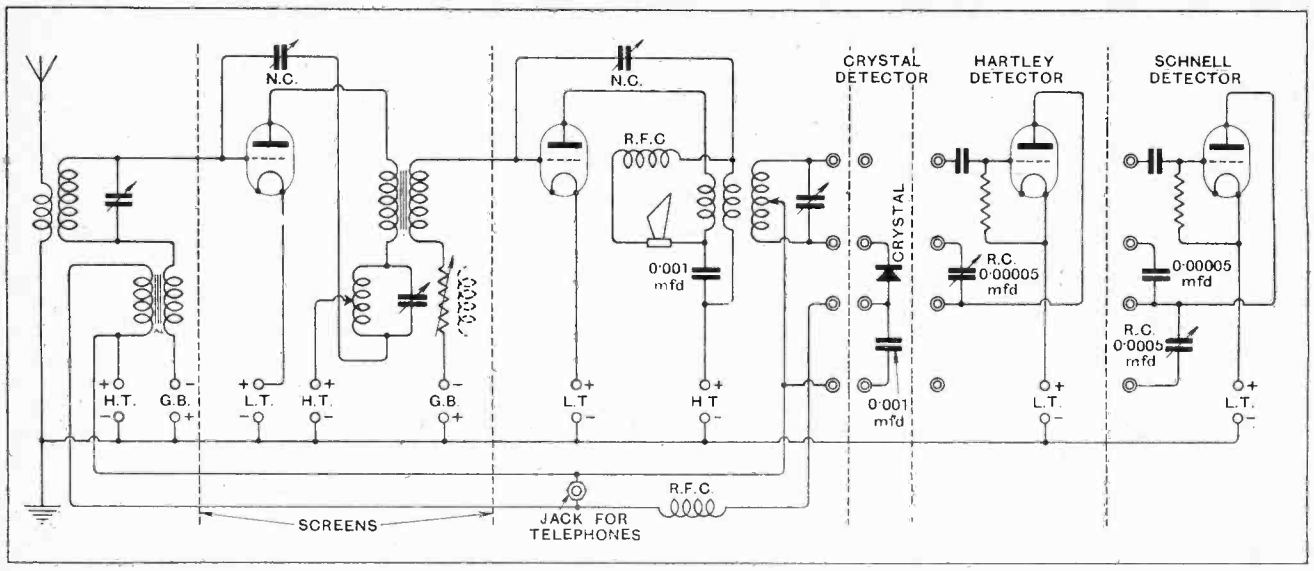


Fig. 6.—Schematic diagram showing how the crystal in Fig. 5 may be replaced by well-known reacting valve detectors.

the greatest prize of all is the fund of interest which such a subject as reflex receivers provides. At the end of over three years casual experimenting, he has just arrived at the position of realising how very little is known (or at any rate published) about these interesting circuits, and to what small extent they have been developed.

Perhaps a final word will be permitted on the subject of the reflex as a real "super." There is experimental evidence of an occasional grid swing of between 12 and 15 volts on the author's single-valve set from 2LO without reaction, the estimated H.F. input being between $\frac{1}{2}$ and $\frac{3}{4}$ of a volt. There seems to be no reason why a combined H.F. and L.F. voltage amplification of nearly 2,400 should not be obtained from a D.E.5B. type of valve added to this set, making use of Mr. James's recent design of H.F. transformers[5] and an 80-henry $3\frac{1}{2}$: 1 L.F. transformer. Reaction is still available on a faint signal

With far less efficient apparatus the author last winter frequently experienced saturation of the second valve of a two-valve reflex on such stations as Dublin, Hamburg, Brussels, etc. If an extremely watchful eye is kept for strays, both magnetic and capacitative, there is no doubt that the neutralised multi-reflexed valve works, and works well.

[5] The "Everyman's" Four-Valve Receiver, by W. James, *The Wireless World*, July 28th, Aug. 4th and Sept. 8th, 1926.

General Notes.

Messrs. G. G. and A. E. Livesey, Stourton Hall, Horncastle, Lincs, have been allotted the call-sign G 2BZT (Art. A.), and intend experimenting on 5 to 8 metres next December. They would like to get into communication with other transmitters who would co-operate in their experiments on these short waves. They hope eventually to be granted an open licence.

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Mr. Alfonso Marullo (I 1CU), via XX Settembre 69. Rome 30, tells us that he has completed his first series of tests on 45 metres, and will carry out his second series during the week beginning on November 1st, in accordance with the special low-power tests organised by the T. and R. Section of the R.S.G.B.

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Short-wave Tests in America.

We have received from the American Radio Relay League a short preliminary note of the result of tests which were conducted during August on 5-metre transmission and reception. The purpose of these tests was not to establish long-distance records, but to find out the general utility of these short waves. The chief difficulty encountered appears to be in the accurate tuning of receivers, a very small change of capacity causing the tuning to "whiz across the desired signal," and a similar difficulty was experienced in finding a suitable wavemeter to calibrate the receivers. On the whole, however, the tests were very encouraging.

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TRANSMITTERS' NOTES AND QUERIES.

New Call-signs Allotted and Stations Identified.

G 2RG	(ex 2BQL) C. Allan Richardson, 20, Craignish Ave., Norbury.
G 5BY	H. L. O. Heffernan, 2, Chepstow Road, Croydon (change of address).
G 5UF	(Ex 2BJP), A. A. Barrett, "Langside," Cabbell Road, Cromer. Transmits on 150–160 metres every Saturday between 23.00 and 23.10 G.M.T. and will welcome full reports.
G 5QG	(Ex 2ASL), G. W. H. Tripp, Harford House, Chew Magna, Somerset.
G 5XH	L. W. Hooke, 87a, Haverhill Road, Balham, S.W.12, transmits on 90 and 150–200 metres.
G 6NC	N. E. Haigh, 16, Fairfield Road, Bridlington, E. Yorkshire. Transmits on 45 metres.
GI 5MO	C. Morton, "Simla," Glastonbury Ave., Belfast.
G 2AHM	J. M. Rutherford, 146, Ethel Street, Benwell, Newcastle-on-Tyne.
G 2AJC	(Art. A.) H. Brabrook, 31, Court Lane, Dulwich, S.E.21.
G 2AOP	(Art. A.) A. E. Fisher, 15, Duncan Street, Glasgow, W.
G 2BPT	(Art. A.) R. A. Grand, 2, Connaught Road, Sheffield Park, Cromer.
G 2BWR	(Art. A.) D. H. C. Rudd, 83, Cricklade Ave., Streatham Hill, S.W.2.
G 2BZT	(Art. A), G. G. and A. E. Livesey, Stourton Hall, Horncastle, Lincs.
A 7HL	H. F. Lovett, 3, Kahibah Road, Mosman, Sydney, N.S.W. (temporary address), will welcome reports from British amateurs.
EAR 31	A. Estublier, Calle Jaime I., 9, Barcelona.
Z 1AO	R. G. White, Marton Avenue, Mount Albert, Auckland, N.Z. (Change of address).

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QRA's Wanted.

A 6MA, 6TD, 5HB, DX8.

33.—Sir Oliver Lodge, the Pioneer of Tuning.

By ELLISON HAWKS, F.R.A.S.

IN our last instalment we dealt with Marconi's work, up to the time when signals were transmitted across the English Channel and when his system was adopted by shipping companies and the Admiralty. Let us leave Marconi's work for a moment and turn to one of the most important of all wireless inventions, brought into use about this time. This was the condition of "syntony," or "resonance," as it was called in those days, but more popularly known to-day as tuning, of which Sir Oliver Lodge was the pioneer.

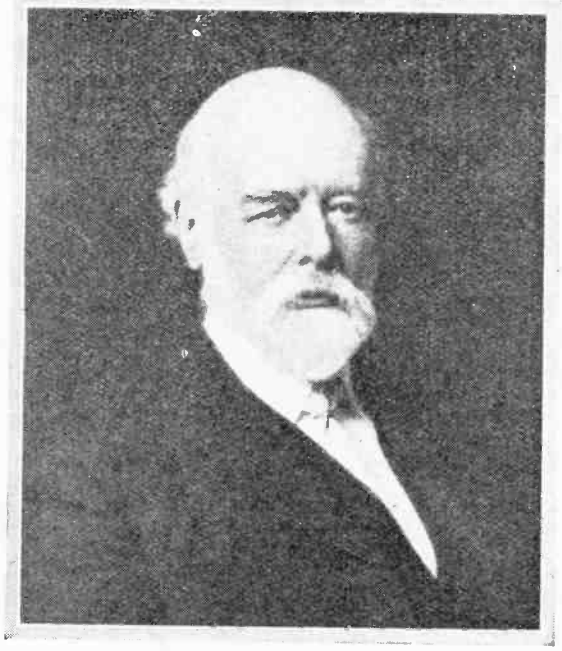
A Disciple of Hertz.

Oliver Joseph Lodge was born at Penkhull, Staffordshire, on June 12th, 1851. He was sent to the Grammar School at Newport, where he remained until he was fourteen. On leaving school his father, who was a potter, took him into the works, and everything pointed to the boy becoming a successful potter.

During this time, however, he came across some old copies of the *English Mechanic*, and a new world opened its doors for him. He had had no teaching in science—in fact, he did not know there was such a thing, but now he read everything he could during his leisure hours.

Seven years were spent among the clay and the potter's wheels before his father would consent to him following his natural inclinations, and then sent him to London to study at the University College. Here the youth matriculated, was appointed demonstrator in Physics, took his B.Sc. and D.Sc. degrees. He then became Assistant Professor of Physics and Mathematics at the Liverpool University, where later he was appointed to the Chair of Physics. From here he proceeded to the Birmingham University, of which he became Principal in 1900.

Whilst at Liverpool, Lodge commenced a long series of experiments in connection with electrical phenomena, ether, and kindred subjects. He was attracted by the predictions of Clerk Maxwell, and was a disciple and expounder of Hertz in England. He was actually transmitting wireless signals long before the world had heard the name of Marconi. As early as June 1st, 1894, he lectured in London, repeated all Hertz's experiments, and demonstrated the efficiency of the Branly coherer as a detector of Hertzian waves up to distances of 150 yards.



Sir Oliver Lodge.

Introduces "Tuning."

On May 11th, 1898, a complete set of Lodge's apparatus was shown at the Royal Society. Instead of the Morse key generally used, Alexander Muirhead's automatic transmitter, with punched tape, was employed, and a siphon-recorder was connected to the receiving apparatus. The apparatus worked well, as it always had done, and it is regrettable that Lodge never tried it over any considerable distance, but confined his experiments to the laboratory and the lecture room.

It is remarkable to think that although wireless telegraphy,

Pioneers of Wireless.—

for which scientists had been searching for so many years, was at this time well within his grasp, he failed to seize the opportunity of turning Hertz's discovery to practical value. "Stupidly enough," he wrote later, "no attempt was then made to apply any but the feeblest power, so as to test how far the disturbance could really be detected."

Two of the great objections to Marconi's system, the latter of which became more serious with the installation of every additional transmitter, was (1) that there was no privacy in the messages transmitted, and (2) with a number of stations working at the same time there was a general interference that at times amounted, at any rate, to difficulty in working if not a general confusion.

In 1897 Lodge called attention to the greatly improved results to be obtained from tuning the transmitter and receiver. He showed that some degree of privacy could be obtained, and that unwanted messages could be eliminated to a certain extent. Some of his suggestions in this connection were embodied in his Patent No. 11,575 (May 10th, 1897) for "Improvements in Syntonised Telegraphy Without Wires."

At first Marconi used an induction coil, with a battery connected to the primary circuit. The secondary circuit was connected direct to the spark gap, one ball of which was connected to earth and the other to the aerial. In 1900, however, Marconi introduced an improved apparatus, in which was a modified Leyden jar or "condenser," and a coil of wire, the discharge being through the induction coil and across a spark gap as before. The effect of the condenser was to store up a great amount of energy every time it was charged; when discharged this energy was imparted to the aerial, and so to the ether. Lodge's suggestion for tuning was also adopted by connecting one terminal of a second coil to the aerial and leading its other terminal to earth.

There were thus two distinct circuits: the first composed of the induction coil, the condenser, and the primary tuning coil; and the second of the aerial and the secondary tuning coil. The two circuits were tuned one with the other, thus causing the oscillations set up by the rapid charge and discharge of the condenser to be repeated by induction as sympathetic oscillations in the aerial. Not only was the energy thus radiated very much more powerful, but the waves decreased only slowly in amplitude.

The receiver was also improved, a tuning coil being introduced, and the primary and the secondary circuits tuned, as in the case of the transmitter. All four circuits were thus in tune with each other, and this improvement was a great step towards the commercial success of wireless.

NEXT INSTALMENT.

Marconi at Work in England.

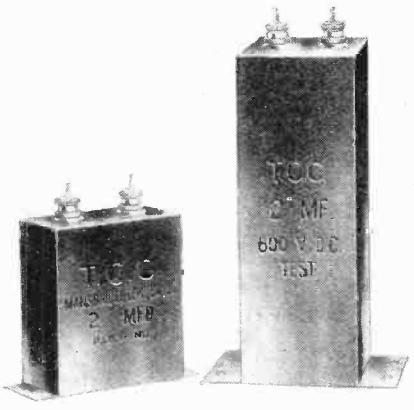
SMOOTHING CONDENSERS IN BATTERY ELIMINATORS.

MANY amateurs in the matter of designing smoothing circuits merely select condensers of suitable capacity without concerning themselves with the voltages which the condensers are designed to withstand. Entire disregard to the maximum potential which can be applied to large-capacity smoothing condensers probably arises from the fact that manufacturers in the past have merely stamped their condensers with capacity values, though it would now seem desirable to mark them also with the maximum voltage on which they can be safely used.

The popular type T.C.C. condenser such as is used as a radio or audio-frequency shunt across the H.T. battery, is in general quite unsuitable for connecting across mains working on a potential of 240 volts. These condensers are actually tested by the manufacturers to withstand a potential of 300 volts, but, allowing for a margin of safety, the amateur is not recommended to connect condensers of this type across direct-current supply where the potential exceeds 200 volts. Particularly are such condensers unsuitable for connecting to alternating current mains where, although the maximum potential may be expressed as only 240 volts, the peak voltage will rise to a value as high as 340 volts and the condenser will in all probability break down after a comparatively short use. A special condenser is made for this purpose, and is marked as being capable of withstanding a direct current potential of 600 volts.

Smoothing condensers are, however, rarely connected directly to alternating current supply, and their position is usually across leads carrying pulsating uni-directional currents. Yet here again, if the maximum output voltage is to be of the order of 150, the peak voltage will exceed 200. Bearing in mind also that the voltage across the condenser will vary with the load and the potential drop through the rectifying valve, one is recommended, in order to be on the safe side, to employ the 600-volt type.

These remarks are made without providing for a factor of safety such as is necessary in the design of apparatus to be connected to the mains, and it may be said that where a condenser is to be used with a peak or D.C. potential of 150 volts that it should be capable of withstanding at least 300 volts.



From this illustration the reader can visualize the difference in dimensions between the T.C.C. battery bridging condenser and the new type specially designed for use in the construction of battery eliminators.

TRADE NOTES.

Change of Address.

On October 20th The British Electrical and Allied Industries Research Association will remove to new offices at 36 and 38, Kingsway, London, W.C.2 Telephone: Holborn 0171.

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Coils for Long-range Receiver.

Readers constructing the three-valve long-range receiver described in *The Wireless World* of September 29th may be interested to learn that suitable inductances already wound can be obtained from Mr. John T. Nichols, manufacturer of Wireless Components, 4 and 5, Glebe Road, Kingsland Road, London, E.8.

MICROPHONIC NOISE.

Some Notes on its Cause and Cure.

Everyone who has used dull emitter valves, particularly those of the fine filament variety, will have noticed the tendency for a low-toned hum, which may develop into a prolonged howl if the set is knocked, or will sometimes even develop of its own accord as soon as the valves are switched on. The trouble is due to the phenomenon known as "microphonic noise," and may become a very serious hindrance to loud-speaker reception. Armed with a knowledge of the causes of this phenomenon the amateur should have no difficulty in effecting a cure.

By F. E. HENDERSON, A.M.I.E.E.

IT is quite certain that the filament is the chief offender in the setting up of valve noises, although it is possible that vibration of grid or anode may have some effect on the extent of microphonic noise to which the valve is prone. Owing to the fact that the trouble is practically entirely absent with bright emitter valves which operate with the filament at a high temperature, it is obvious that it must be due to the elasticity of the low temperature emitting filament, which is of sufficiently high order to enable it to execute transverse vibrations.

Microphonic noise may be considered under three distinct heads:—

1. The effect produced when the valve is tapped or knocked.

2. The prolonged howl caused by reaction effect from the loud-speaker.

3. A condition set up by general vibration of the set, caused by persons walking about, or adjustment of the receiver itself.

Vibration of the Filament.

Some interesting experiments carried out with fine filament dull emitter valves have shown that while the howl is actually in progress, the filament bows out as a violin string, but even with the aid of a powerful microscope no vibration can be observed of the grid or anode.

In the case of (1) above, a knock or jar on the bulb will cause the filament to commence a series of vibrations at its own natural period, the pitch of the note produced (providing there were no reaction from the loud-speaker) depending upon the length, diameter, mass, and tension of the filament wire, according to the expression:—

$$n = \frac{1}{2l}\sqrt{\frac{t}{m}}$$

Where n = frequency per second.
l = length in centimetres.
m = mass in grams per unit length.
t = tension in dynes.

The vibrations in this case are not sustained.

The next, and more serious consideration, is that of the sustained howl often obtained when a large amplification is attempted.

Experiments have shown that, when this is in progress, by increasing the tension on the filament, the pitch of the note produced in the loud-speaker is not materially changed, being the natural frequency of the diaphragm, the filament thus executing a forced transverse vibration, not of its own natural period.

The third condition as given above is also important, and consists of a combination of (1) and (2).

The resulting frequency of note produced depends upon the amplification being obtained, and if the reaction effect is sufficiently strong to force vibrations in the filament at an unnatural frequency. If not, the note will depend on the nature of the filament, and will probably be quickly damped out.

The difficulty now arises that by reducing the tension and thus the tendency to vibrate, the filament is inclined to sag over on to the grid, and thus a certain, carefully designed tension must be put on the filament to prevent this occurrence.

With hot tungsten filaments, the filament naturally expands when the valve is lit up to its operating brightness, and loses some of its elasticity, thus reducing its tendency to set up sustained vibrations at any particular frequency. In the case of thick filament, heavy consumption, dull emitting valves, vibrations are not easily set up; therefore, the trouble is not so apparent.

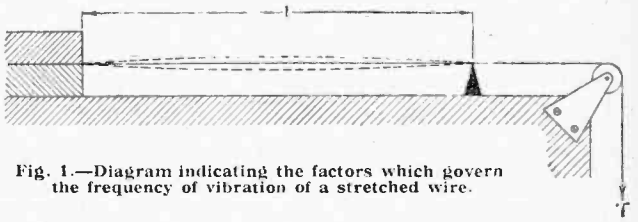


Fig. 1.—Diagram indicating the factors which govern the frequency of vibration of a stretched wire.

The microphonic howl occurs when a large amount of audio-frequency amplification is being obtained, and a set of conditions is formed similar to that observed when the receiver and transmitter of an ordinary domestic telephone are placed in contact.

The sound waves emanating from the loud-speaker horn appear to react on the bulbs of the detector or preceding audio-frequency amplifying valves, either through the air as a medium, or even through the table on which the loud-speaker and set are placed. The filament will respond, and a continuous howl set up by pure audio-frequency reaction.

The most obvious methods of getting rid of microphonic noise, are either to use bright emitter valves, or to reduce the total amplification being obtained—neither of which is to be recommended or likely to be adopted.

Methods of Elimination.

Owing to the disadvantages of reducing filament tension, as explained above, and as the result of experimental work, the means to prevent microphonic noise cannot be found in the design of the valve itself, that is, of the electrodes within the bulb. If, however, we

Microphonic Noise.—

could prevent vibrations of a frequency corresponding to the natural period of the loud-speaker diaphragm reaching the filament, the trouble would be solved. This is best done by mounting the valve so that the whole system cannot respond to any but very low-frequency vibration. A valve holder, mounted either on a spiral spring with a very low natural period, or, alternatively, on flat springs of a resilient nature, will usually go a very long way to eliminating the trouble, although if the amplification is very great and certain types of valves are used, there may still be a tendency to howl. A further precaution would be to surround the bulb with an open cylinder of tin or such like material, which has the effect of shielding the valve to some extent.

It will probably have been noticed that the tendency for the microphonic howl is considerably reduced if the loud-speaker is removed to a considerable distance, preferably to another room from the amplifier, and if only slightly troublesome, can usually be eliminated merely by turning the horn of the loud-speaker so that it directs the sound away from the valves.

Experiments have shown that it is the detector valve that is the chief offender, and usually it is sufficient to mount the valve in this stage of the receiver in an "anti-microphonic" holder, of which there are now, fortunately, several reliable patterns on the market.

By the substitution, therefore, of one such holder in the detector stage it is usually possible to reap the full benefit of low current consumption dull emitters of efficient characteristics, and thus obtain large total amplification and decreased running costs, without the probability of microphonic howl which would otherwise be troublesome.

LOW-POWER TESTS FOR TRANSMITTERS.

General Arrangements for the T. and R. Section's Active Week.

IT will be no news to our readers that the T. and R. Section of the R.S.G.B. intend to conduct a series of low-power short-wave tests during the week beginning on Monday, November 1st. The general arrangements are given in the "T. and R. Bulletin" for October, 1926, and readers, both in Great Britain and abroad, who are interested, either as transmitters or as listeners willing to report, are asked to communicate with Mr. Gerald Marcuse (G 2NM), the Hon. Sec., T. and R. Section, or with Mr. G. A. Exeter (G 6YK), the Hon. Assistant Organiser, QRP Tests, at 53, Victoria Street, London, S.W.1. Special forms have been prepared for recording the required particulars, and copies will be forwarded to those intimating their willingness to participate.

Briefly, the general arrangements will be as follows:—

Power not to exceed 5 watts input to anode of valve. Voltage not to exceed 200-220. Source of current to be either dry cells or D.C. mains only. Each station participating in tests must use a five-letter code word for each transmission, and, if possible, two-way contact established with stations assisting in tests to enable confirmation to be obtained. Reports of reception will also be taken into consideration if these check with competitor's log and code words. Code words to be changed daily.

Prizes will be given to members showing best number of contacts, or other records, taking into consideration distance in miles from transmitting station and reports of reception from other sources; decision of T. and R. Committee final.

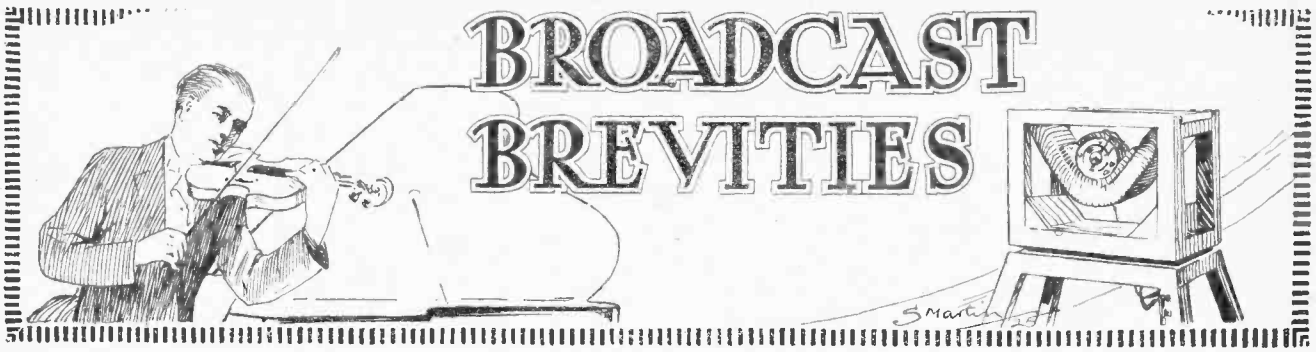
Persons other than those who are T. and R. members can compete, providing they can show sufficient reasons why they have not joined the Section; and, if possible, contribute a sum of 5s. towards the expenses of the Section in undertaking the arrangement of the tests. This sum will be deducted from the subscription due if membership is taken up within the current year.

The Hon. Sec. wishes to emphasise that, in order that these tests may be completely successful, it is absolutely essential that all amateur transmitters using these wavelengths, whether participating in these tests or not, should co-operate by refraining from using higher power than 5 watts, or raw alternating current as a source of supply to the valves. Loose-coupled circuits should be used, and on no account should marking and spacing waves be used. The Hon. Assistant Organiser particularly draws attention to the fact that the tests are being held with a purely scientific object, namely, to ascertain the limit of range possible for satisfactory communication in the 45-metre wave-band with a small input, given satisfactory conditions and absence of QRM. They also afford an opportunity to test the efficiency of various generating circuits in use, together with the external radiating system. At the conclusion of the tests we should have some valuable data on all the above points.

The fixing of the voltage to 200-220 has also been done partly to accommodate the low-power man, but mainly to avoid the temptation to "pump a bit more in," and this is responsible also for the banning of generators and A.C. supply to a great extent, and as a further point, to avoid all undue QRM due to badly filtered generators and rectified A.C. For this reason, too, it is requested that A.C. shall not be used for filament supply. All stations taking part using D.C. mains are also requested to ensure elimination of any supply hum from their QSB, as neglect of this may lead to them being dropped on unduly for possible contravention of the rules; some D.C. mains sound like A.C. improperly filtered.

Finally, a word to all those stations not taking part, both in this country and abroad.

If you won't join in with the rest of the gang, then, as a matter of courtesy and consideration for your fellow experimenters, you are asked to refrain from transmitting during the hours mentioned in the schedules. If you must, then please QSY to 90 metres, and try that for a change; there's plenty doing up there, although lots of people don't know it. These tests will last for one week only.



NEWS FROM ALL QUARTERS.

Wavelength Trouble Ahead?—Marconi House Testing—Trials of a Studio Dance Band—Those Weather Forecasts—No Programmes for Mars.

Early Tests with New Wavelengths.

Although it appears that we shall have to wait until the end of November before the Geneva wavelength scheme gets going, quite a number of stations have been carrying out tests with the new wavelengths on their own account. The British relay stations spent a night of trial and tribulation about a fortnight ago with results which were not entirely happy.

Using the common wavelength of 288.5 metres allotted by the Geneva Committee, the relay stations began working at 4.30 a.m., sending different programmes. "Pandemonium," writes one listener.

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A Full-dress Rehearsal?

Considering the strong indications that trouble may be expected when the changes come into operation, the B.B.C. engineers would be well advised to set their alarm clocks early one of these fine mornings and conduct a full dress rehearsal. The idea has already been considered, and I hear from an authoritative source that the British stations may carry out a few preliminary tests in conjunction with certain stations on the Continent.

Whatever happens, none of these tests will be publicly announced, so listeners who are determined to share the fun will have to dispense with sleep from now onwards until further notice. Ah well; we've done it before.

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Still Going Strong.

"Vera has been playing the piano since she was five," explains the mother of an eleven-year-old child who will broadcast shortly. So wireless hasn't killed the non-stop pianist.

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Graded Licence Fees.

The Bill to facilitate the use of wireless telegraphy by the blind, which, as mentioned in last week's *Wireless World*, Captain Ian Fraser will introduce when Parliament reassembles, reminds me that special facilities for certain classes of listener are already the rule in Russia.

Soldiers, sailors, war invalids, the unemployed, and all poor citizens pay 50 kopecks for their licences. Army officers and State officials are required to pay 1 rouble (100 kopecks) for crystal sets, and 2 roubles for valve sets.

Working men's clubs are taxed at 3 to 5 roubles, while commercial houses pay as much as 10 roubles. For sets in railway restaurant cars and ships' saloons the licence fee is 75 roubles.

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Where a Licence is Compulsory.

Once again the Post Office authorities have been asked to explain the regulations in regard to listeners who do not own a set but take their entertainment from a common receiver shared by a group of individuals. A landlord in a block of Westminster flats possesses a three-valve set from which he has taken leads to the rooms of various tenants.

The position of the tenants is made clear by the Post Office. Each must be in possession of a receiving licence.

Misunderstood.

In these days the Marconi House transmitter rather reminds one of a kind-hearted but cautious mother-in-law, ready to assist the younger generation if her services are required. But mothers-in-law, I believe, are often misunderstood, and poor old "M.H." sustains the tradition.

"What a nuisance it is," writes a correspondent, "that Marconi House always begins test transmissions just when 2LO closes down, and when I want to tune in foreign stations. What, anyway, is the purpose of these tests?"

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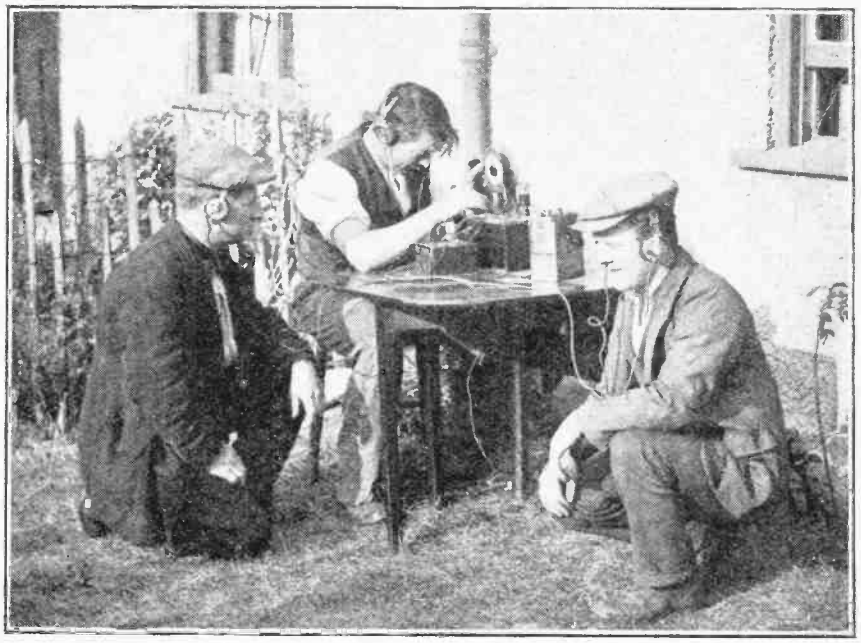
Let Us Be Calm.

The question is a pertinent one, especially at a time when there are rumours of an alternative programme for Londoners. But I am afraid there is nothing at the



LISTENING FOR STRIKE NEWS? These miners in the Kent coalfield are evidently making the most of the strike period to improve their broadcast reception, but they are probably enthusiastic listeners, strike or no strike!

moment to justify excitement. The present tests, I learn from Savoy Hill, are purely for the purpose of keeping the Marconi House transmitter in trim in case of emergencies. 2LO will have plenty of hard work this winter, and the possibility of breakdown must always be provided for.

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And So To Bed.

Regarding the complaint that the "M.H." transmissions are conducted at an awkward hour, it is pointed out that to avoid interference with official and commercial services, such tests can only occur at night and at a time when 2LO is silent.

Might we also try to remember that, despite appearances to the contrary, even broadcasting engineers have beds?

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The Inevitable.

Bill: "Do you believe in auto-suggestion?" Bert: "Is that the system where you keep on repeating 'Every day I get better and better,' and you get well if you're poorly?" Bill: "That's it." Bert: "Well, I believe in it. Every day for the last three months I've said to myself, 'Some day I'll get a summons for not having a wireless licence.' and, sure enough, it came yesterday!"—*News of the World.*

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Jazz Without Dancers.

The other evening I was talking to Mr. Sid Firman, the popular conductor of the London Radio Dance Band. What makes the job of a dance band in the studio rather more difficult than that of "outside" performers is the absence of dancers. The *tempo* and rhythm must be preserved at all costs, and a bare studio with its unemotional microphone is a poor substitute for a gay and glittering ballroom.

Mr. Firman's vivacious conducting is a joy to behold.

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The Unceasing Topic.

Can any other station beat Zurich in the matter of weather reports? It transmits no fewer than four inside eight hours! Talks and music are broadcast during the intervals.

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A Magazine Critic.

A well-known journalist will shortly give a series of broadcasts in which he will summarise and discuss magazines and periodicals in general. His feature will be a sort of wireless "Review of Reviews."

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B.N.O.C. at Leeds.

The boudoir scene from "The Marriage of Figaro," as performed by the B.N.O.C., will be broadcast from the Theatre Royal, Leeds, on November 4th. The cast includes Percy Heming, Miriam Licette, and Robert Radford.

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Sir Oliver Lodge.

Sir Oliver Lodge is to broadcast a talk on "Atoms and Worlds—The Chemical Atom," from 2LO studio on October 27th.

Manchester Wireless Exhibition.

Programmes will be broadcast from Manchester between October 26th and November 1st in connection with Manchester Wireless Exhibition which is being held in the City Hall. The transmissions throughout the week will include the opening speeches, a musical comedy, a concertina band, short sketches, and band concerts.

FUTURE FEATURES.

Sunday, October 24th.

LONDON.—Raymond Trafford reading "The Hound of Heaven."
CARDIFF.—Religious Service in Welsh.
MANCHESTER.—Recital by Dale Smith (baritone) of Tennyson's Songs.

Monday, October 25th.

LONDON.—The Old Inns of London.
MANCHESTER.—Grand Orchestral Concert conducted by Percy Pitt.
NEWCASTLE.—Schubert Programme.
GLASGOW.—Bizet Anniversary.
BELFAST.—"A Country Cottage" Fantasy, by Patience Raymond.

Tuesday, October 26th.

LONDON.—Chamber Music.
BIRMINGHAM.—"Sleuth 'Ounds," by Birmingham Radio Players.
GLASGOW.—"The Ambition of Annabella Stordie"—Scottish Recital.
ABERDEEN.—Ballad Concert.

Wednesday, October 27th.

LONDON.—Russian Programme.
BIRMINGHAM.—Students' Carnival Concert.
CARDIFF.—Recital of The Orchestra's Favourites
MANCHESTER.—Inaugural Concert of Manchester Station's Wireless for the Blind Fund.
GLASGOW.—Paisley Programme.

Thursday, October 28th.

LONDON.—Strauss Songs sung by Vivienne Chatterton.
BIRMINGHAM.—"An Autumn Programme."
CARDIFF.—"Lady Windermere's Fan," by Oscar Wilde.
MANCHESTER.—The Manchester Concertina Prize Band.

Friday, October 29th.

LONDON.—"Potted Opera," conducted by Stanford Robinson.
CARDIFF.—"Musical Chairs." by Alma Vane, Florence Oldham, and Harold Kimberley.

Saturday, October 30th.

LONDON.—"My Programme," by J. R. Clynes.
GLASGOW.—Scottish Hallow-e'en Programme.
ABERDEEN.—"Salt Beef," presented by Aberdeen Radio Players.

***Punch*'s Editor.**

Sir Owen Seaman, Editor of *Punch*, will make his contribution to the broadcast series of illustrations of "Humour from Different Angles" on October 28th.

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The Pirate at His Worst.

The highest number of broadcast pirates to the square mile is probably to be found in South Africa, where an early end to broadcasting is being prophesied by the more pessimistic members of the community. During the past year the Johannesburg station incurred a loss of £4.166, and the number of licences dropped from 8,281 to 5,268. In Durban the deficit for the current year amounted to £7,600.

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Mars Again.

On October 27th, we are told, the planet Mars will be in a more favourable position for wireless communication with the earth than at any other period for the next 100 years.

A leading official of the B.B.C. has stated that no sort of programme is being framed for the entertainment of the Martians on this auspicious occasion. This seems to be a wise decision, considering that the B.B.C. is having a hard enough job trying to please its earthly audience.

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Broadcasting from a Train.

The Canadian National Railways, which were the first in the world to provide passengers with regular broadcast programmes, are now responsible for another interesting wireless development. An official at the London branch of the C.N.R. tells me that a broadcast transmitter has been installed on a special train in which lecturers tour the prairie provinces giving agricultural information and instruction to farmers.

The lecture car has accommodation for only 100 people, but by means of broadcasting many farmers situated in outlying districts can tune in the lectures which otherwise they would never hear. The service is much appreciated.

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"The Gondoliers."

The second transmission of an excerpt from a Gilbert and Sullivan opera from the Princes Theatre, London, will take place on Monday next, October 25th, when a half-hour excerpt from "The Gondoliers" is to be given.

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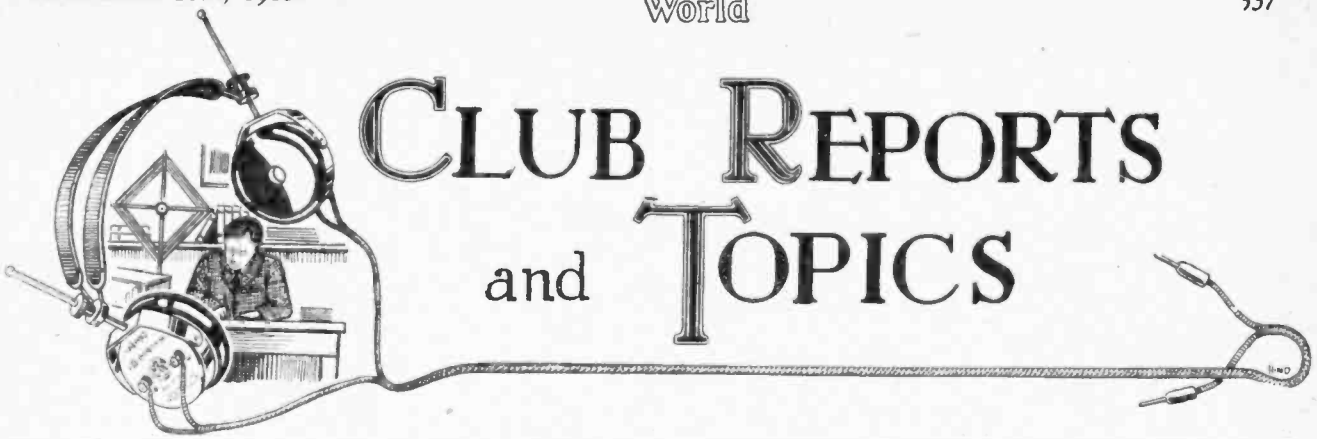
Colonial Premiers to Broadcast.

Speeches by several of the Colonial Premiers attending the Imperial Conference will be broadcast from the Guildhall on Friday next, October 22nd. The speeches will follow a dinner given in honour of the Premiers by the Royal Colonial Institute, the Overseas League, the British Empire League, the Victoria League, and the British Empire Club. The broadcast will probably include speeches by Mr. Bruce, General Hertzog, Mr. J. G. Coates, and Mr. Mackenzie King.



CLUB REPORTS and TOPICS

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

Loud-speakers Compared.

A demonstration of three distinct types of loud-speaker was conducted by Mr. Diggle at the first winter meeting of the Southport and District Radio Society on October 4th.

The lecturer's subject was "Modern Loud-speakers," and he showed by comparison how different instruments reproduce the higher and lower frequencies at varying strength.

Hon. secretary: Mr. T. G. Storry, 67, Virginia Street, Southport.

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A New Lease of Life.

The Walthamstow Amateur Radio Society (Y.M.C.A.) has now taken on a new lease of life. Meetings will be held in the Y.M.C.A. every Thursday at 8 p.m. New members will be especially welcome.

The hon. secretary, to whom all enquiries should be addressed, is Mr. H. J. Sarson, 79, Ferndale Road, N.15.

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A North London Amalgamation.

Future meetings of the Muswell Hill and District Radio Society will be held at Tollington Park School, where there are unrivalled facilities for conducting demonstrations and experiments. The new premises have been secured partly owing to an encouraging increase in membership and partly because, by a unanimous vote, an amalgamation has been effected with the Tollington School Society, which forms a junior section.

An excellent programme of demonstrations and lectures has been arranged for October, November and December. A copy of the new syllabus, together with a membership application form, can be obtained from the hon. secretary, Mr. Gerald S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

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Successful Year at Ipswich.

Perhaps the most important work of the Ipswich and District Radio Society during the past year was carried out beyond the confines of the club-room. At the request of the B.B.C. the Society dealt with several cases of complaint from the general public, and also conducted tests which, it is believed, proved of considerable help to the Broadcasting Company.

These facts were mentioned by Mr. H. E. Barbrook, the hon. secretary, in submitting the annual report at the Society's business meeting on October 4th. Five public lectures were delivered during the year, and, in addition, club meetings were held every fortnight. The membership has increased by 25.

The first popular lecture of the winter session will be given on Monday, November 1st, at the club headquarters, 55, Fonnereau Road, Ipswich. The subject will be "Condensers," and the speaker will be a representative of the Dubilier Condenser Co., Ltd.

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A Lecture on Telearchics.

"Telearchics, the Wireless Control of Distant Mechanism," was the title of a lecture given before the Golders Green and Hendon Radio Society by Mr. A. P. Castellain, B.Sc., D.I.C., on October 7th. Starting with the fundamental arrangement for distant control, Mr. Castellain proceeded to explain the various relays used to control currents, and described the apparatus necessary to produce and receive the controlling energy. He showed alternative methods of obtaining various controls on one wavelength by means of (1) varying modulation of the transmitter and transformer circuits tuned to the several modulations, and (2) impulse control, an ingenious arrangement whereby the armature turns a cog wheel one degree for each impulse. He illustrated the operation of this latter method of control by his now celebrated model boat, "Telearch 1." Many questions and some discussion followed this most interesting lecture.

The next meeting of the society will be held on Thursday, October 21st, when Dr. Morgan will give two lecturettes, (a) "The Eye and the Ear in Relation to Radio," and (b) "The Superheterodyne." The hon. sec., Lt.-Col. H. A. Scarlett, 357a, Finchley Road, N.W.3, invites enquiries from anyone in the district who is interested.

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QRP.

The QRP Transmitters' Society, which was recently formed in the Wanstead district, is carrying out a series of low-power transmission tests on 45 metres with the idea of obtaining data on the most suitable aerials for the work and the best method of feeding them. Several members are conducting tests in transmission without an aerial.

Hon. secretary: Mr. L. J. Fuller (6LB), Glenburn, 13, Seagry Road, Wanstead, Essex.

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A Triumph for Peckham.

An exhibition to signalise a triumph was held by the Oglander Radio Fellowship at their headquarters in Oglander Road, Peckham, London, S.E., on October 6th. The triumph lay in the fact that the Society has won the first and second prizes in a competition organised in connection with the Selfridge Radio Exhibition.

The Fellowship exhibition was composed of sets contructed by members, and included several outstanding pieces of work. Among them was an Anglo-American 6-valve set shown by Mr. C. H. Higgins, Vice-President, and a 2-valve portable constructed by Mr. White. Also on view was a 4-valve Neutrodyne built by all members of the Society.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 20th.

Muswell Hill and District Radio Society.—At 8 p.m., at Tollington School, Tetherdown. Demonstration and Lecture on "Construction of Cone Loud-speakers," by Mr. W. G. Cauldwell and Mr. Anderson.

Golders Green and Hendon Radio Society.—At 8 p.m., at the Club House, Willifield Way. Club Dance.

THURSDAY, OCTOBER 21st.

Golders Green and Hendon Radio Society.—At 8 p.m., at the Club House, Willifield Way. Lecture: "The Eye and the Ear" and "The Superheterodyne," by Dr. Morgan.

Tottenham and District Wireless Society.—At 8 p.m., in the Lansdowne Hall, High Road, Tottenham, N.17. Exhibition and Demonstration (admission free).

MONDAY, OCTOBER 25th.

Southport and District Radio Society.—At 8 p.m., at St. Andrew's Hall, Part Street. Discussion on Competition and Exhibition.

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.C. MAINS RECEIVERS.

Sir,—In your issue of September 29th there appears a letter on the subject of operating wireless receiving sets direct from alternating and direct current mains.

It would be extremely difficult for anyone to be severely dogmatic as to the priority of any particular person or firm in the operation of wireless sets in the manner indicated.

It is not perhaps generally known that some of the earliest researches in this direction date back to the year 1917, when M. R. Barthelemy studied this particular problem on behalf of the French Government with a view to eliminating accumulators and batteries from the sets then in use for war purposes. Subsequently a great deal of additional research was carried out by M. Moye and Dr. Corret, in France, on this subject, the results of which were in part published in *T.S.F. Moderne* for August, 1922, since which time complete wireless sets arranged for operation on D.C. and A.C. mains have been produced and sold by the firm of Pericaud and others.

There has never been any insuperable difficulty in obtaining good reception in this manner, providing all the factors disclosed by the early investigators were taken into consideration, and, in fact, the writer demonstrated some years ago at the Institution of Electrical Engineers a four-valve McMichael set which could be operated from the A.C. supply or from accumulators by means of a change-over switch, so as to demonstrate that it would work equally as well on either source of supply.

The factors controlling satisfactory operation with raw or unrectified A.C. do not appear to be generally well known or understood, although they were communicated in a lecture by the writer to the Radio Society of Great Britain at an informal meeting more than two years ago. One of the main difficulties arises from the fact that manufacturers are all desirous of selling a battery eliminator apart from the actual receiving set.

I am of the opinion that it will be extremely difficult to guarantee perfect headphone reception until all freak receiving sets have been eliminated and unless the receiving set and the battery eliminator are designed specially to co-operate with each other.

L. F. FOGARTY, M.I.E.E.

Ruislip.

October 2nd, 1926.

BATTERY ELIMINATORS.

Sir,—Visiting the recent Radio Exhibition at Olympia, one observed that there is a tendency to introduce apparatus for the elimination of batteries, in other words, to take the current from the electric lighting mains to use for wireless sets. Most of the apparatus exhibited for this purpose would, to my mind, be unsafe to connect to the electric light mains, and it would appear that the designers have very little knowledge of regulations which control any apparatus that is for connection at such voltages as we use in our homes. I think a note of warning should be given, and no apparatus should be allowed to be connected the design of which does not comply with the regulations which exist for the protection of the public.

A few of the points which should be looked to are as follow:—(1) Protecting the apparatus by proper size fuses. (2) Making it impossible to get at terminals which may have the full supply voltage on them, without first disconnecting the supply to the apparatus. (3) Cable entries to the apparatus should be carefully bushed. (4) All external metal work should be carefully earthed. (5) The safety factor on condensers used on this type of apparatus, when connected to a public supply, must be higher than heretofore. The puncturing of a condenser would cause a serious short circuit and danger of shock. All condensers should stand at least four times the supply voltage.

There was only one design at the Exhibition in which, seemingly, the designers had in mind the above point of view.

N. W. PRANGNELL.

London, W.3.

Oct. 4th, 1926.

THE "EVERYMAN" FOUR.

Sir,—A few days ago I wrote asking you to recommend me a 4-valve circuit of good quality and after obtaining the two copies of *The Wireless World*, which foolishly I had not bought during the summer months, containing the instructions for making up the "Everyman" Four, I have carried out the instructions therein and made the receiver.

This is only one of many of your circuits which I have made up, but it has such outstanding qualities that I feel I must write and congratulate you upon the product: it is a little difficult to believe that this set can produce such wonderful results.

To those who think the transformers will prove a little difficult to construct, I should like to advise them to buy a 16in. length of $\frac{3}{16}$in. ebonite rod, threaded 32 to the inch, from their wireless dealer, and if they cut it into strips of 2in. and cut it in half lengthways, they will find that when these pieces are placed round the former and held in position by a rubber band, the transformer winding is made extremely simple.

Wishing you every success with your publication at its reduced price.

LOUIS PEARSON.

London, N.12.

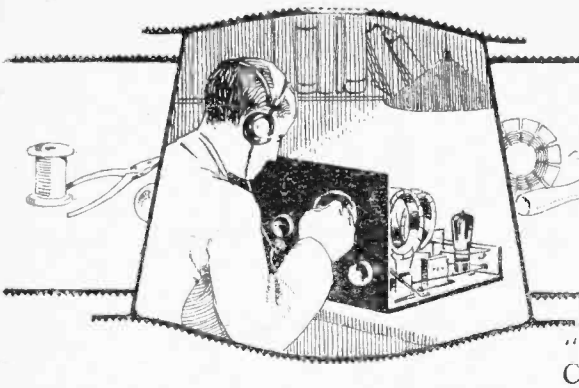
October 13th, 1926.

AMERICAN RECEPTION.

Sir,—Mr. Filgate's letter in the September 29th issue reminded me of your request for reports on American station reception. I received WPG on Sunday morning, August 29th, from 1 a.m. B.S.T. until he signed off at 5 a.m. B.S.T., followed by WG? (WGY by wavelength) and WEA between 5 a.m. and 5.30 a.m. On Sunday morning, September 5th, I switched on at 12.55 a.m. B.S.T. and picked up WPG again at once and held him until he signed off at 5 a.m. B.S.T. After this I picked up WGY, and a station which was most probably CNRA, Canada; items from the last station were clear; also announcements, with the exception of the call sign (I got the RA or CA at the end and knew it was composed of four letters); the wavelength tallies with this station. I have received confirmation from WPG of the August 29th reception and also a surprise. I thought WPG was working with 500 watts power (as listed in *World Radio*), but I have received a picture from the station director of the new high-power transmitter working on 5kW (5,000 watts), so this accounts for his apparent super-range. His strength has really been excellent; both times I got him he was at what I call small loud-speaker strength, with wonderful clarity, using 1-v-2 (H.F. neutralised with loose coupled aerial). The new transmitter is a Western Electric Graybar type.

GUY HARTLEY.

Hull, October 3rd, 1926.



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.

Solid Dielectric Condensers.

I notice that in receivers using a small fixed condenser in series in the aerial circuit, an ordinary solid dielectric condenser is usually used. Would any advantage be gained by using an air dielectric condenser in this position? D.P.R.

In a receiver of modern design in which great pains have been taken to eliminate losses in other parts of the circuit it might be an advantage to use an air dielectric condenser in this position, since these are now obtainable. In many receivers, however, the losses are so high that any advantage obtained from little refinements such as this would pass unnoticed, or, to put it another way, it might be said that any losses introduced by the solid dielectric condensers would be swamped in the far greater losses present in other parts of the circuit. Indeed, it might almost be said that in the old type of direct-coupled set, little, if any, advantages were obtained by using an air dielectric tuning condenser of good design over those given by a solid dielectric variable condenser of bad design, since it must be remembered that the damping present in the circuit due to the high resistance aerial and leaky grid rectification was so high that any additional losses in condenser or tuning coil would be overshadowed, and so the substitution of a low loss coil and condenser would make no appreciable difference whatsoever.

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A Sensitive Two-valve Receiver.

Some time ago you published a circuit in the "Readers' Problems" section of your journal under the title of "Sensitive Two-valve Receiver." I constructed this set, and found that its claims to sensitivity were more than justified, and have succeeded in logging a large number of European stations. I wish, however, to effect an improvement in selectivity, and should be glad of any hints concerning this. J.J.M.

This circuit was published on page 433 of our March 17th issue. Its ability to receive stations at a considerable distance is solely due to the remarkable smooth control which is to be had over reaction, which many readers have informed us considerably exceeds that obtainable from a conventional Reinartz circuit.

In order to achieve greater selectivity it is necessary to use a coupled aerial circuit, the aerial being coupled either magnetically or capacitatively to the tuned grid circuit. The necessary circuit diagram is given in Fig. 1. Connecting the aerial to A3 gives the ordinary direct coupled aerial circuit, but it must be remembered that, owing to the fact that the fine reaction control enables the receiver to be adjusted very close to the oscillation point, quite a useful degree of selectivity can be obtained even without a coupled circuit. If the aerial is connected to A3 the tuning coil should be a No. 25 or 35 on normal B.B.C. wavelengths and No. 150 on Daventry, the reaction coil correspondingly a No. 50 and No. 100. Connection of the aerial coil to A2 gives us a capacitatively coupled aerial circuit, since the variable condenser between A2 and A3 (which may be of 0.0005 mfd. capacity) must be considered as a variable coupling rather than as a tuning device, and it should only be touched when it is desired to alter the degree of coupling, and never when it is merely desired to alter the tuning. In this case coil values will be as follows:—B.B.C. wavelength, No. 50 for tuning and No. 35 for reaction; Daventry, No. 250 for tuning and No. 75 for reaction. Connection to A1 gives us a magnetically coupled circuit. In this case the "aperiodic" aerial coil can consist of a 15-turn coil on the normal wavelengths and a No. 50 coil on Daventry, the other coil values being the same as for the A2 connection. All the coils may be inserted side by side in three fixed coil holders spaced about one inch apart.

With regard to the relative merits of capacitative and magnetic coupling for obtaining selectivity, you should refer to the reply given to "G.P.K." on page 542 of our April 7th issue, in which the merits of the two methods were compared, and it was pointed out that in this type of circuit a capacitative coupling is prefer-

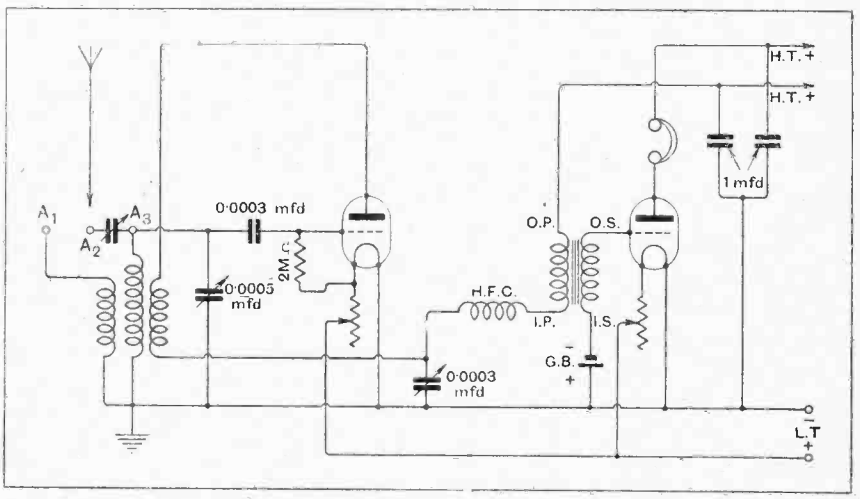

Fig. 1.—A sensitive arrangement of two valves.

able. It should not be forgotten, however, that excellent results can be had by a combination of the two, that is, by putting a 0.0005 mfd. variable condenser in series with A1.

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A Use for Ex-Government Chokes.

I am intending to construct a loud-speaker filter circuit for use with my receiver which employs a low-impedance valve in the output stage. I have a number of small 20-henry chokes, but as these have a core of very small cross-sectional area, and a negligible air gap, I am afraid that they are liable to get saturated under the influence of the rather heavy plate current of my output valve. As I do not want to go to the expense of a special choke, can you tell me if I can alter one of these chokes in any way in order to make it suitable? *T.F.S.*

The main purpose of using a choke filter circuit is, of course, to avoid any risk of loss of volume and quality by magnetic saturation of the loud-speaker core. It is of little use, however, employing a choke of the type you mention, or the trouble will merely be transferred from the loud-speaker to the choke. If you connected two of your chokes in parallel in the output circuit, the permissible plate current would be doubled, because the total cross-sectional area of core would be doubled for a given plate current, or, to look at it another way, we could say that, looking at each choke individually, the current flowing through the windings would be halved, or, in other words, the magnetising force would be halved for a given cross-sectional area of core.

Unfortunately, the connecting of two chokes in parallel would halve the total inductance, and it might be found that this caused a loss of the lower tones, even though, of course, the output valve were of low impedance. Since you have a number of these small chokes, however, you can overcome the difficulty by paralleling two pairs of them, and then, considering each pair as one unit of 10 henries inductance, connect in series, thus restoring the original value of inductance. This method of using four chokes will give the same inductance as one choke, but will have double the current carrying capacity from the point of view of magnetic saturation. Similarly, it would be possible to use six chokes (two units of three paralleled chokes) to give three times the current carrying capacity and the same inductance.

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A Polarity Puzzle.

I wish to charge a small L.T. accumulator from my D.C. mains in series with a lamp. I intend actually to charge by inserting an adapter in a lamp holder. Although the positive and negative mains are each clearly marked at my meter, I have no method of knowing which is which in my lamp holder. Can you give me a simple method of ascertaining this? *P.K.T.*

This can be determined in a very simple manner. Obtain a glass of water and dissolve in it a teaspoonful of ordinary salt, and connect up in series with the lamp holder and a lamp (the lamp which you will have removed from the holder will be suitable) in accordance with Fig. 2. It will not be found that bubbles are emitted from both wires which are immersed in the water, but twice the amount of bubbles are given off from one wire than from the other. The wire giving off the larger number of bubbles is the negative main, and must be connected to the negative terminal of the accumulator for charging purposes. The reason for the emission of double the number of bubbles from the negative main is that simple electrolysis takes place, the water being separated into its component parts of two parts hydrogen and one part oxygen, the hydrogen being liberated at the negative main in double the quantity of the oxygen at the positive main. The glass of water with the two wires dipping into it becomes, in fact, the simplest form of accumulator.

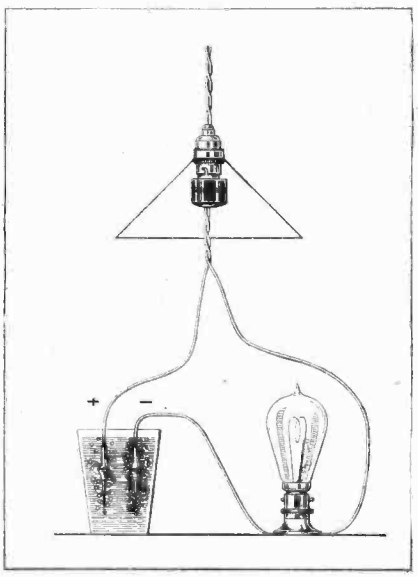

Fig. 2.—Testing mains for polarity.

The purpose of the salt is to increase the conductivity of the water, and without it the bubbles are liberated in too small a quantity to tell the mains polarity at a glance, unless the two wires are fairly close together and a lamp of high wattage is used to pass a fairly heavy current. Do not forget that when this is done it will be necessary to mark the lamp holder and adaptor in order that the adaptor may be inserted in the correct manner on subsequent occasions without the necessity of again applying this test. It might be pointed out that if this test is applied to A.C. mains bubbles will be released in equal quantities from each main, and this, therefore, provides a useful test for those who do not know whether their house mains are A.C. or D.C.

De Profundis.

I was greatly attracted by the "Universal Three-valve Receiver" described in your August 18th issue, and I connected it up roughly, using two plug-in type coils of equal size mounted side by side in place of the special centre tapped coil used by the author. Results exceeded my expectations, and I accordingly decided to build it in permanent form as a "final" set as suggested by the author. I went to very great expense in procuring an elaborate pedestal cabinet, and obtaining the best possible components. I determined, however, not to purchase the special centre tapped coils as I had a large number of plug-in coils by me, and they had given excellent results in the experimental model. After spending much time in the careful construction of this set, I switched on, and not a sound was heard. I have checked the wiring again and again, and have had each component out and tested it separately in another set, but still no sound, even on the local station, and I cannot get the set to oscillate. I reconstructed my original rough model, and I find I cannot get a sound with that now. Can you please assist me to find this mysterious fault, as at present I am in the unfortunate position of having spent a great deal of time and money without obtaining the slightest satisfaction? *O. W.*

Although, of course, it is always difficult to advise in a case of this kind without having the opportunity of an actual instrument test on the receiver, we do not think that your trouble is at all a serious one.

What has probably happened in your case is that when building your original rough model you happened by pure chance to connect up your two plug-in coils the right way round, but when constructing your permanent model and later reconstructing your rough model you were less fortunate.

It is obvious that since these two plug-in coils are standing side by side close up against each other, and are of the same size, the magnetic fields associated with each will, when a certain method of connection is adopted, cancel out, whilst reversing either one of the coils would result in the two magnetic fields harmonising with instead of opposing each other. Reversal of both coils would have the same effect as if neither of them had been reversed. If the magnetic fields of the two coils oppose each other and cancel out, of course the net result will be that the inductance of the whole tuned circuit is practically nil, and it is not surprising that nothing is heard.

You should therefore connect up your set once more, and if nothing is heard, one of the two coils should be reversed, it being immaterial which one is adjusted. It should be pointed out that the reversal can be accomplished either mechanically by actually reversing the coil or electrically by reversing the connections to the coil. The latter is, of course, the most convenient method to adopt.

The Wireless World AND RADIO REVIEW

(14th Year of Publication)

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IDENTIFYING TRANSMISSIONS.

NOW that we have passed out of the Summer season of atmospherics and are rapidly approaching the period of the year when distant reception is least interfered with by weather conditions, more than usual interest attaches to a letter published in our correspondence columns this week, in which a plea is put forward for the adoption of some method whereby broadcasting stations can be easily identified.

Only a small percentage of the world's listeners will ever be satisfied with purely local reception alone, because one of the greatest attractions of wireless is the fact that a wireless set can connect the listener with a choice of stations far afield. It does not require keen observation to recognise that the demand for sets capable of tuning in foreign broadcasting stations, as well as our own, is steadily increasing.

Accepting these facts, those responsible for the programmes of the stations should look farther afield than they are inclined to do at present and realise that beyond their own local centres there may be many thousands who are intent on listening to their programmes; this being so, in the interests of distant listeners it is very desirable that every station should be easily identified, and in these times of overcrowding of the ether identification by wavelength is becoming a difficult problem for any but the experienced experimenter who possesses a reliable wavemeter.

The suggestion of our correspondent is that every station should be identified by a number and that the number should be transmitted in Morse. Whilst we do not necessarily endorse this particular proposal as the best method of providing means for identifying the stations, yet something of the kind is badly needed, and it should preferably be a signal which can conveniently be repeated at frequent intervals during the programme—as, for example, between each distinct item. Now that the broadcasting authorities throughout Europe are able to meet periodically in conference to discuss matters of mutual interest, it would be comparatively easy to introduce some such scheme. Numbering stations would have certain obvious advantages, in that listeners would check off those stations which they heard regularly and would be particularly keen to search out any missing numbers. Periodical reports could then be called for when interesting technical information of value to the stations concerned would be available to show over what areas the range of individual transmitters was ineffective. The numbering of stations might very well be done in order of wavelength, and some distinguishing sign could be given to indicate whether the broadcasting station had a wavelength which rendered it free from heterodyne interference with other broadcasting stations. As it is at present, it is not easy to go from station to station on a highly selective receiver without passing over stations. By numbering stations in order of wavelength, and provided that these numbers were repeated frequently during transmission, a great service would be rendered to listeners. It would be interesting to have the views of readers on the subject.

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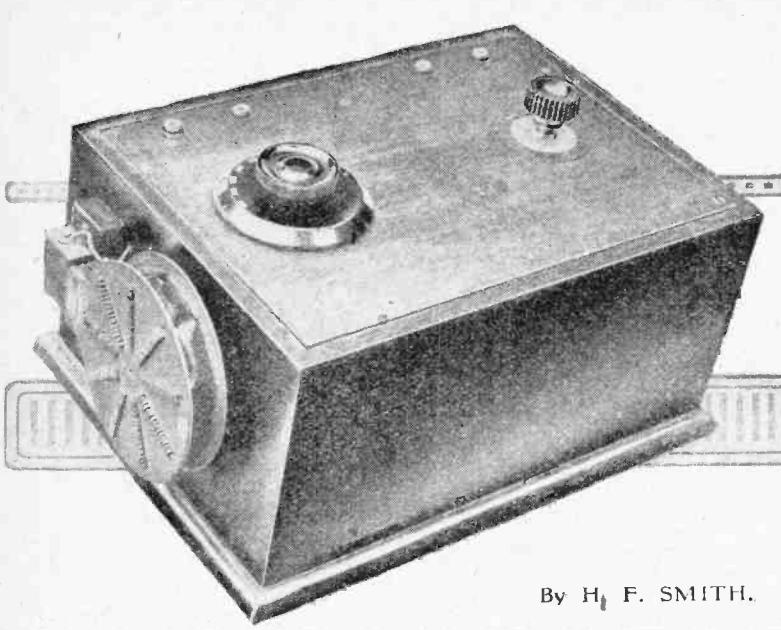


"Economy Two" Loud Speaker Set for the Local Station

By H. F. SMITH.

THE recent introduction of valves with an exceptionally high magnification factor is likely to have an important effect on the design of broadcast receivers. These valves have, unfortunately, a very high internal impedance, but this is being gradually reduced by improved design, and there can be no doubt that they have now reached a stage of practical development where their use can hardly be ignored when a set is required to be economical both in first cost and upkeep. The application of these valves is limited by their inability to handle distortionlessly large grid voltages, and, as already suggested, by their high internal resistance. In view of these facts, such valves would seem to be most usefully and safely employed as anode or "bottom bend" rectifiers, coupled by a high anode resistance to a succeeding L.F. amplifying valve, which can only be of the high magnification type if very small input amplitudes are to be handled.

A couple of years ago it would have been considered impossible to operate a loud-speaker from a set consisting of a detector valve without reaction, followed by a single stage of resistance-capacity coupled L.F. amplification, but, thanks to the improved valves now obtainable, this is quite practicable, provided that a really strong incoming signal is available. It is hoped that a description of a simple and, above all, inexpensive set of this kind will be of interest to those who are either taking up wireless for the first time or who are about to change over from a crystal or single-valve receiver, giving only 'phone signals, to loud-speaker reproduction. Another type of reader to whom this set will possibly appeal is the experimenter, who must have often felt the need of a "stand-by" receiver capable of giving really good reproduction, while his more ambitious instrument is undergoing alterations.

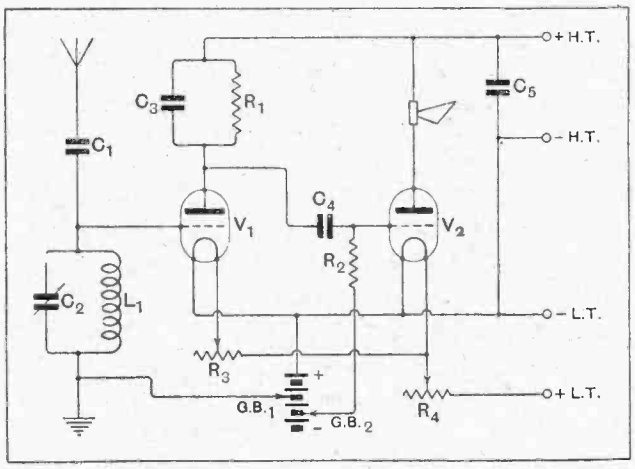


Fig. 1.—The circuit diagram.—C_1 = 0.0002 mfd.; C_2 = 0.0005 mfd.; C_3 = 0.0001 mfd.; C_4 = 0.001 mfd.; C_5 = 1 mfd.; R_1 = 1 megohm; R_2 = 5 megohms; R_3 = 25 ohms; R_4 = 6 ohms.

Provision for Tone Control.

In spite of the fact that the parts used in the set illustrated cost only about two guineas (valves, batteries, etc., are, of course, not included), it can be fairly stated that the quality of reproduction is such that any improvement in this respect would not be noticeable as far as the great majority of loud-speakers at present available are concerned. It is not suggested that the L.F. amplification is equal at all audible frequencies; those who have seen an output curve of even the better type of loud-speaker will realise that it would hardly be an exaggeration to say that this is about the last thing we really need for perfect quality! Instead of striving for the theoretically perfect amplifier, it seems better to face the fact that the average loud-speaker gives undue prominence to the higher frequencies, and to arrange our amplifier so that the voltages corresponding to these notes are reduced, while the low tones are magnified as much as possible. A certain amount of control over this reduction is desirable, in order that various loud-speakers and, equally important, various tastes may be suited.

"Economy Two" Loud-Speaker Set.

It should be emphasised that the set described in this article has a strictly limited range, and will only provide really sufficient loud-speaker volume on an input which would give loud signals on a good crystal set. With a reasonably efficient aerial-earth system its range may conservatively be estimated at from five to ten miles from a main station, and thirty to forty miles from Daventry. Low upkeep cost is a distinct feature; as the detector valve may be run with a dull filament, its L.T. consumption is generally negligible compared with that of the L.F. valve, and its anode current is measured in microamps. instead of milliamps. This valve itself should last almost indefinitely, so, for practical purposes, we have only one valve to maintain.

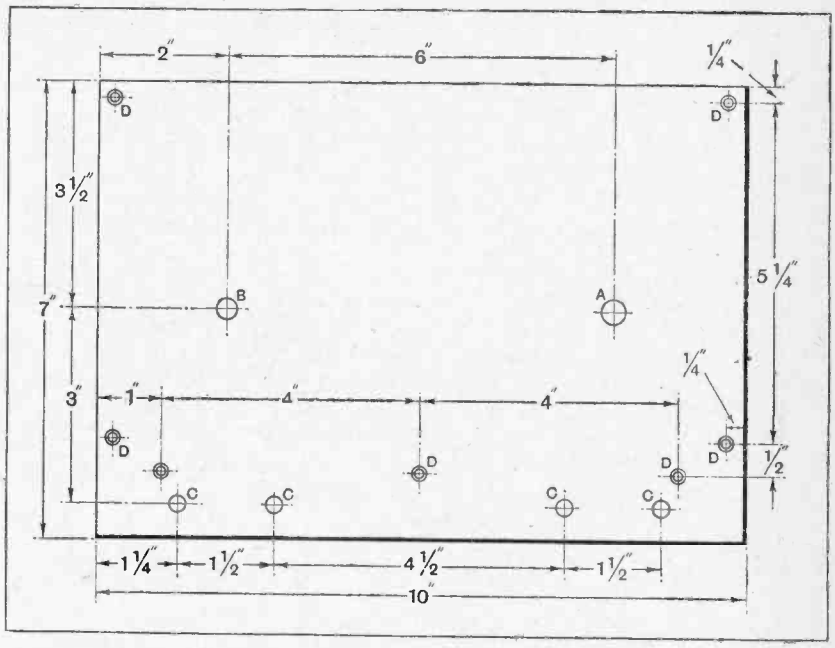


Fig. 2.—Drilling details of top panel. A, 3/8in. dia.; B, 5/16in. dia.; C, 1/4in. dia.; D, 1/8in. dia., countersunk for No. 4 wood screws.

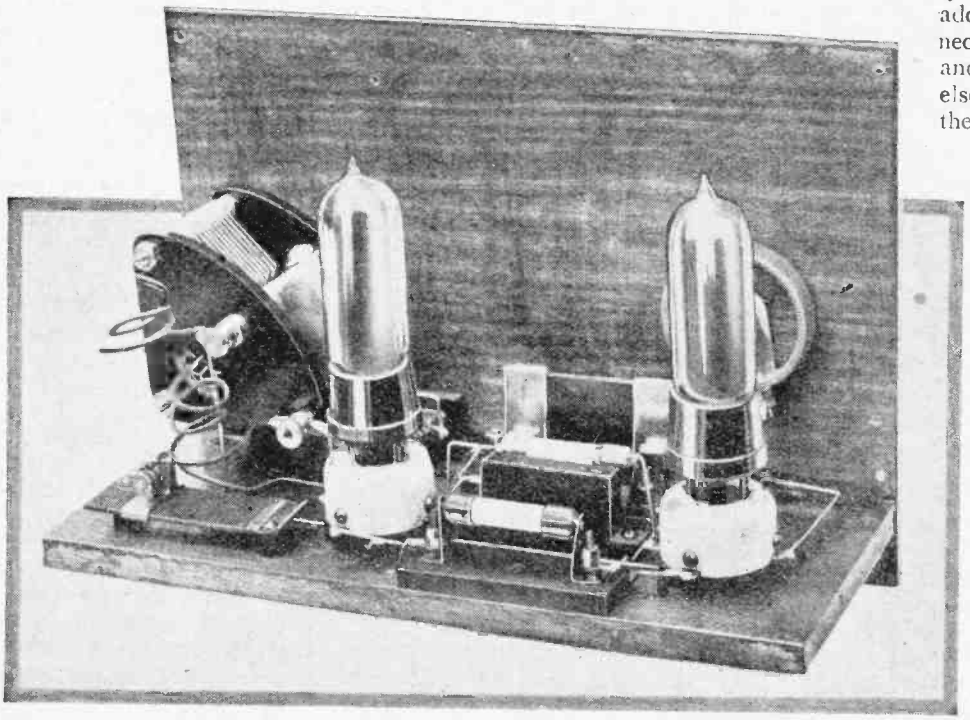
The Intervalve Coupling.

The circuit diagram is given in Fig. 1. To simplify matters a direct-coupled aerial circuit is used with a fixed series condenser and parallel tuning capacity. Across the tuned circuit is connected the grid and filament of the detector valve through the bias battery, which impresses the necessary negative voltage for rectification.

This valve is coupled to the L.F. amplifier through a high anode resistance of 1 megohm, and a 0.001 mfd. condenser fitted with a 5-megohm leak. The values of these components are somewhat unusual, but are those which have been found to give the best all-round results with the particular types of detector valves to be specified later, and are, moreover, readily obtainable.

The arrangement of the filament resistances is also not quite conventional, and has been adopted in order to avoid the necessity of either turning on and off two separate rheostats, or else fitting a battery switch. As the detector valve will always take less filament current than the L.F. amplifier, it is a convenient and practicable arrangement. The resistance R_1 is of the semi-variable type, and, as this valve is not critical as to voltage, it needs only an initial adjustment.

The insulation of a receiver of this description, which includes high resistances, should be beyond suspicion—at any rate, as far as the intervalve coupling is concerned. This point should be borne in mind when selecting components, but otherwise a wide latitude may be allowed in the layout, choice of parts, and method of construction. The anode resistor, however, should be of a type which



View of the underside of the panel, also showing layout of components on the sub-panel. The negative loud-speaker socket is that connected to the plate of the valve.

is guaranteed to carry any appreciable current without change of value. Many grid leaks, although suitable for the particular function for which they were designed, are useless in this capacity.

The mounting of the components will be fairly obvious from the various photographs. With the exception of the grid and anode resistance holders, all the parts are obtained ready-made. The holders are simply rectangles of $\frac{1}{4}$in. ebonite, measuring $2\frac{3}{4}$in × $\frac{3}{4}$in., carrying grid leak clips secured by 6B.A. screws and nuts. These screws are passed through from the underside, and their heads are deeply countersunk to avoid the possibility of contact with the wooden baseboard.

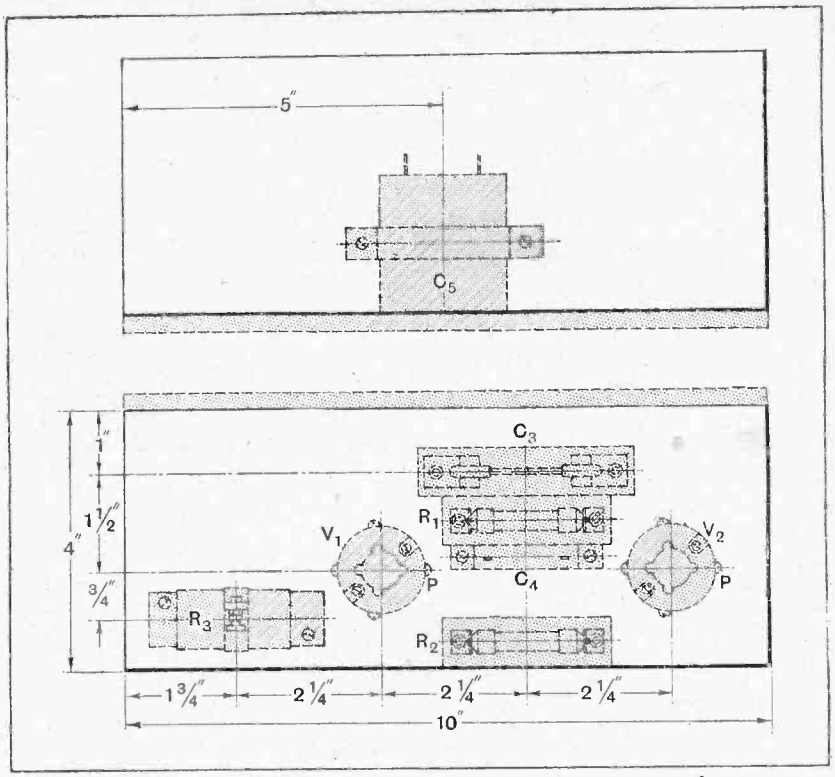


Fig. 3.—Mounting of condenser on back of sub-panel and (below) layout of components on the front of this panel.

Constructional Details.

For the sake of economy, the top panel is of wood $\frac{1}{4}$in. thick. Plug sockets are used instead of terminals (to facilitate changing over when the set is used as a stand-by), and are fitted with insulating bushes. The variable condenser, rheostat, and aerial series condenser C_1 are also fitted to the top panel, and to it is screwed the vertical sub-panel, also of wood, and $\frac{3}{4}$in. thick, which carries the remainder of the components. The woodwork is given a coat of shellac varnish.

The valve holders are raised above the surface by ebonite washers, $\frac{1}{4}$in. thick, as is the Igranic semi-variable resistor. This component is supplied with an eyelet at one end, which acts as the electrical connection; a soldering tag should be placed under the head of the wood screw which passes through this eyelet hole into the sub-panel. Another screw hole must be drilled at the opposite end.

The large by-pass condenser, C_5, actually used in the set illustrated, is of an old pattern, and is secured by a metal strap to the back of the sub-panel. The condensers now sold are fitted with feet, and may be screwed to the underside of the top panel.

The wiring diagram, Fig. 4, shows all the components as if laid out in one plane, but will be found quite easy to follow. No. 20 S.W.G. bare tinned copper wire is used for the majority of the connections, and is insulated by short lengths of sleeving

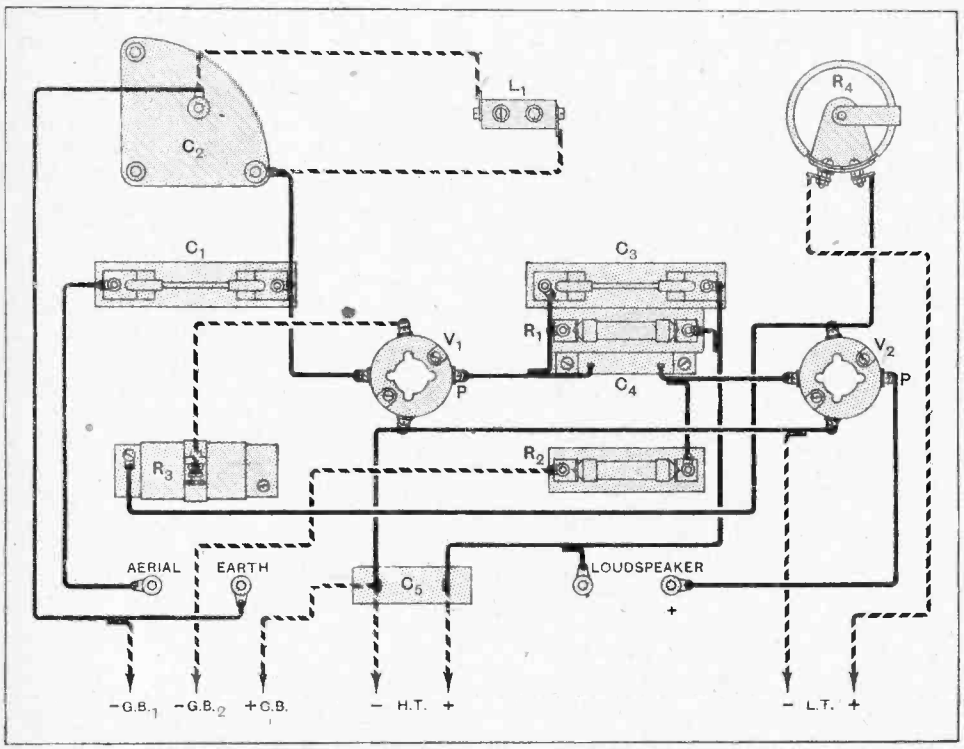
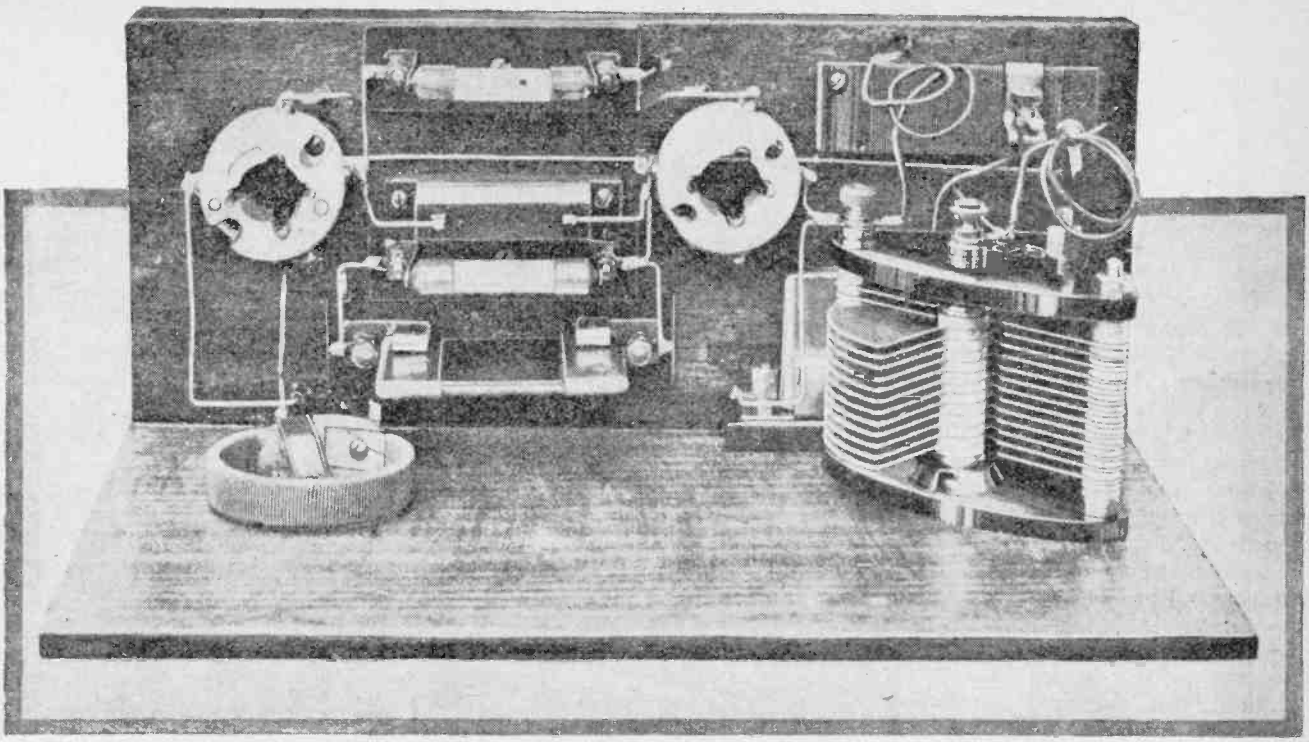


Fig. 4.—The practical wiring plan. Flexible connectors are shown in broken lines. The lettering of the components corresponds with that of the other diagrams.



Another view showing the mounting of components. Note the flexible leads from the variable condenser terminals for joining to the external coil holder.

where it passes through the sub-panel, although this precaution is perhaps hardly necessary.

Instead of using terminals, long leads of flexible wire are passed through holes in the back of the cabinet for connection to the L.T., H.T., and grid bias batteries. Twisted twin wires, coloured red and black and fitted with suitable tag ends, are used for the two first-mentioned batteries, and three leads, of different colours, are plaited together for connecting to the grid bias cells. To prevent any strain on the joints, all these wires are anchored to the back of the sub-panel by improvised cleats, made of soldering tags suitably bent into shape.

The coil socket is screwed to a block of wood measuring $2\frac{1}{4}$in. × 1in. × $\frac{1}{2}$in. thick, which is mounted on the side of the cabinet as shown in Fig. 5. Flexible leads, which should be long enough to allow the set to stand on top of the cabinet, are passed out to this coil holder through suitably drilled holes.

A 50-turn plug-in coil of most of the standard makes will generally be suitable for the reception of a short-wave station, although, in exceptional circumstances, a slightly larger or smaller coil will be required. For Daventry, except at very short ranges, a 0.0005 mfd. fixed series condenser is recommended, instead of that shown, with a 200-turn coil. Alternatively, the condenser base may be short-circuited; if this is done, a No. 150 coil will suit the average aerial.

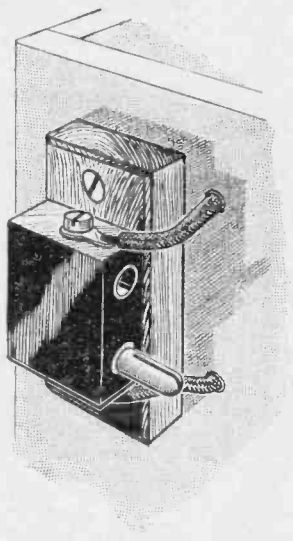


Fig. 5.—Mounting of the coil holder.

Our choice of valves for use in the detector socket (V_1) is at present somewhat limited. An amplification factor of 30 or more is required, and, as far as the writer is aware, the only types of this kind on the British market are the Cosmos S.P.18 "Blue Spot," the D.E.55 "Blue Spot" of the same make, and the Mullard P.M.5*a*. The first requires a filament voltage of slightly under 2 volts, while the other two are 6-volt valves. Another valve which, while of slightly lower amplification, is capable of giving excellent results, is the Ediswan R.C.2, which also takes less than 2 volts.

Operating the Receiver.

The second valve (V_2) is, as already stated, an L.F. amplifier, and if sufficient volume is to be handled distortionlessly, must be at least a small power valve. With a 2-volt detector, one of the same filament rating will naturally be used as an amplifier, and a large number are available; to mention a few, the Mullard P.M.2, Marconi-Osram D.E.6, Cossor Stentor Two, and Cosmos S.P.18/8, all have suitable characteristics. Any 6-volt power valve, with an impedance of some 7,000 ohms and an amplification factor of 6 or 7, might follow either of the 6-volt detectors mentioned above.

As only a small emission is required from the detector, quite a large proportion of the resistance R_1 may be included in circuit; this adjustment is best made while listen-

ing. Filament brilliancy should be only sufficient to give maximum signal strength.

An H.T. voltage of not appreciably less than 120 is recommended; this will necessitate a grid bias of up to 9 volts on the L.F. valve (the G.B.-2 tapping) and about 1½ volts on the detector valve (G.B.-1), depending on its characteristics. For very strong signals 3 volts may be applied here; indeed, an increase of negative bias beyond a certain point acts as a form of volume control.

The suggested value of 0.0001 mfd. for C_3 (across the anode resistance) may seem to be somewhat high, but its weakening effect on the high notes is generally a very real advantage, and, to the writer's taste, at any rate, its use results in a very pleasing and natural tone from the average reasonably good loud-speaker. The critical listener is strongly recommended, however, to experiment himself with values of from 0.00005 to 0.0003 mfd.; it will be noticed that the particular make of condenser used is easily interchangeable. Alternatively, a variable condenser may be connected up in place of the fixed capacity.

Results Obtained.

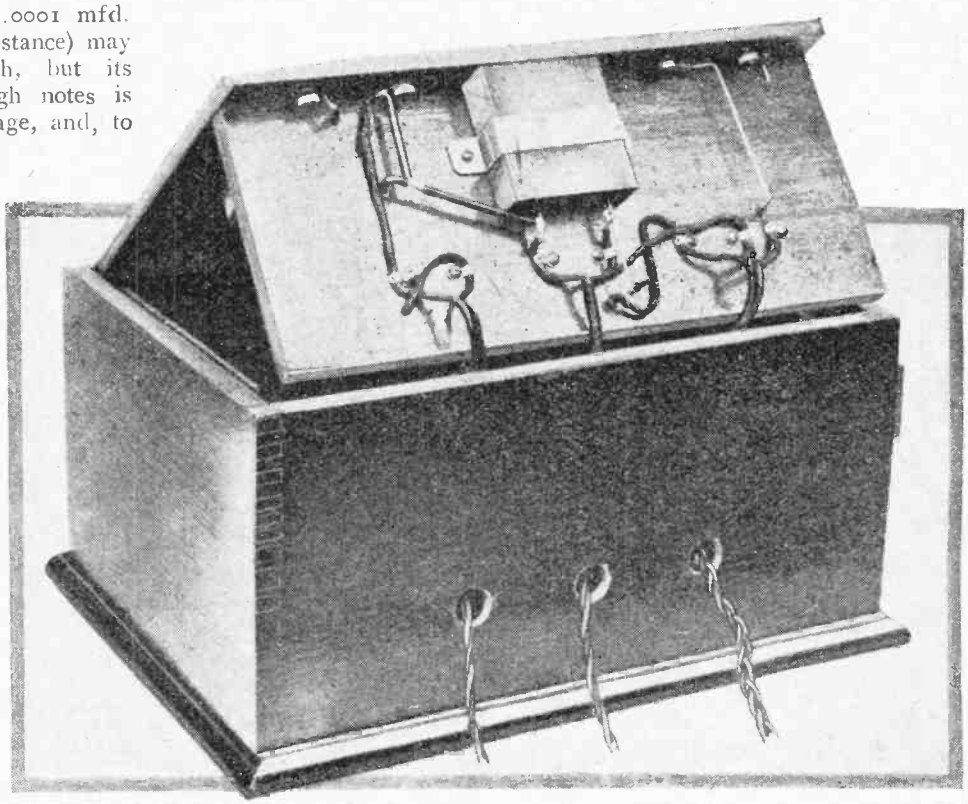
In a simple receiver of this description it is not likely that any puzzling faults will have to be overcome, provided that the components are in order and that attention is paid to the special points mentioned. The only trouble encountered in testing the set illustrated was due to the use of a "soft" valve—this seems to be all too common at the present time. The cause of the poor amplification and bad distortion was evident from the fact that a pronounced blue glow was apparent around the electrodes.

Tested on a good aerial at 2½ miles from the London station, it was found that an ordinary small power valve was hopelessly overloaded, in spite of the fact that a series resistance was inserted in the aerial to cut down signal strength. With the H.F. input still further reduced, good loud reproduction, up to the maximum power-handling capacity of the valve, was obtained.

Handling Greater Volume.

A larger power valve was then tried; the writer admits to being conservative enough to have experienced a guilty feeling at his temerity in using such a valve in a detector-L.F. receiver, although calculations, based on measurement of the H.F. voltage developed across the aerial coil, made it seem likely that it could be usefully employed. This assumption was found to be correct, as it was possible to overload even this valve, with 150 volts on its plate.

The set was also tested at thirty-five miles from the Daventry station, on an indifferent aerial. Good signals were obtained, just up to the voltage-handling capacity of a small power valve with 120 volts of high tension.

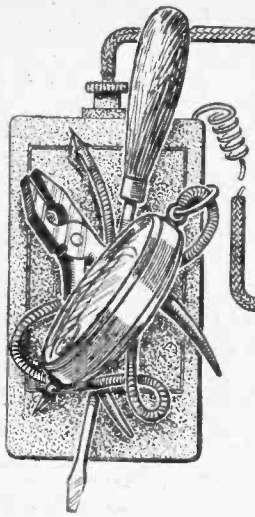


The set partly removed from the cabinet. The method of securing the flexible leads is clearly shown.

LIST OF PARTS.

1 Cabinet (W. & T. Lock).
1 Wooden panel and sub-panel.
2 Valve holders (Athol "Tiger").
1 Fixed condenser with base, 0·0002 mfd. (McMichael)
1 Fixed condenser with base, 0·0001 mfd. (McMichael).
1 Fixed condenser, 0·001 mfd. (Dubilier).
1 Fixed condenser, 1 mfd. (T.C.C.).
1 Variable condenser, 0·0005 mfd. (Jackson Bros.).
1 Grid leak, 1 megohm (Ediswan).
1 Grid leak, 5 megohms (Ediswan).
4 "Clix" parallel plugs, with sockets and bushes.
1 Semi-variable resistor, 25 ohms (Igranic).
1 Rheostat, 6 ohms (Peerless).
1 Single coil holder.
Wire, screws, ebonite, flex wire, etc.

Total cost - approximately £2 2 0, including coil.



PRACTICAL HINTS & TIPS

A Section Mainly for the New Reader.

ALTERNATIVE CRYSTAL RECTIFICATION.

A simple and effective switching arrangement for using either a crystal or valve detector is shown in Fig. 1. The method is applicable only to a direct-coupled set with one or two stages of L.F. amplification, the first of which must be coupled by a transformer. With a fairly obvious modification, however, the same system of connections may be adapted for use with a coupled aerial circuit.

When it is desired to use the crystal detector the switch is closed, and the filament of the detector valve is extinguished by turning off its rheostat.

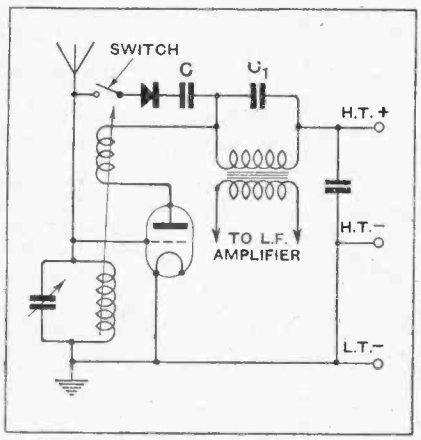


Fig. 1.—Changing from valve to crystal detection.

Incidentally, it is, of course, immaterial whether the valve normally acts as an anode or grid rectifier; no arrangement for rectification is shown in the diagram, as this does not affect the change-over connections. Rectified pulses from the crystal are passed through the stopping condenser C, which should be of large enough capacity to act as a low-resistance path—from about 0.25 mfd. upwards is suitable. This condenser insulates the crystal from the H.T. battery.

The circuit is completed through the primary of the L.F. transformer (across which is connected the usual by-pass condenser C_1) and the H.T. battery or its shunting condenser, and so back to earth.

The switch should be of good insulation and low self-capacity, as it is at high oscillating potential whichever detector is being used. A plug and-socket arrangement may be used instead of a switch if desired.

It will hardly be necessary to add that, when the crystal rectifier is used, the reaction coil will no longer have its usual effect, and it should accordingly be swung clear of the grid coil.

oooo

FILAMENT RHEOSTAT VALUES.

It has already been pointed out that the correct value of filament resistor (in ohms) for use with any valve may be readily ascertained by dividing the volts to be dropped in the resistance by the current taken by the valve (in amperes). The same formula may be applied when two filaments are connected in parallel, and controlled by a common rheostat (or fixed resistor) as shown in Fig. 2 (a). It will be necessary, however, to allow for the increased current, and on the assumption that the valves are of similar type, we can consider the two as a single valve with a doubled filament current.

To take the example of two valves rated at 0.06 ampere, 2.8 volts, and fed from a 4-volt battery, we get 1.2 (the volts to be dropped) ÷ 0.12 (the current in amperes taken by the valves together). Thus a resistance of 10 ohms is required.

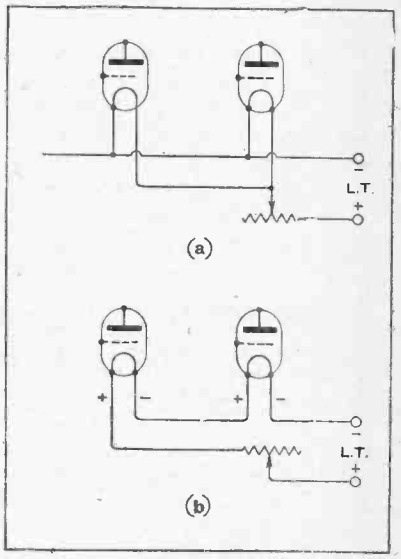


Fig. 2.—Valve filaments in parallel (a) and in series (b). In the latter arrangement the positive and negative ends of each filament are marked.

A similar procedure may be used in determining a suitable resistance value when filaments are connected in series. Referring to Fig. 2 (b), it will be assumed that both valves take 0.1 amperes, the first at 1.8 volts, and the second at 3.7 volts, and that their filaments are to be heated from a 6-volt battery. Thus the voltage to be dropped is 0.5 (6 less 1.8 + 3.7), while the current taken is, of course, 0.1 ampere, so a resistance of 5 ohms will be suitable. In practice, it is usual to choose a rheostat having a maximum value of about twice that actually required.

H.T. BATTERIES.

When purchasing a dry-cell H.T. battery, it is always as well to buy a unit, or units, giving slightly higher voltage than that actually required. This is due to the fact that the pressure supplied by the battery soon begins to fall off after it has been in use for a short while, and, if it has no surplus voltage, it will soon become necessary to connect external cells in series. This is not a very convenient arrangement, and it is very much easier to move the tapping connection to compensate for the inevitable drop in voltage.

It is not suggested, however, that the battery should be greatly in excess of the required size. There is a certain amount of deterioration in even the best dry cells, whether they are used or not. It is difficult to give definite figures, but generally speaking a battery with an excess voltage of about 25 per cent., or even a little more, may with advantage be obtained. It should be remembered that well-made cells of fair size are often capable of giving good service when their voltage has fallen to about two-thirds of the original figure.

Although high-capacity batteries, made up with large cells, may almost invariably be considered as the most economical for use with a multi-valve set taking a heavy anode current, their extra expense is hardly justified in the case of a simple one- or two-valve set. If unnecessarily large cells are used, their life may possibly be terminated by normal deterioration rather than by the drain imposed by the receiver.

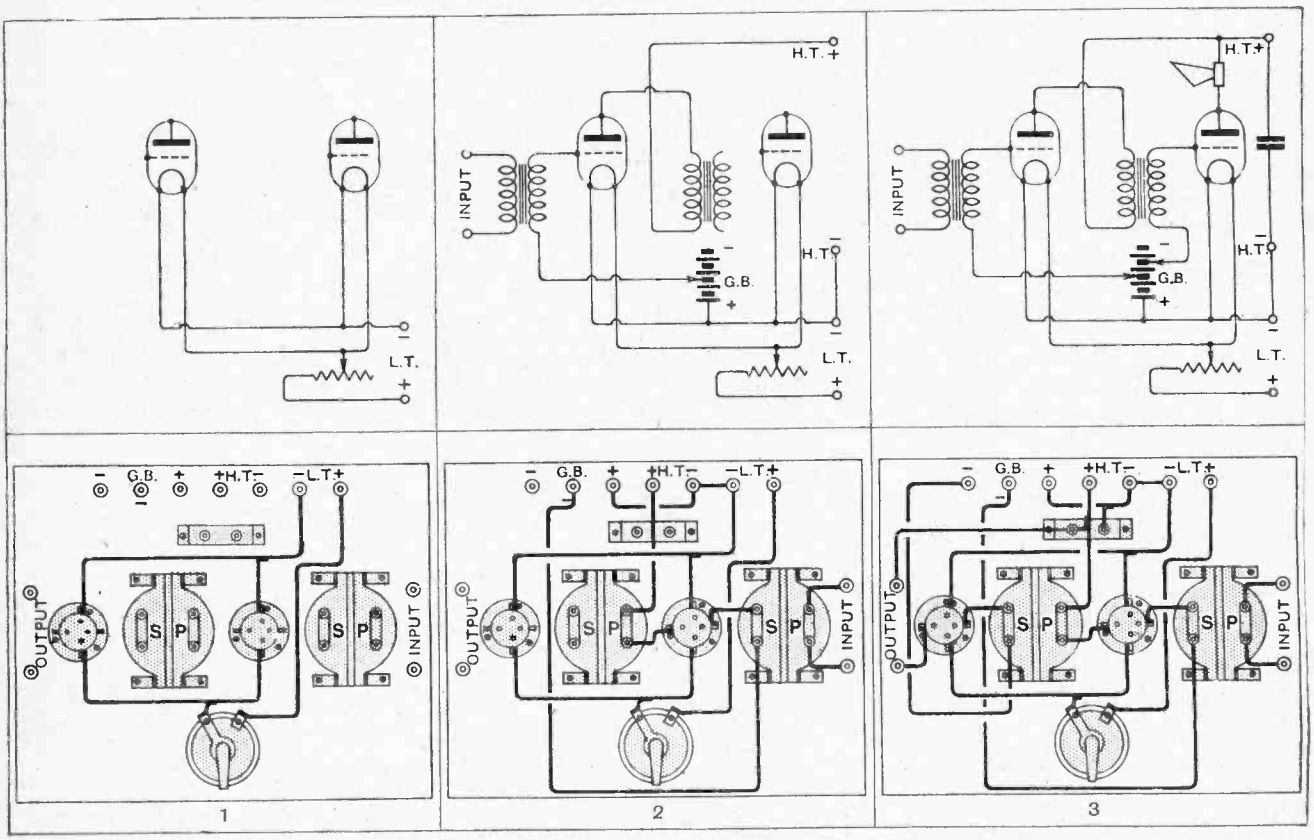
These batteries should always be kept in a dry and moderately cool place; it has been found that their life is very considerably reduced when they are installed in a room where the temperature is high.

DISSECTED DIAGRAMS.

Step-by-step Wiring in Theory and Practice.

No. 47.—A Two-stage Transformer-coupled L.F. Amplifier.

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 amplifier shown below is suitable for adding to an existing valve or crystal detector, in order to increase volume for working a loud-speaker.



The filament circuits are wired in the conventional manner. A single rheostat, which controls both valves, is inserted in the L.T. positive lead as usual. Separate rheostats must be used if the two valves have different filament characteristics.

The transformer primary is wired to the input terminals, which are for connection to an external detector. Its secondary is between grid and filament, with interposed bias battery. The anode circuit is completed through the primary of a second transformer—

—the secondary of which is joined to grid and filament of the succeeding amplifying valve, again through the bias battery. The anode circuit of this valve is completed through the loud-speaker and high-tension battery.

THE RADIO SHIP "TELEARCH I"

Detailed Description of a Wireless Controlled Boat.

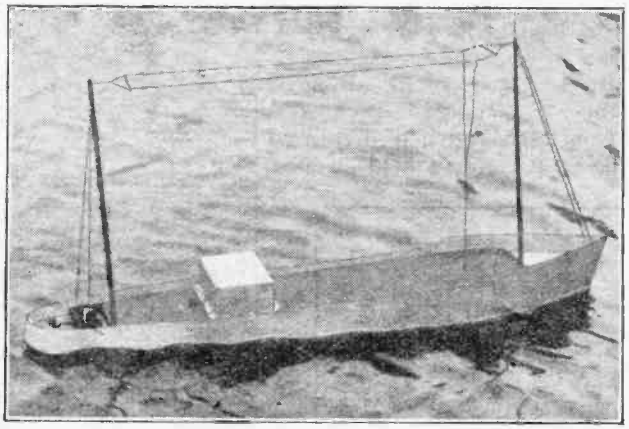
By A. P. CASTELLAIN, B.Sc., A.C.G.I., D.I.C.

A SHORT time ago[1] the writer introduced the subject of Telearchics and showed briefly how it is possible to obtain control of distant machinery without the aid of connecting wires. A little later[2] a general description of a wirelessly controlled model was given, the model taking the form of a small boat—*Telearch I*—about four feet long.

The essential parts of the boat may be divided into the following headings:

(*a*) The radio receiver.
(*b*) The relay panel or "electric brain."
(*c*) The steering gear.
(*d*) The driving motor.
(*e*) Batteries.

A general view of the boat is shown in the photograph, and a plan view in a further photograph, and this should carefully be compared with the outline sketch Fig. 1, showing the positions of the various parts of the "works" detailed above, each of which will be fully described in turn.



General view of the boat in the water.

[1] *The Wireless World*, August 25th, 1926.
[2] *The Wireless World*, September 29th, 1926.

The Radio Receiver.

The receiver is nothing more or less than a single valve detector across a circuit permanently tuned to a fixed wavelength, with provision for reaction to increase the sensitivity, and the whole arrangement is put inside a copper box in order to eliminate, as far as possible, interference by local transmitters on near-by wavelengths.

The circuit of the receiver is shown in Fig. 2, and it will be seen that the well-known Hartley transmitting circuit is used with a variable condenser feed from the plate of the valve to one end of the tuning coil. A small condenser, such as is used for balancing in high-frequency transformer amplifiers, is very suitable in this position, as it will usually be found that the valve just oscillates in the maximum position of the condenser. Thus, by adjusting this condenser the amount of reaction may be controlled; also, once set to the most sensitive position, the condenser may be there clamped once and for all by

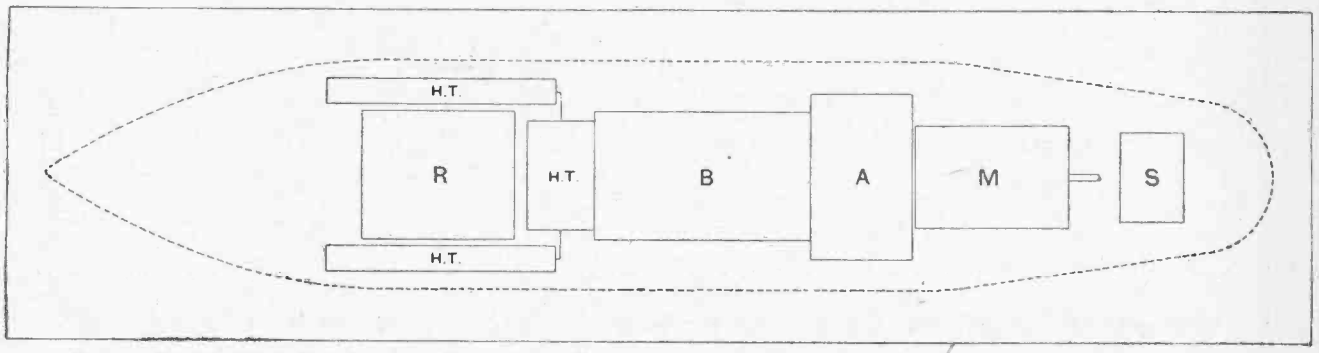


Fig. 1.—Outline sketch of boat. R=radio receiver; B=electric "brain"; A=accumulator; M=motor; S=steering gear.

means of the clamping nut usually provided on the better types.

In constructing the receiver, the first thing that should be made is the copper box, as it is usually a little difficult

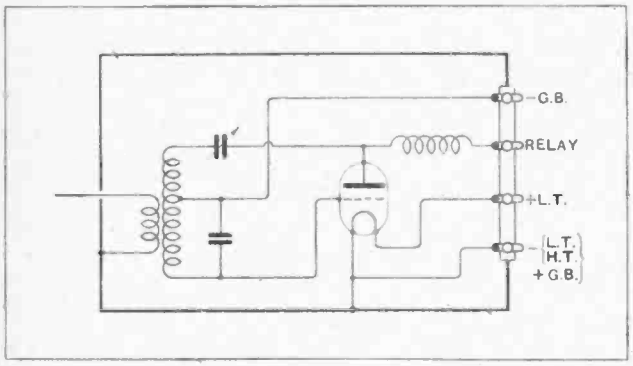


Fig. 2.—Showing the circuit of the radio receiver.

to make such a box exactly to size, and if it is made first and the baseboard cut and apparatus mounted to fit the box, it is probable that much time will be saved.

The finished size of the box is 6in. long by 5in. wide and 4in. high, but variations of a quarter or even a half-inch are not very important so long as they err on the large side. For the box, a piece of copper sheet of about 24 gauge and 6in. wide by 2ft. long is required. First cut a piece 13in. long from this strip, and bend it carefully at right angles 4in. from each end and over a piece of board, the latter being preferably held in a

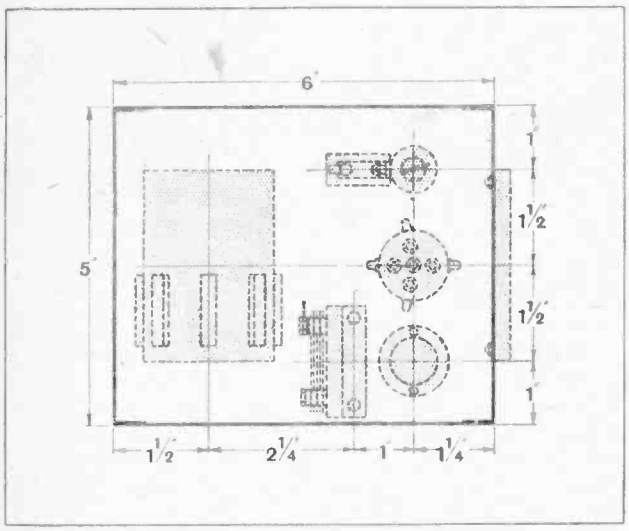
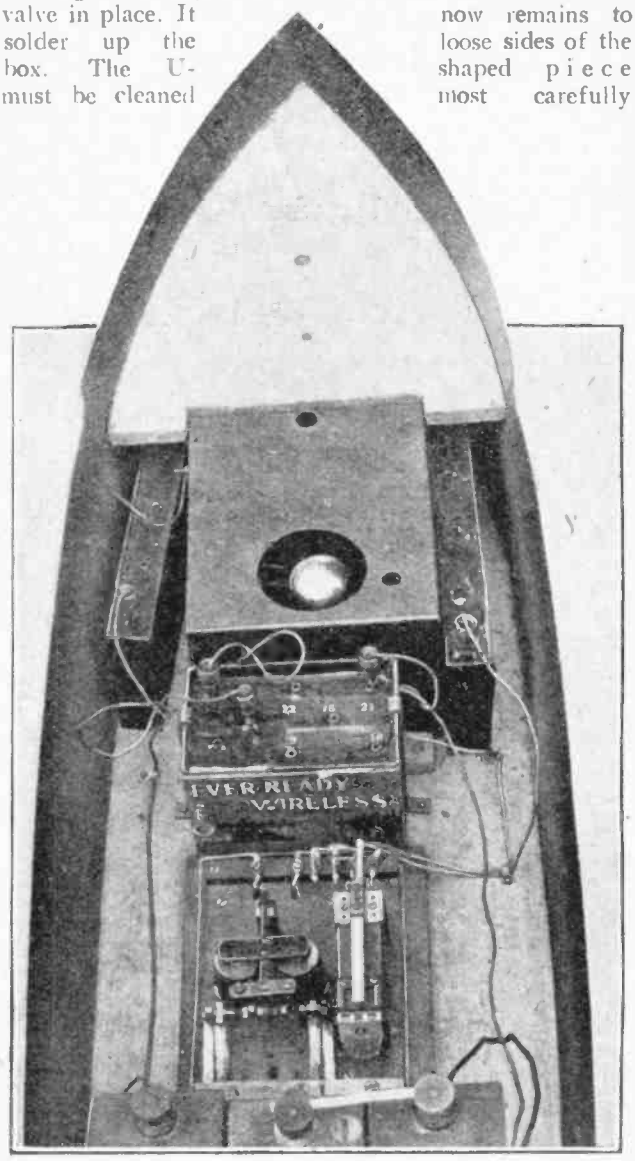


Fig. 3.—Layout of apparatus on baseboard of radio receiver.

vice. The result of this will be a U-shaped piece, giving the bottom and the two longer sides of the box. For the remaining sides cut two pieces 4½in. long from the strip. It will be seen that these pieces overlap the U sides of the box by half an inch, and this amount is intended to be turned in to be soldered. Before turning over this half-inch margin, it is necessary to cut out a half-inch square of the copper at the two bottom corners—if there is any difficulty in seeing just how these squares should be cut, the writer advises obtaining a cardboard box lid and cutting down the corners with a sharp knife in order to spread the lid out flat, when it will be seen that there is a square piece missing from each corner. A vice will be found most useful in turning over the margin, and also the edges of the lid, which is made from a piece of copper 6½ × 5½in. with ¼in. squares cut from each of the corners. Before bending the edges of the lid, two holes should be cut in it, one 2½in. diameter, and one half an inch diameter, for the valve and the reaction condenser knob respectively. The centre of the larger hole is 2in. from one of the shorter sides of the lid (before bending), and is on the centre line, while the smaller hole is drilled 1¼in. from each side of the lid. The positions of these holes will be gathered from the photograph showing the complete receiver with its lid on and the valve in place. It now remains to solder up the loose sides of the box. The U-shaped piece must be cleaned most carefully



A general view of the screened radio receiver, with the relay panel in the foreground.

for at least half an inch depth round the edges where the loose sides will come, and the cleaned part tinned all over. The outsides of the turned-over parts of the loose sides should also be cleaned and tinned, after which they can be slipped in position and there soldered. A fairly large iron should be used owing to the large area of metal exposed for cooling—in fact, a small iron simply will not tin or solder the box at all. The corners of the lid are just lightly soldered to make the turned-down edges firm and prevent them opening out.

Baseboard Assembly.

Having completed the copper box, the next thing to do is to cut out a baseboard from half-inch wood to fit the bottom of the box, but beware of making it fit too tightly, or it will be very difficult to withdraw in case of need. The layout of the apparatus on the baseboard is given in Fig. 3, while in Fig. 4 is shown how the little reaction condenser is mounted. The valve holder may be of any type for baseboard mounting. The tuning coil is wound on a 2in. diameter ebonite former 3in. long, with a thread of 24 turns per inch cut in it (see Fig. 5). Three 6B.A. screws with soldering tags are used to terminate the windings, one being at each end of the coil and one in the middle—the turns used being 30 for the grid section and 25 of 26 S.W.G. for the plate section of the coil, and the aerial coupling coil of 10 turns wound over the grid section. The coil should be mounted as shown, so as to be equidistant from each side of the box.

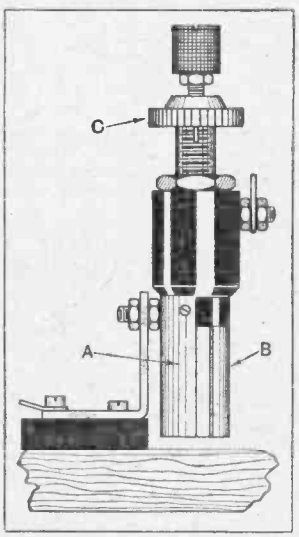
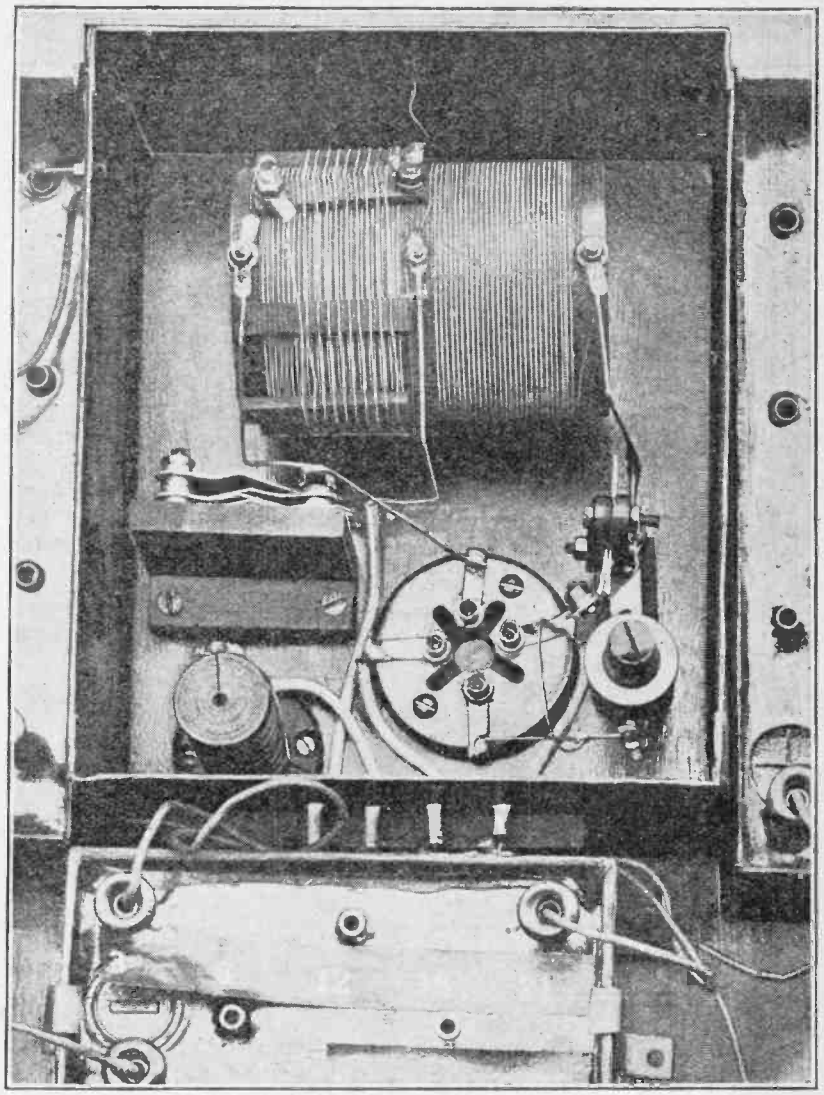


Fig. 4.—Showing details of reaction condenser mounting. A = fixed plate, B = moving plate, C = clamp.

The former for the choke is made from ¾in. ebonite rod 2½in. long, with seven slots ⅛in. wide and ⅛in. deep separated by ⅛in. These slots are wound about two-thirds full of No. 42 S.W.G., the ends of the windings being brought out to a No. 8B.A. screw at each end of the former, and the whole choke is fixed to the baseboard by means of an ebonite disc 1⅜in. diameter, which is secured to the former by a short 4B.A. screw passing through the centre.

The remaining component to be dealt with is the fixed tuning condenser, which is an Ormond 0.0001 mfd. air



A plan view of the inside of the radio receiver.

dielectric type with some of the plates removed. The method of adjusting this condenser will be dealt with at some length, as it is a matter of importance to be able to adjust a fixed wavelength receiver exactly to some given wavelength. The adjustment is carried out as follows: First wire up the complete receiver according to the wiring diagram Fig. 6, bringing the four battery leads through holes drilled in the side of the box and fixing them to an ebonite connecting strip screwed on to the box (see the photograph above showing this strip between the box and the H.T. battery. A Mullard P.M.2 or P.M.4 valve, with about 4 to 6 volts grid bias and 30 volts on the plate, should be used, and a 0.2 or other fairly low reading milliameter connected between the + H.T. and the connection marked Relay in the circuit, Fig. 2. The free end of the coupling coil should be connected to a short length (say, about a yard) of wire rigged up as an aerial, and an "earth" wire taken from the copper box to the negative L.T. terminal of a small heterodyne wavemeter covering the desired final wavelength.

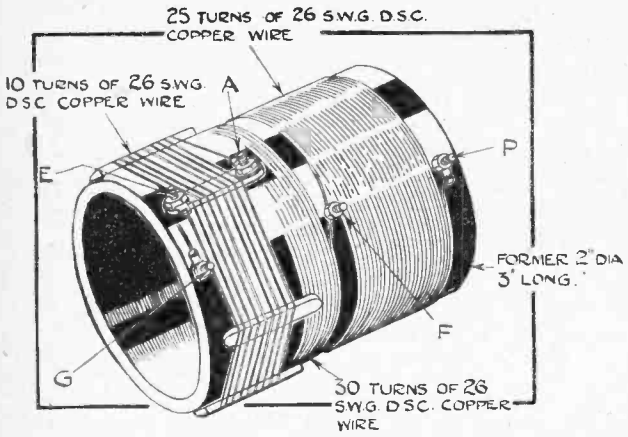


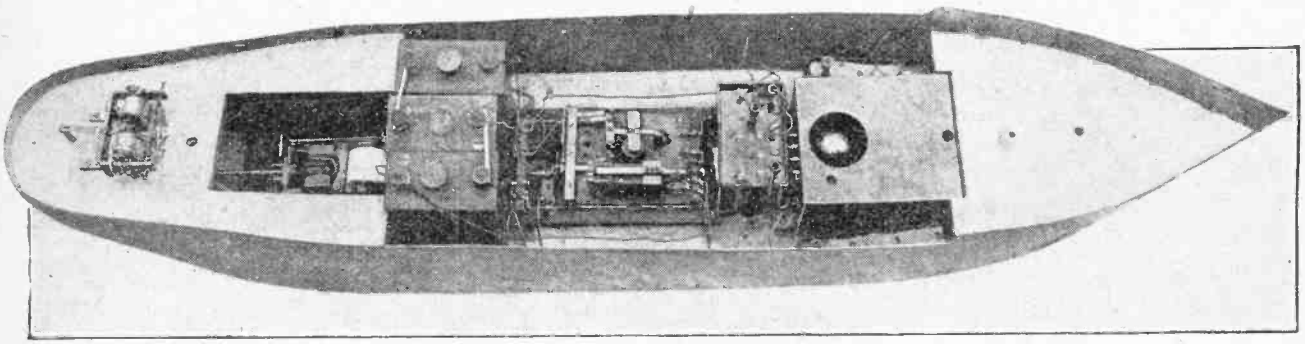
Fig. 5.—Details of the tuning coil. E=earth; B=aerial; G=grid; P=plate.

The wavemeter should be put about ten feet away from the receiver and the milliammeter connected to the latter most cases, and consists in putting two spacing washers under one end of the last plate and only one under the other, thus putting the plate on a slant. The adjustment of capacity is obtained by bending this plate by pressing on it near the higher end with a screwdriver.

It should here be noted that if on first testing the receiver the wavelength is found to be about one and a half times the desired wavelength, then the capacity of the tuning condenser will have to be halved: if it is double, then the tuning capacity will have to be decreased to one-quarter of its original value. If the reader desires to use a wavelength of 45 metres, it is suggested that fewer turns be used on the coil.

When doing the final adjustment of the condenser, the lid of the box *must* be replaced before every test of the wavelength, as the inductance of the tuning coil (and hence the wavelength) is altered when the lid is added.

When adjusting the receiver in this fashion, the reader is actually carrying out an experiment in distant control—the "earth" wire need not really be counted as a wire since two separate earth connections would do as well.



A plan view of the boat, which should be compared with Fig. 1.

propped up so that its pointer may be seen from the wavemeter. The milliammeter reading in the ordinary way will be very small, due to the relatively large grid bias used, but when a signal is received on the same wavelength to which the receiver is tuned, then the effect will be to neutralise some of this grid bias and thus to increase the milliammeter reading.

Tuning the Receiver.

In order to find out to what wavelength the receiver is tuned, the heterodyne wavemeter condenser should be altered until the milliammeter reads a maximum. It should be remarked that the tuning is very sharp, so that the wavemeter should be adjusted slowly.

If an Ormond 0.0001 mfd. condenser is used intact, the wavelength of the receiver will be too high—about 120 metres or so—therefore some of the plates should be removed to reach the desired wavelength.

For final adjustment, two methods are available, one being to remove the spacing washers from under the last plate and to insert spring washers in their stead. By tightening up the nuts securing the plates, the distance of the last plate from the rest may be adjusted over a small range, thus giving quite a fine control of the capacity. The other method is cruder, but is sufficient in

It may be said that, even if the reader is not contemplating the construction of a complete wireless controlled boat, the construction of one or two screened receivers similar to the one here described, will enable him to perform many extremely interesting experiments in radio control.

(To be continued.)

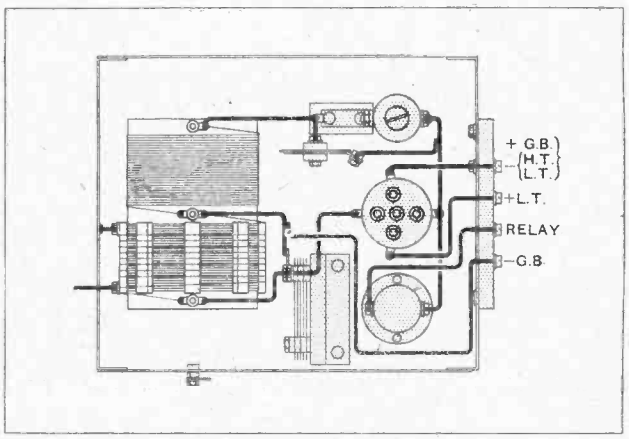
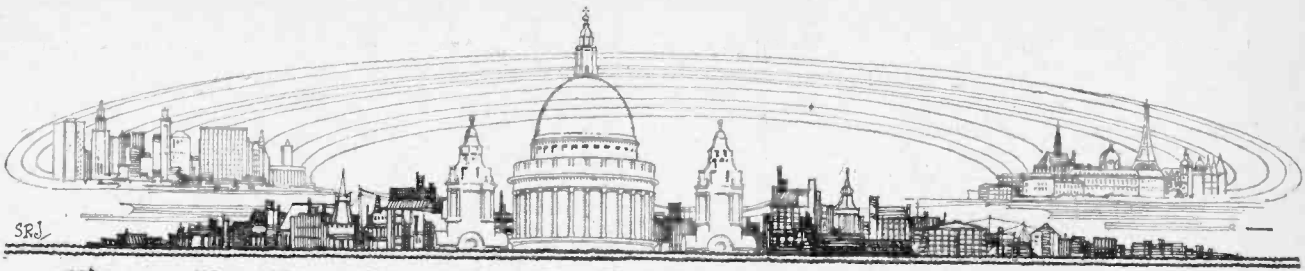


Fig. 6.—Wiring diagram for the radio receiver.



CURRENT TOPICS

Events of the Week in Brief Review.

ALL ROADS LEAD TO MANCHESTER.

Manchester is the mecca this week of all Lancashire wireless enthusiasts. The Manchester wireless exhibition, organised by the *Evening Chronicle*, is in full swing at the City Hall, and will remain open until Saturday, November 6th.

A Guide to the Show will be found on pages 575-576 of this issue.

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WIRELESS FETCHES THE DOLLARS.

The turnover of the exhibitors at the Radio World's Fair held in New York in September is estimated at 100 million dollars.

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THE LUCKY MICROPHONE.

Women journalists, according to a Northern newspaper, quake at the prospect of facing the mysteries of the microphone. This explains the conduct of several modest celebrities who have been found cultivating the "microphone look."

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WIRELESS AT BRITISH INDUSTRIES FAIR.

Despite the serious effects of the coal stoppage, the Department of Overseas Trade is receiving daily applications for space at the London Section of the British Industries Fair, which is to be held at the White City from February 21st to March 24th next. Nearly thirty wireless firms have applied.

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NEW DOMINION BEAM SERVICE.

On Monday last, October 25th, the General Post Office opened a high-speed beam wireless service between Great Britain and Canada. Prior to the inauguration of the service the Marconi Company received the Post Office official certificate that the stations constructed at Bodmin and Bridgwater had passed their official seven days' test.

During the test week speeds of 1,250 letters a minute were worked for hours on end, the average for the whole period being about 600 letters a minute.

The establishment of the first Dominion Beam service maintains Great Britain's world leadership in wireless communication.

PARIS TRADERS UNITE.

Radio retailers in Paris have formed a "Syndicat Professionnel," believing in the motto "Unity is Strength."

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A SOUTHPORT DISPLAY.

Wireless enthusiasts in the Southport district will be flocking to the Temperance Institute, London Street, to-morrow and the two following days for the exhibition organised by the Southport and District Radio Society.

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GERMAN GEAR IN NORTHERN IRELAND.

A fortnight ago we recounted the experience of a reader in the Irish Free State who, on visiting a little country town, discovered that its sole wireless shop exhibited German apparatus only. It should have been explained that the town is situated in Northern Ireland.

SOMETHING TO THINK ABOUT.

There are between 12,000,000 and 15,000,000 radio sets in operation throughout the world, according to the electrical equipment division of the U.S. Department of Commerce.

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NEW HEADPHONES WANTED.

A reminder that even wireless apparatus wears out comes from the Papworth Sanatorium, Cambridge, which issues an appeal for new headphones to replace those which have deteriorated after several years of strenuous and much-appreciated service.

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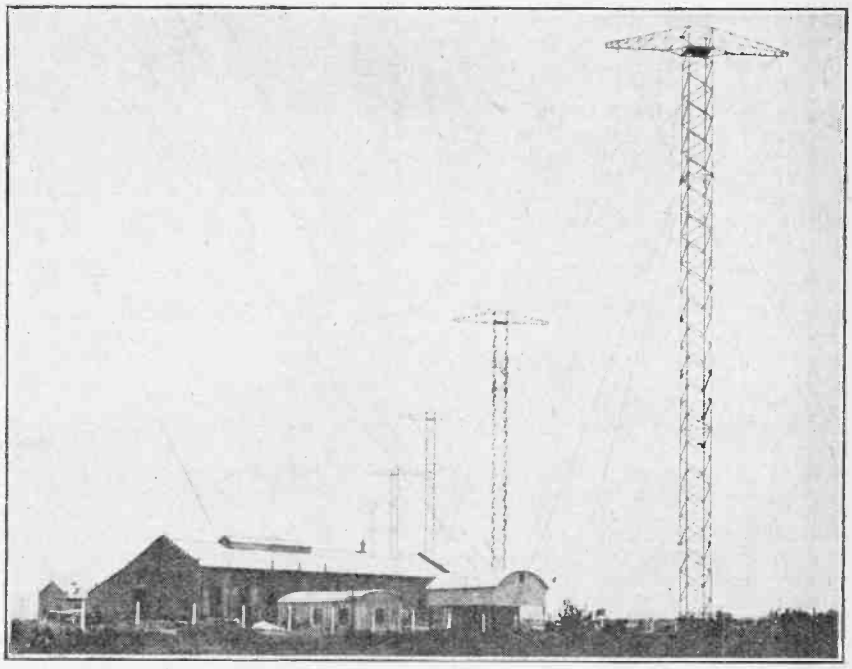
CANADIAN WIRELESS TRIUMPH.

For the first time in history, states Mr. C. V. Sale, the governor of the Hudson's Bay Company, vessels starting from Vancouver and Montreal respec-



NEW DOMINION BEAM SERVICE. A general view of the Bodmin beam station which serves as the British transmitter in the newly-established short wave service between this country and Canada. The Canadian transmitter is situated at Drummondville, near Montreal, the receiver being at Yamachiche, 25 miles north of Drummondville. The British receiving station is at Bridgwater.

tively have been able this season to communicate by wireless over the land separating the Western Arctic from Hudson's Bay.

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HIGH SPEED AUTOMATIC TRANSMISSION.

A paper entitled "High Speed Automatic Transmission" will be read by Mr. A. H. A. C. Cranmer at a meeting of the Institute of Wireless Technology to be held at the Engineers' Club, Coventry Street, London, W., on Wednesday, November 10th, at 7 p.m. Further particulars are obtainable from the Hon. Assistant Secretary at 71, Kingsway, London, W.C.2.

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CHEAPER PACIFIC WIRELESS.

By arrangement between the American Radio Corporation and the Japanese Government, reductions are to take place as from November 1st, in the cost of wireless messages across the Pacific.

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PAYING THE PIPER.

When requests for bands to perform for a fee are entertained, says a new Fleet Order, every effort is to be made to ensure that the terms accepted are not less than those that would in similar circumstances be offered to civilian bands, an extra fee being likewise charged for any performance relayed for broadcasting purposes.

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THE ELECTRIC STORM.

The violent electric storm which prevailed almost throughout the world at the beginning of last week does not appear to have affected wireless working to any appreciable extent. Few complaints were received by the British Broadcasting Company.

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A NEW INSULATOR.

A new insulating material, known as "Micalex," has been developed by the General Electric Company of America. The new product is a composition of ground mica and lead borate, and is said to possess better insulating properties than porcelain. It is economical to manufacture as use is made of mica particles which were formerly wasted.

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IRISH IMPORT TAX CRITICISED.

The tax on wireless apparatus imported into the Free State has been the subject of much criticism in the Irish Press.

"If there were a genuine effort to manufacture wireless apparatus in the Free State," says the *Irish Radio and Musical Review*, "our sympathy would have inclined towards the imposition, but, knowing that such an effort is non-existent, we fail to see on what just grounds the tax was ever introduced."

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THE COMPLETE CAR.

Wireless receivers incorporated in cars figured prominently at the Paris Motor Show. M. Gaston Doumergue, President of the Republic, showed special interest in a new six-cylinder saloon containing a loud-speaker set and artistically disguised roof aerial.

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POLITICS AT THE MICROPHONE.

Both Republican and Democratic campaigners in American politics have decided that broadcasting must take its place in the "political education" of the electors during the coming winter.

This emphasises the paramount merit of a wireless receiver, viz., it can be switched off at will.

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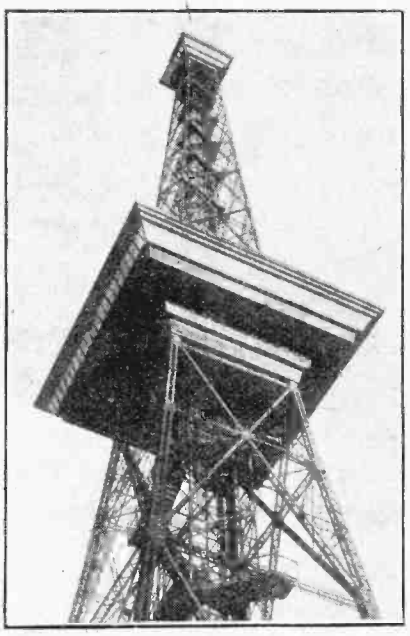
IRELAND'S WIRELESS SHOW.

Many leading English manufacturers are represented at the Irish Radio Exhibition which opens at the Mansion House, Dublin, on Monday next, November 1st, under the auspices of the Irish Association of Radio Traders.



GERMANY'S AERIAL RESTAURANT. A new photograph of the Berlin "Radio Tower" with its restaurant, which has accommodation for two hundred diners. The tower is 430 feet high and the summit can be reached by an electric lift.

A WIRELESS INTERVIEWER.

At one of the New York broadcasting stations a regular feature of the programmes is the "Interviews with Celebrities" by Miss R. T. Nagel, who is said to be able to infuse some semblance of life and reality into this difficult task. Miss Nagel thinks it is much easier to interview a critic than an actor because the former is used to an invisible audience, whilst the latter seldom feels natural unless he can see the immediate reaction of his words on his audience. Questions and answers prepared beforehand obviously lack spontaneity, but it is stated that Miss Nagel can accomplish the difficult task of eliciting impromptu replies from her "victims" and steering them through the horrors of an interview in a perfectly natural manner.

TRANSMITTERS' NOTES AND QUERIES.

General Notes.

Capt. E. H. Robinson (G 5YM), Langmead, Pirbright, Surrey, is conducting some experiments on 32-34 metres and will be glad to hear from any reader, at home or abroad, who is able and willing to work with him. Anywhere between 30 and 40 metres is convenient, any time and any day.

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Reception of American Broadcasting.

The letters which have appeared recently in our correspondence columns on the subject of reception of American broadcasting have brought in a considerable number of reports tending to show that the short-wave stations can be heard in this country with comparative ease and that there can be no question of "freak" reception.

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A correspondent in Oxford heard the whole of the broadcast description of the Dempsey-Tunney fight from U 2XAF and on September 27th heard U 2XAD on 22.8 metres. The announcer stated that the transmission was being made with the object of its being picked up and relayed by European stations, particularly those of the B.B.C., and asked that reports of signal strength, quality, constancy of wave and fading effects might be sent to the G.E.C. at Schenectady, New York.

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Another correspondent states that he has received U 2XAF at Thornton Heath regularly since September every time the station was transmitting. Signals were very strong and easily tuned in on the loud-speaker on an 0-v-3 resistance-coupled receiver. U 2XAD also came in well on 23 metres, but KDKA was not so easy to pick up, and then only on good 'phone strength. Many other stations were heard on approximately 50 metres, music coming through clearly but speech being indistinguishable.

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From Warrington, Lancs, comes a report of the reception of WGY on 32.7 metres at 10.30 p.m. on October 12th, speech being beautifully clear with very little fading and no trouble from atmospherics, heterodynes, Morse, or "mush." The receiver was a three-valve Reinartz with a loud-speaker and every word was heard all over the house. In this case, also, KDKA, on 62 metres, was not so satisfactory, but a German station on about 50 metres could be tuned in at terrific strength. The aerial used is 100 feet in length and 30 feet average height, and the earth is a water pipe.

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Mr. A. G. L. Acland (G 2UD) reports that on June 20th at 5.20 a.m. B.S.T. he received U 2XAF on 32.79 metres, using an 0-v-2 receiver and a large "Claritone" loud-speaker. The transmission was comfortably audible over a large room.

GUIDE TO MANCHESTER EXHIBITION.

Over Eighty Exhibitors at Important North of England Provincial Show.

FOREMOST among the provincial Wireless Exhibitions is that which is being held in Manchester from Tuesday, October 26th, to Saturday, November 6th, inclusive, and organised by the Manchester *Evening Chronicle*.

Much of the apparatus to be seen has already been referred to in the pages of this journal describing the Olympia Show, though there are, of course, a number of firms in the North of England who take space at the Manchester Exhibition and whose products will be new.

The Exhibition in particular is devoted to the display of components rather than complete sets, and in this respect differs somewhat from Olympia, where complete sets predominated. There are no restrictions excluding the display of foreign apparatus, and the amateur is afforded an opportunity of examining the products of several American and Continental manufacturers.

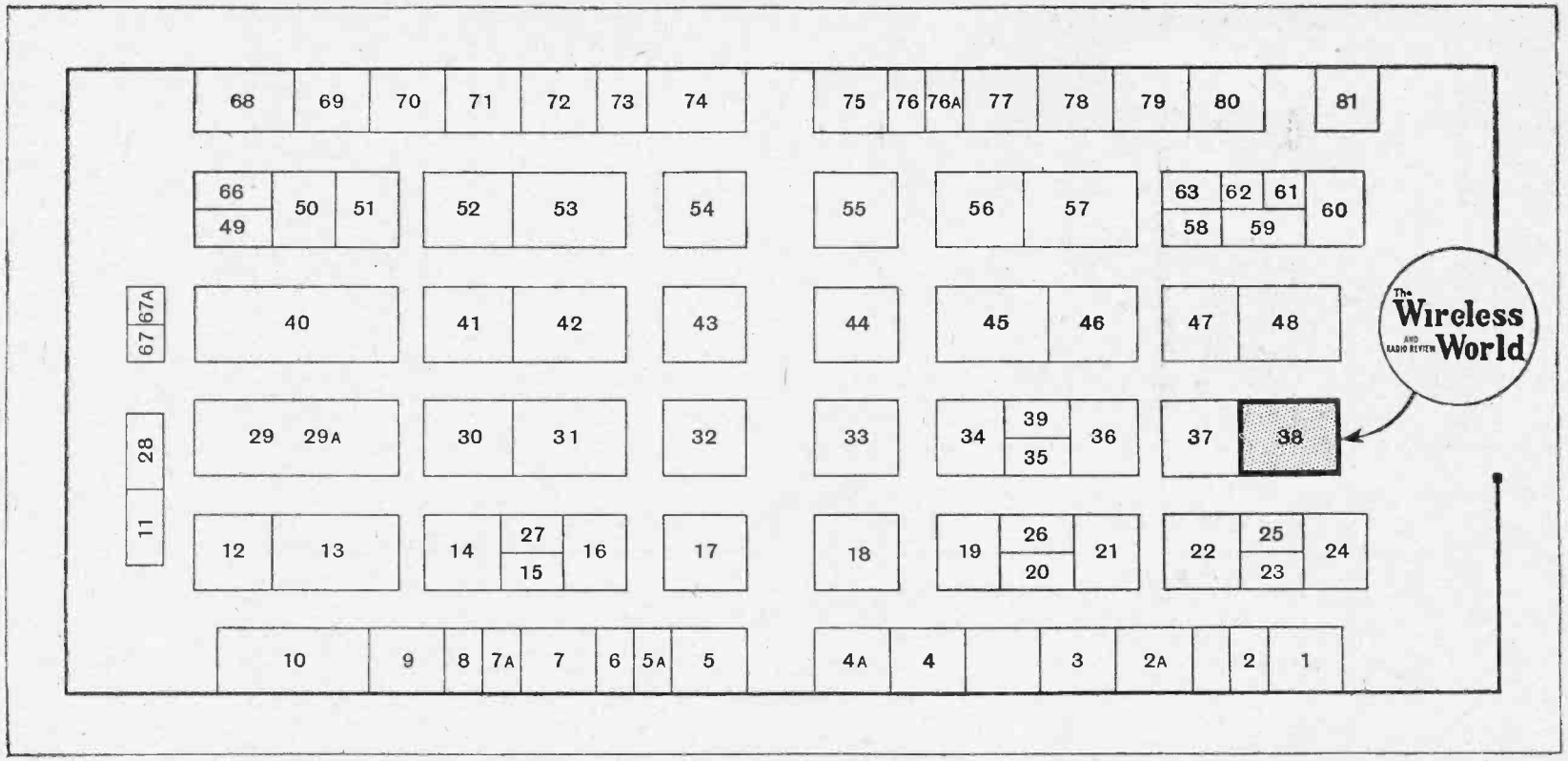
In former years the exhibition has attracted considerable interest, and reflects the keen interest which is taken in constructional work in this part of the country. It is, in particular, an exhibition for the amateur, though the non-technical broadcast listener is well catered for.

Although the names of many well-known London firms are not to be found among the list of over eighty exhibitors, arrangements have been made in many instances for their products to be shown on the stands of factors and local representatives.

ALPHABETICAL LIST OF EXHIBITORS.

	Stand Nos.
Accumulators Elite, 32, King Cross Street, Halifax	73
Allied Newspapers, Ltd., Withy Grove, Manchester	40
Anderson's Wireless Sales Agency, 9-15, Oxford Street, London, W.1	2
Anodon, Ltd., Commerce House, 72-86, Oxford Street, London, W.1	24
Barraclough, G. D., 16-18, Moult Street, Cross Street, Manchester	18
B.B.C. Fund for the Blind	10
Belling & Lee, Ltd., Queensway Works, Ponder's End, Middlesex	5
B.N.B. Wireless, 65, Renshaw Street, Liverpool	4a
Bretwood, Ltd., 12-18, London Mews, Maple Street, London, W.1	36
Britain's Best Crystal, Ltd., 170 Garratt Lane, London, S.W.18	67, 72, 80
British Ebonite Co., Ltd., Nightingale Road, Hanwell, London, W.7	16
British Electrical Sales Organisation, 623, Australia House, Strand, London, W.C.2	56
Brown Bros., Deansgate, Manchester	68
Brown, Ltd., S. G., Victoria Road, North Acton, London, W.3	43
Brownie Wireless Co. (of Great Britain), Ltd., 310a-312a, Euston Road, London, N.W.1	48
Burndept Wireless, Ltd., Aldine House, Bedford Street, London W.C.2	18
Bush House, 35, Shudehill, Manchester	53
B.S.A. Radio, Ltd., Small Heath, Birmingham	29a
Cables & Electrical Supplies, 234, Pentonville Road, London, N.1	76a
Carborundum Co., Ltd., Trafford Park, Manchester	12
Caxton Wood Turnery Co., Salisbury Square, Fleet Street, London, E.C.4	34
Chloride Electrical Storage Co., Ltd., Clifton Junction, nr. Manchester	32
Clackson, Ltd., A. H., 119, Fleet Street, London, E.C.4	81
Clarke & Co. (Manchester), Ltd., H., Atlas Works, Old Trafford, Manchester	44
Cleartron Radio, Ltd., 1, Charing Cross, London, S.W.	45
Collett Mfg., Ltd., S. H., 60, Pentonville Road, London, N.1	6
Coranto Gramophone Works, 104, Bold Street, Moss Side, Manchester	61
Cossor, Ltd., A. C., Aberdeen Works, Aberdeen Lane, Highbury, London, N.5	54
Darimont Electric Batteries, Ltd., Darimont Works, Abbey Road, Park Royal, London, N.W.10	39
Deansgate Electro Radio (Manchester), Ltd., 240, Deansgate, Manchester	19
Detex Distributors, Ltd., 110, Victoria Street, London, S.W.1	67a
Dunderdale, F. (Wellworth Wireless), 8, Withy Grove, Manchester	58
Eastick & Sons, J. J., Felex House, 118, Bunhill Row, London, E.C.1	27
Evans, Y. W. P., 66, Oxford Road, Manchester	47
Falk, Stadelmann & Co., Ltd., 83, Farringdon Road, London, E.C.1	30
Ferranti, Ltd., Hollinwood, Lancs	52
Formo Co., Crown Works, 22, Cricklewood Lane, London, N.W.2	26
Garnett Whiteley & Co., Ltd., Lotus Works, Broadgreen Road, Liverpool	15
Gil-Ray Trading Corporation, Ltd., Sicilian House, Sicilian Avenue, London, W.C.1	60
Goswell Engineering Co., Ltd., 95-98, White Lion Street, London, N.1	50
Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, London E.15	42
Hughes & Co., Ltd., F. A., 204-206, Great Portland Street, London, W.1	33
Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, E.C.4	55
Iliffe & Sons, Ltd., Dorset House, Tudor Street, London, E.C.4	38
Kremner, L., 49a, Shudehill, Manchester	21
Lamplugh, Ltd., S. A., King's Road, Tyseley, Birmingham	49
Lancashire Dynamo & Motor Co., Ltd., Trafford Park, Manchester	74
Le Breton Engineering Co., 193, Windsor House, Victoria Street, Westminster, London, S.W.1	11
Lustrolux, Ltd., Lower House Mills, West Bollington	79
Makerimport Co., Melville Chambers, 50a, Lord Street, Liverpool	35
Manchester Evening Chronicle Bureau	70
M.A.P. Co., 246, Great Lister Street, Birmingham	8
Marconiphone Co., Ltd., 17, Whitworth Street West, Manchester	57
Metro-Vick Supplies, Ltd., Trafford Park, Manchester	31
Middleton, F. H., 15, St. John's Hill, London, S.W.11	23
Northern Steel and Hardware Co., Ltd., 9, South Parade, Deansgate, Manchester	7a
Oldham & Son, Ltd., Hyde Street, Denton, Manchester	46
Ormond Engineering Co., 199-205, Pentonville Road, King's Cross, London, N.1	77

PLAN OF THE MANCHESTER EXHIBITION.



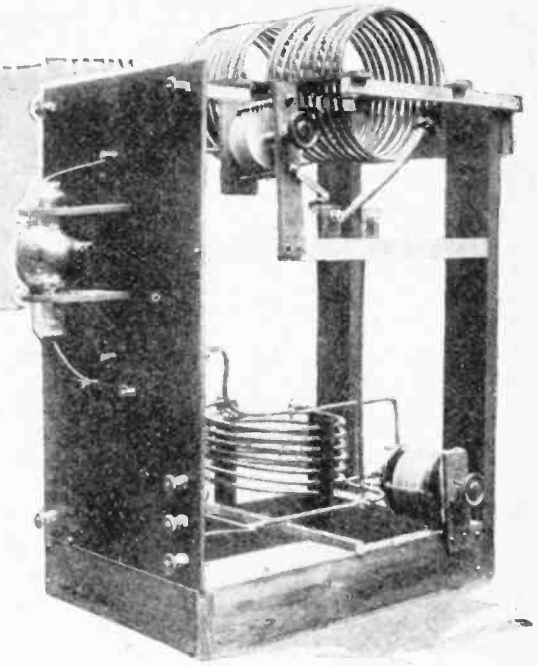
	Stand Nos.
Palatine Wireless Equipment Co., 3, King Street West, Deansgate, Manchester	22
Peter Curtis, Ltd., 11, Red Lion Square, London, W.C.1	51
Peto Scott Co., Ltd., 44, High Holborn, London, W.C.	41
Philips' Lamps, Ltd., 145, Charing Cross Road, W.C.2	75
Power Equipment Co., Ltd., Kingsbury Works, The Hyde, Hendon, London, N.W.9	63
Preen, A., Formo Co., Crown Works, 22, Cricklewood Lane, London, N.W.2	26
Pressland Electric Supplies, Ltd., 84, Eden Street, Kingston-on-Thames	76
Primus Manufacturing Co., 114-115, Great Saffron Hill, London, E.C.1	7
Radio Devices Co., Newdigate Street, Nottingham	25
Radio Service, 5a, Gledhow Gardens, London, S.W.5	2a
Radions, Ltd., Bollington, Macclesfield	37
Redfern's Rubber Works, Ltd., Hyde	59
See & Sons, J. W., 12, Earl Street, Maidstone	20
Spring Washers, Ltd., Eagle Works, Alexander Street, Wolverhampton	3

NEXT WEEK.

In addition to our usual articles and features we shall include a special report of the MANCHESTER EXHIBITION, describing in detail the principal exhibits on the stands.

	Stand Nos.
Standard Insulator Co., Ltd., Winsley House, Well Street, Oxford Street, London, W.1	66
Trader Publishing Co., Ltd., 139-140, Fleet Street, London, E.C.4	1
Truphonic Wireless Co., Triumph House, 189, Regent Street, London, W.1	5a
Tungstone Accumulator Co., Ltd., 3, St. Bride's House, Salisbury Square, London, E.C.4	34
Tunometer Works, Gosford Road, Beccles, Suffolk	62
Tutills, Ltd., 7-9, Swan Street, Manchester	14
Vandervell & Co., Ltd., C. A., Warple Way, Acton, London, W.3	13
Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester	17
Wireless Association of Great Britain, 7, Southampton Street, London, W.C.1	9
Wireless League, The, 6, Chandos House, Palmer Street, London, S.W.1	71
Wireless Trader, The, 139, Fleet Street, London, E.C.4	1
Wireless World, The, Dorset House, Tudor Street, E.C.4	38

TRANSMITTING ON 45 METRES



Notes on a Transmitter Suitable for the Forthcoming Low-power Tests.

By G. A. EXETER (6YK).

IN view of the proposed series of low-power tests to take place in November amongst the transmitting amateurs of this country, the following details of an inexpensive and fairly efficient 45-metre transmitter may prove of interest. It is not claimed that it is the last word in such equipment, but it is certainly a fair example of a reliable instrument that will repay anyone wishing to construct a transmitter on these lines.

In consideration of the small input, every detail that made for efficiency had to be observed and all losses made as small as possible, and in addition it had to be fairly flexible to allow of various experiments being tried.

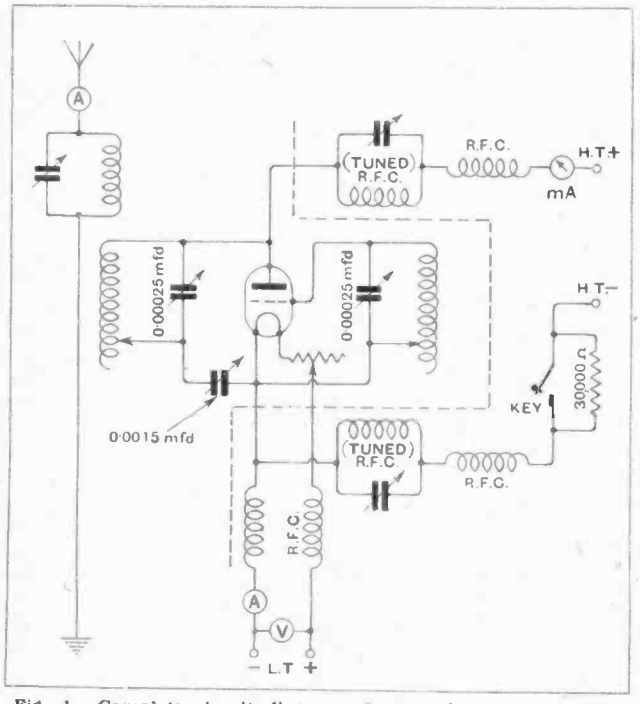


Fig. 1.—Complete circuit diagram of transmitter arranged for third harmonic excitation. The portion to the right of the dotted line is built as a separate unit.

The circuit chosen, after many trials, is the tuned grid and plate arrangement, commonly known as the Armstrong circuit (Fig. 1).

This circuit has characteristics that commend it for high-frequency work, and does not suffer so much from the faults of the well-known Hartley circuit.

Another point in favour of this circuit is that the internal capacity of the valve is used to obtain the necessary feed-back from anode to grid, and is not so detrimental as in other circuits.

Layout of Components.

The layout of the apparatus is as shown in the photographs. The two upper coils are the aerial and anode coils, while fixed to the top support is the anode tuning condenser. To the right and a little below can be seen the two anode stopping condenser terminals. This condenser has been removed for clearness, and in operation is supported on a stand by the side of the transmitter. The lower coil is the grid coil, with its tuning condenser to the right of it. The clips for altering the amount of inductance on both anode and grid coils can be seen. The top right-hand terminal is H.T. positive, the three lower being L.T. positive and negative and H.T. negative. On the left of the panel is a separate L.T. negative terminal for earthing purposes, the middle for connecting various value grid leaks, while the top one is for connecting the aerial lead when using the Hertz form of radiator. With other types the leads are taken straight to the aerial coil by means of clips.

The anode and grid coils are constructed of ¼in. diameter copper tubing wound to a diameter of about 7in., and spaced one diameter by means of holes drilled in ebonite strip. The coils were first wound on an iron former, then allowed to spring off, when they were heated red hot and let cool to soften the metal, making it more easily worked. After rewinding, they were dropped into a dilute solution of sulphuric acid to clean them, the ends

Transmitting on 45 Metres.

of the tube being sealed to prevent any acid from getting inside and corroding the metal. After washing and drying they were threaded on the supporting strips. The coils have nine and eight turns for anode and grid respectively. The tuning condensers are made from old receiving condensers and have capacities of approximately 0.00025 mfd.

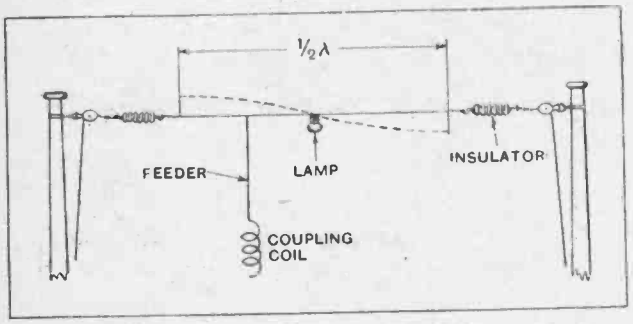


Fig. 2.—Half-wave Hertz aerial with single feeder. The dotted line indicates the voltage distribution.

The anode one has double spacing, as the set has been tried with high voltage inputs.

After much experimenting it was found that on extremely small power the use of grid condensers and leaks did not improve the working of the set, and therefore they are left out when using low power.

All connecting wires in the oscillatory circuits are also of ¼in. copper tube, except in the case of the earth lead from the L.T. negative, which is of ½in. copper strip $\frac{1}{16}$in. thick. The filament leads are of No. 10 S.W.G. copper. It may be thought that this is not necessary, but the results attained have proved that it has been well worth while and also the set could handle inputs up to 100 watts with ease and still have very little loss.

The anode stopping condenser is an ex-Government variable one, obtained cheaply from a dealer. It has a maximum capacity of 0.0015 mfd., and can be oil-filled. It has withstood voltages of 2,500

Ratio of Inductance to Capacity.

The L/C ratio of both coils can be varied by means of flexible leads terminating in clips, for adjusting the amount of inductance and retuning the condensers for correct wavelength. It has been found that a small amount of inductance with fairly large capacity functions best.

All joints in the connecting leads are made by flattening the ends of the tubes and drilling for No. 2B.A. rod. Nuts were then tightened on and the whole joint soldered with a blow-lamp. The various terminals are heavy brass ones, obtained from an old type power distribution board.

The whole apparatus is mounted as shown in a wooden frame with a front ebonite panel to accommodate the valve mounting, in this case a T50 oscillator. This is removed for low-power work, and other valves used by adding a special valve holder. The various leads for the valve are brought to terminals fixed on the panel. The set is supported on large porcelain insulators, with rubber feet, to raise it from the bench and minimise vibration. The input milliammeter, filament voltmeter, and ammeter are not incorporated in the set, as these are sometimes required for other uses, and it was considered desirable to use them externally.

In the high-tension feed leads are radio-frequency chokes wound to approximately 45 metres, and tuned to resonance by means of small two-plate condensers. The chokes are made of No. 16 S.W.G. bare copper, spaced by means of waxed string threaded between turns.

In series with these chokes are further coils consisting of ordinary basket coils of about 140 turns. These are considered a further advantage in keeping radio-frequency energy from the H.T. supply. Filament R.F. chokes are used, consisting of about 30 turns, 2½in. in diameter, No. 16 D.C.C. wire. It is advisable to keep all chokes well away from the fields of the transmitter coils, and they are therefore not incorporated in the set but are added externally.

Coupled to the plate coil is the aerial feed coil, made also of copper tubing, various size coils being available to suit the particular method of excitation in use at the time. Incidentally, this coil is coupled to the anode end of the plate tuning coil, as the field is more intense at this end. The field can be traced by putting the set in operation, holding a neon tube near the inductance, and noting the amount of glow in the tube.

Radiating Systems.

Nothing definite can be laid down on this particular point, as local conditions vary enormously, but a few words on the various methods tried may be of interest.

A six-wire cage aerial with centre down-lead and having a fundamental of approximately 96 metres was erected, and tuned to resonance by means of series condensers, using a small indoor counterpoise. Signals, with an input of 3 watts at 200 volts, were reported from France, Belgium, and Sweden, with an average strength of R5.

The aerial was then made slightly larger and tuned to 135 metres, the third harmonic of which is 45 metres, using a parallel tuning condenser and direct earth. With an input of 1.5 watts this arrangement gave considerably better signals all over Europe, as far as Helsingfors and Rome, or average reported strength R6.

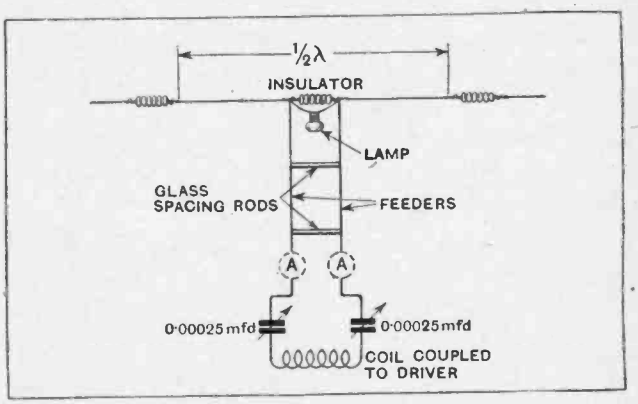


Fig. 3.—Hertz aerial with twin feeders. The lamp is removed and ammeters inserted in each feeder after wavelength adjustment.

Increasing power to 3 watts gave no greater signal strength in Europe, but two reports of R3 and R4 have been received from U.S.A. Prior to these reports arriving the cage aerial was dismantled, and a half-wave Hertz oscillator tried (Fig. 2). Reports on this aerial seem to indicate louder signals at smaller ranges, but no improvement on the third harmonic for long-distance work. In

Transmitting on 45 Metres.

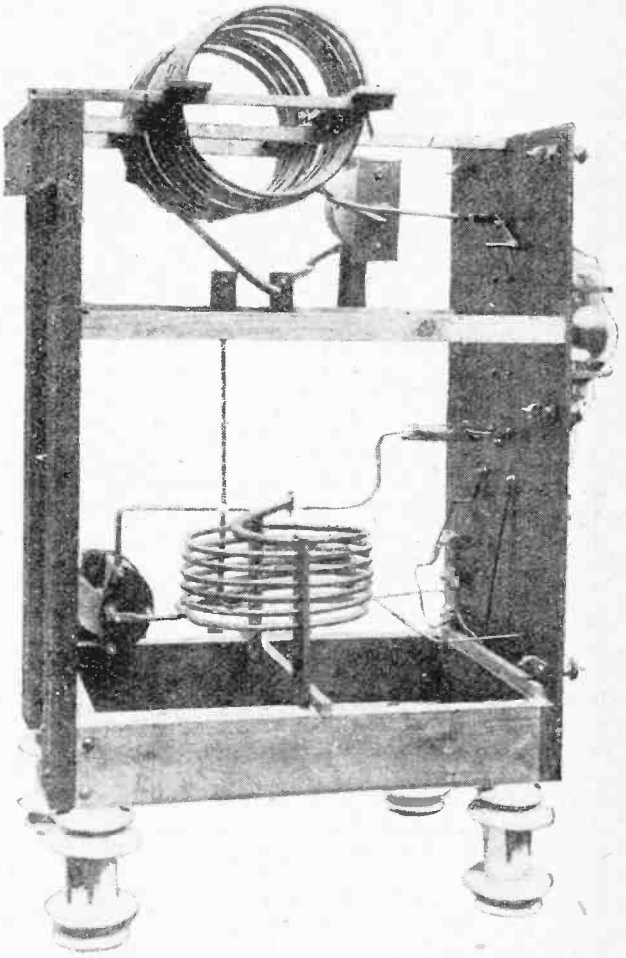
addition, it was found very critical in operation, and unless the feed-point is carefully adjusted local interference is considerable. The system, too, had a decided tendency to break into a sort of aerial-earth arrangement with the feeder radiating and giving very poor results. After considerable trial the system was abandoned and the current feed arrangement shown in Fig. 3 adopted. The half-wave Hertz was cut at the centre, and an insulator inserted. On either side of this insulator two R.F. feeders were fixed and kept apart by means of glass rods about 10in. long, spaced at intervals of about 12ft. These two lines were led to the feed coil *via* two series condensers. For adjusting purposes an indicating lamp was hung between the centre insulators and the set tuned to give the best glow on this, at the same time varying the series capacities to aid matters. The lamp was then removed.

This was a decided improvement on the single feed Hertz, being much more stable and apparently not radiating from the two feeders. Signals were comparable with the third harmonic system, and there seems to be little to choose between the two. One advantage of the two-line Hertz is that it can be made to vary its wavelength over wider ranges than the ordinary Hertz by simply adjusting the series condensers. The ammeters shown in the diagram should be giving the same reading in each, otherwise the system is not properly adjusted. With a little care this arrangement works quite well, but the writer prefers the third harmonic, as it is easier to erect and control.

Keying.

The keying of transmitters has been a matter for controversy ever since the problem of local interference came up. Keying the grid circuit gives considerable "key clicks," much to the annoyance of one's neighbours, and the use of the absorption method is not recommended on small power. The "space-wave" method obtained by keying part af the aerial circuit does not cause any local interference, but in view of the crowded state of the ether is not to be recommended. If the high-tension lead is keyed direct, "key clicks" are radiated, and in addition the note has a bad "chirp," due to the building up of oscillations. The writer uses a method as shown in the circuit in Fig. 1. The key is placed in the negative high-tension lead and a resistance of about 30,000 ohms shunted across the contacts. This resistance allows sufficient current to flow to allow the set to remain oscillating weakly. On the contacts being closed the full voltage is impressed on the anode. This method keeps the note steady, while the "spacing wave" effect is too weak to cause much trouble. Also the local interference is reduced to a great extent.

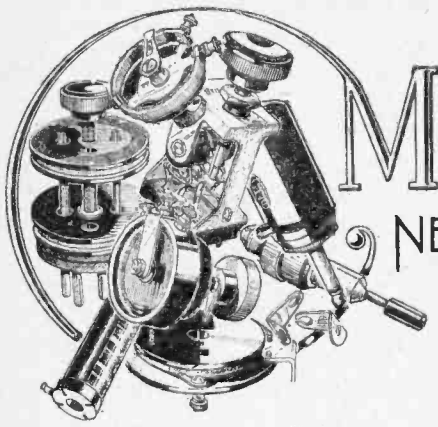
The set as shown has given very satisfactory results under adverse conditions, as the location of the station is very badly screened by high buildings, but in spite of this great things are expected during the forthcoming tests, and the equipment can be confidently recommended.



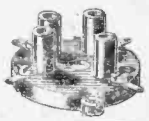
Side view of oscillator frame, showing aerial, grid and anode coils.

The valve used was the Cossor P1, which gave very good results with 200 volts input. As an experiment the T50 was tried with 200 volts input, and in spite of the losses gave consistent signals throughout Europe as far as Latvia and Finland, with a maximum of 2 watts input. The writer would be pleased to hear from anyone trying this set, and will be only too glad to furnish any further information.

In response to a great demand for a 3-valve receiver of the "Everyman's Four" type, an article describing a new receiver—the "Everyman's Three"—will appear, with full constructional details, in next week's issue, dated November 3rd. This description will be accompanied by a special wiring diagram supplement, which should prove of great assistance to constructors.



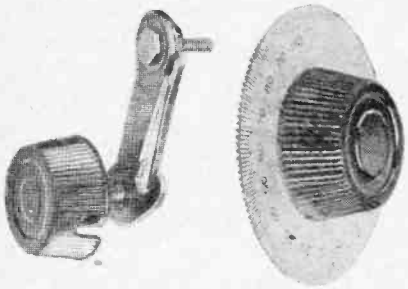
MANUFACTURERS' NEW APPARATUS



A Review of the Latest Products on the Market.

GEARED DIAL WITH SPRING ACTION.

Rivalry in the production of geared dials has led to the adoption of somewhat intricate designs. Although in the majority of cases dials with internal reduction gear are entirely reliable, complication has arisen in the endeavour to set up the quick and critical controls as concentric adjustments. A train of wheels was at one time made use of to give the requisite reduction ratio, and a number of pinions were needed owing to the limited space under the knob in which to house the gearing. When several pinions are used in this way backlash inevitably results.



Simple geared dial fitted with spring action to ensure good meshing between the pinions.

There is, of course, the simple arrangement in which a single pinion is made to engage on the rim of the dial. It is surprising that this design is not more generally adopted, and the only objection would seem to be the need for accurately engaging the teeth of the small auxiliary wheel with those cut round the edge of the dial.

A dial made on this principle is obtainable from Claude Lyons, 76, Old Hall Street, Liverpool, and in order to overcome the difficulty of correctly meshing the pinions a spring action is provided which forces them together.

The dial is heavily constructed in brass and is fitted with a silvered hundred division scale, the teeth of the bigger pinion being hidden beneath the rim. The auxiliary wheel engages firmly without backlash, for instead of being made of brass it is constructed from some hard fibrous material. This dial provides a very simple yet most effective method of obtaining critical adjustment. The diameter of the dial is 2¾in., and the control knobs, which are cleanly moulded, are of attractive design. Instead of the usual pointer form of indicator a piece of celluloid with an engraved black line is mounted over the scale.

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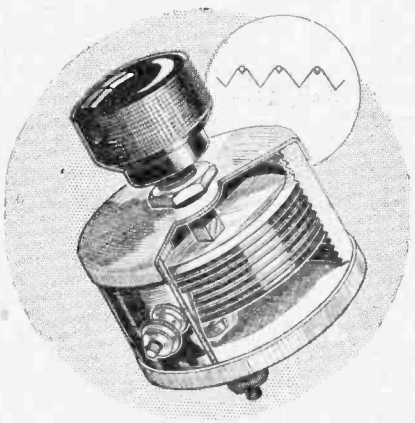
VERNIER RHEOSTAT.

The critical variation of a filament resistance is only obtainable when the sliding contact is arranged to provide connection with the resistance wire at any point along its length. This is accomplished in the new vernier rheostat manufactured by F. L. Cheers of Childwall, Liverpool, by winding the wire as a spiral on a threaded drum so that as the drum rotates it also advances turn by turn under a rubbing contact. Thus in the 5 ohm model the maximum to minimum resistance adjustment is made by seven revolutions of the knob instead of the usual single turn. Actually, two threads are cut, one of which, operating in a thread on the inside of the body of the rheostat, gives the necessary advancement under the contact, while the resistance wire is carried on a second thread of similar pitch cut into the top of the first thread.

The rheostat occupies little more space than the usual type, is totally enclosed by means of aluminium end covers, and is provided with one-hole fixing. The action is smooth and the sliding contact reliable.



Totally enclosed rheostat in which the resistance wire is carried in a spiral groove so that maximum to minimum adjustment is spread out over seven complete turns of the knob.

TRADE NOTES.

New Hobbies Catalogue.

To wireless amateurs the most interesting section of the new catalogue published by Hobbies, Limited, of Dereham, Norfolk, is that relating to parcels of wood, supplied in various styles, for the construction of wireless cabinets. The wood is mahogany, cut and planed ready for fitting. The size may be easily altered to suit one's own particular set, and constructional details are given on the leaflet sent with each parcel.

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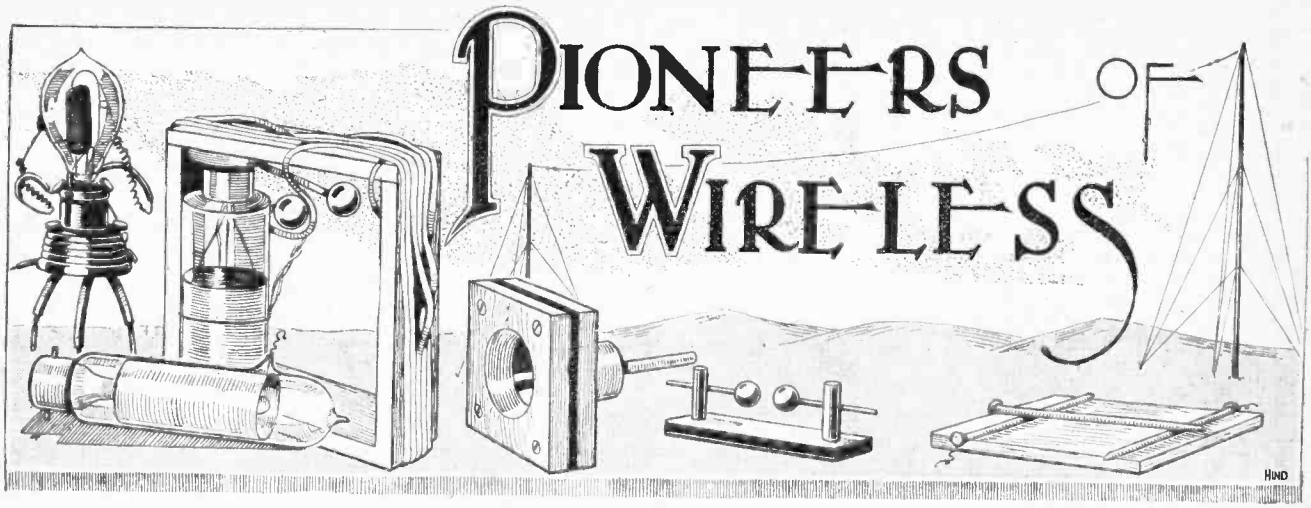
Buyers' Guide to Receivers.

So many developments have taken place in the manufacture of Wireless Receivers since the publication of the "Buyers' Guide" in our issues of February 10th, March 17th, and April 14th, that, encouraged by the favourable reception given to these lists by manufacturers, users and, particularly, by retailers, we intend bringing out a revised list on similar lines in the near future.

We have endeavoured to get into touch with all manufacturers of receiving sets but if we have inadvertently overlooked any we shall be greatly obliged if manufacturers who have not yet received copies of the forms we have prepared for recording the desired particulars will kindly communicate with us, when they will at once be supplied with them.

It is intended, as before, to group the sets under the following headings: (1) Crystal. (2) Crystal and Valve. (3) One-valve. (4) Two-valve. (5) Three-valve. (6) Four or more valves. (7) Portable sets. (8) Amplifier Units. To facilitate the compiling of the lists, particulars of each group should be furnished on separate forms.



34.—Marconi at Work in England.

By ELLISON HAWKS, F.R.A.S.

IN his later experiments at Bologna, Marconi used an induction coil giving a 6in. spark, in conjunction with two metal spheres of 4in. diameter separated by $\frac{1}{25}$ in. The length of the waves radiated was only from one to two metres, and their frequency about 250 million per second. His aerial consisted of an insulated wire connected to one knob of the exciter. It terminated in a sheet of wire netting, called the "capacity area," placed at the top of a mast. The second knob of the exciter was connected to earth, and the aerial and earth arrangements at the receiving station were similarly arranged, except that the coherer was substituted for the transmitter.

His First Transmissions in London.

Marconi believed that the range of the transmitter increased with the size of the capacity areas and with their distance from the earth. He subsequently came to the conclusion, however, that the improved results did not depend upon the height of the capacity area from the earth, but were due to the increased length of the wire connecting it to the apparatus. He therefore eliminated the capacity areas, and employed instead only a vertical wire, carried by a mast or—in the case of subsequent long-distance experiments—by a kite or a balloon.

Marconi's first experiments in this country were made from a room in the General Post Office, London, with the receiving apparatus installed on a roof over one hundred yards distant. The transmissions were quite successful, even though several walls intervened, and Marconi then removed his apparatus to Salisbury Plain, where it was subjected to more severe tests. Here (in 1896) he succeeded in transmitting and receiving signals over nearly two miles before representatives of the Army and Navy.

Senator G. Marconi.

Transmits to Ships at Sea.

Further experiments were conducted in May, 1897, across the Bristol Channel, between Lavernock Point and Flat Holm ($3\frac{1}{3}$ miles), and between Lavernock and Brean Down (about 9 miles). Vertical aerial wires 150ft. in height were used, and a coil that gave a 20in. spark. On the cliff at Lavernock Point was the receiving apparatus. A 90ft. pole with a zinc cap 6ft. in length and 3ft. in diameter stood some 60ft. above sea level. An insulated copper wire connected the zinc cap to the detector, an earth wire running down the cliff into the sea.

Here (on May 11th and 12th) the experiments were complete failures. For two days the signals were not received, and the fate of the new system trembled in the balance. On the morning of the 13th someone had an inspiration, and the receiver was carried down on to the beach, adding another 60ft. of wire in the down lead from zinc cap, making the aerial 150ft. in all. The additional wire made all the difference, for signals now came through clearly, and the situation was saved.

The next important trials were carried out (July 11th-18th, 1897) at Spezia, at the request of the Italian Government, whose atten-

tion had been attracted by the success of the experiments in England. During the first three days excellent results were obtained over a distance of 3½ kilometres. On the 14th the transmitter—with a 78ft. vertical wire terminating in a zinc plate—was installed at the arsenal of St. Bartholomew, on the eastern side of the Gulf of Spezia. The receiver was placed on board a tug-boat, which was moored at various distances from the shore. The vertical receiving wire on the tug was 50ft. in height, running to the top of the mast and terminating in a zinc plate. Transmission was successful up to four kilometres, but was interrupted by atmospherics. On the two following days, however, conditions were more satisfactory, and transmission took place over 7½ kilometres. On the 17th and 18th the receiver was transferred to a warship, the *S. Martino*, and with the vertical wire on shore increased to over 100ft. signals were transmitted up to a distance of 18 kilometres.

During these experimental transmissions to ships it was noticed that when the funnels, masts and wire ropes were in line with the shore apparatus, reception was weak owing to the screening effect of the metal. A more serious difficulty was encountered, in that when the vessel was cut off from view at the transmitting station by a headland signals ceased altogether.

"Screening" Effect of Trees and Buildings.

Hertz had shown that his waves passed without appreciable obstruction through doors, walls, and other non-conducting bodies. In actual practice, however, Marconi found that trees, buildings, hills, and similar obstacles absorb the waves. He carried out further experiments to overcome this obstacle, which he found to be surmountable, to a great extent, by increasing the height of the vertical aerial wires and by increasing the power of the transmitter and the sensitivity of the receiving apparatus.

Resulting from the Spezia experiments, Marconi confirmed an earlier observation in regard to the influence of the height of the vertical aerial wire on the distance over which signals can be transmitted. "The distance at which signals can be obtained," he wrote, "varies approximately as the square of the height of the capacity areas from the earth, or, perhaps, as the square of the length of the vertical conductors . . . the law has never failed to give the expected results across clear space. . . . I find that . . . vertical wires 20ft. in length are sufficient for communicating one mile; 40ft., four miles; 80ft., 16 miles; and so on. . . ."

Transmits from England to France.

In August, 1897, Marconi returned from Italy and carried out further tests in England. These included transmission from Salisbury to Bath (34 miles), Alum Bay, Isle of Wight, and Bournemouth (12 miles), and from the Needles to a steamer cruising off the South coast (18 miles). In the same year communication was established between Ballycastle and Rathlin Island Lighthouse (7½ miles), and the results of the Kingstown Regatta were reported by wireless for the *Dublin Express*. Marconi also installed an apparatus on board the Royal yacht *Osborne*.

In March the following year an attempt was made to bridge the English Channel. Signals passed between the South Foreland Lighthouse and Wimereux, near Boulogne (about 28 miles). On this occasion the vertical conductors were about 155ft. in height. In September of the same year (1898) signals passed between Wimereux and Dover, Wimereux and Harwich, Wimereux and Chelmsford, the latter being over eighty miles distant.

The *Ibis*, a dispatch boat, communicated with the South Foreland over about thirty miles, with an antenna 70ft. in height. Signals also passed between the South Foreland Lighthouse and the East Goodwin Lighthouse, through fog, rain, and storm, without difficulty. This achievement undoubtedly laid the foundation of signalling from ships at sea to land stations. By the end of 1899 communication between ships and land stations over distances of eighty to one hundred miles became an accomplished fact. Shipping companies, realising the value of the discovery, installed wireless on their ships, and the Marconi Wireless Telegraph Company erected a number of shore stations at various places.

Marconi's System Adopted by the Admiralty.

In March, 1900, the Norddeutscher Lloyd shipping line adopted Marconi's system, apparatus being installed on the *Kaiser Wilhelm der Grosse*, and also on the Borkum lightship. During the second half of that year over 580 telegrams were received by the lightship from passing shipping equipped with wireless apparatus, and twenty telegrams by the lighthouse. The total number of words transmitted was over 8,000, and the commercial value of the system was undoubtedly realised. Its utility was demonstrated in a dramatic manner when the lightship broke away from its moorings during a gale. A wireless message for help resulted in the rescue of the crew, who would certainly have been drowned but for the existence on board of the Marconi apparatus.

In July, 1900, the British Admiralty contracted for the installation of the Marconi system in twenty-six warships and at six land stations. It is interesting to note that a stipulation in the contract required the exchange of test signals between ships stationed at Portland and Portsmouth, a distance of sixty-two miles, with the Dorset hills intervening. These tests were carried out with every satisfaction.

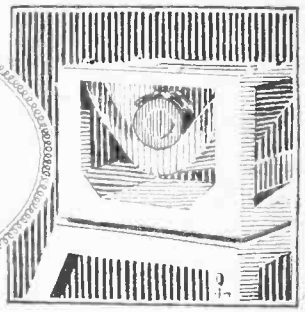
NEXT INSTALMENT.
Marconi Bridges the Atlantic.

WIRELESS AIR LINERS.

EXPERIMENTS for the establishment of wireless communication on short waves between aeroplanes in flight and ground stations are to be carried out by Air Ministry experts at Croydon Aerodrome.

The big twenty-seater Vickers Rolls-Royce Vanguard air liner is to be equipped with elaborate wireless apparatus. The saloon is to be turned into a wireless laboratory, in which a number of Air Ministry wireless engineers will carry out experiments while the machine is flying.

Broadcast Brevities



News from All Quarters: By Our Special Correspondent.

A Geneva Speed-up—2LO's Aerial—"Let Your Friends Listen"—Paderewski Again?—B.B.C.'s Repeater Station.

Speeding up the Geneva Scheme.

General impatience over the delay in bringing the new wavelength scheme to fruition seems to be having a healthy effect. Geneva, I understand, has been endeavouring to instil a little more pep into the calibration work which has been going on at the various European stations during the past month. It now seems likely that important developments may take place in the next week or two.

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Jumps in British Wavelengths.

So far as tuning is concerned, a large number of listeners to British stations will only be affected to the extent of twirling their condensers a few degrees. In Belfast, however, listeners will have to face a jump of over 100 metres—from 440 to 326.1—while the votaries of Newcastle and Bournemouth will also have to slide a good way down the etherial banisters. 5NO will drop from 404 to 312.5 and 6BM from 386 to 306.1.

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Trouble in the Home.

He would be a bold lad who prophesied perfect harmony when the scheme comes into operation. In fact, it seems probable that disturbance will occur not only in the ether, but in many households as well. I will go so far as to predict that on the first evening many highly respectable people will quite forget that the changes have taken place; and further, that many a set will be dismantled and many a temper frayed. And then everybody will be happy again.

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An Aerial Alteration.

2LO's aerial in Oxford Street now wears a rather skeletonised appearance consequent upon certain alterations which were carried out last week. It is now a "T" aerial instead of an inverted "L," and the change has had the desired effect, viz., an increase of signal strength in the East End.

Incidentally, it is interesting to note that any technical alteration of this kind always provokes a flood of correspondence from people who are uncertain whether or not to ascribe improved signals to their own skill. "Only in the last extreme give credit to the transmitter," seems to be the motto.

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"In the Chinese Manner."

"The Yellow Jacket," the popular fantasy "in the Chinese manner," which is almost as well known among theatre-goers in both hemispheres as "Charley's Aunt," will be broadcast, on November 12, as one of the special B.B.C. birthday week transmissions. The studio version has been arranged by Mr. Benrimo (part author with Mr. George C. Hazelton) and Mr. R. E. Jeffrey.

"Let Your Friends Listen."

There is every indication that the B.B.C. will do its fair share to make a real success of National Wireless Week, November 7th—13th, and that the listener who adopts the happy slogan shown above will have really good programmes with which to entertain even his most critical friends. National Wireless Week coincides with the B.B.C.'s birthday celebrations.

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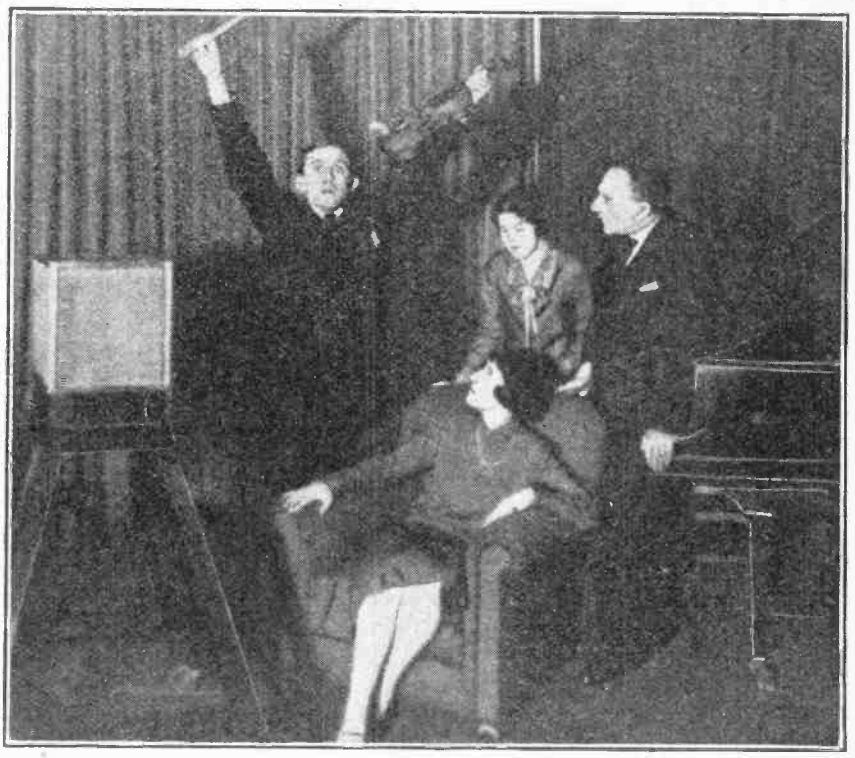
B.B.C. Birthday Broadcast.

The programme on November 7th will begin with the relaying of a special



PUTTING SOME LIFE INTO IT A dramatic moment in the London studio on Wednesday last during the broadcasting of "The Grey Ash," a highly sensational radio play. Action is almost as necessary in the studio as on the theatre stage if a realistic atmosphere is to be preserved.

Huguenot service from the crypt of Canterbury Cathedral, followed by a performance of "The Messiah." For the performance of "The Messiah" Sir Henry Coward, who is to conduct, is bringing a chorus to London from Sheffield, and the chief artists taking part are Caroline Watchard (soprano), Mary Foster (contralto), Frank Titterton (tenor), and Joseph Farrington (bass).

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Further Features.

Other special features for the birthday week may be summarised as follow: November 7: Elizabeth Schumann; Germany's foremost lieder singer; Poulshnoff, pianist. November 8th: Wireless Massed Military Bands, under the direction of Lieut. B. Walton O'Donnell; a broadcast version of "Congo Night." November 9th: Albert Hall concert, conducted by Dr. Richard Strauss. November 10th: Mrs. Violet Gordon Woodhouse, harpsichord recital. November 11th: Armistice Day services from Canterbury Cathedral and Westminster Abbey; Lord Grey's speech from Central Hall, Westminster. November 12th: Schumann Concerto by Solomon; performance of "I Pagliacci." November 13th: Star revue by Graham John.

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Missing.

Scanning these programmes many of us will be glad to note the absence of that over-rated individual, "The Man in the Street." Judging from his recent effort at programme compilation, he seems to be the offspring of Triteness wedded to Compromise.

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Not "My Programme."

Perhaps at this stage I might be permitted to draw attention to a proposed "Birthday Programme" compiled by my friend, "The Man on the Rocks."

This brilliant effort . . . but judge for yourselves:—

1. Opening speech by a Wigan listener who is, and always has been, entirely satisfied with every item on every programme.
2. Deathly silence.
3. "The Post Office Overture,"—a tone poem in which the P.M.G. is heard making a repentant overture to the B.B.C. for permission to hand over misappropriated licence fees.
4. Recitation by Mr. Angus McHaggis, of Aberdeen: "There's nae room for Birmingham on our bonny wavelength."
5. (For discontented listeners.) Silent meditation.

The last item, my friend explains, continues for an indefinite period.

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Who Told You That?

An amusing incident occurred the other day in the Birmingham studio. While singing the hymn "Lead, Kindly Light," an artist received the signal that he was too near the microphone. As he took a pace backward he arrived at the line, "One step enough for me."

FUTURE FEATURES.

Sunday, October 31st.

LONDON.—Ballad Concert; "All Hallowe'en," by Leonora Thornber.
BOURNEMOUTH.—Symphonic Feature Concert.
MANCHESTER. — Radio Military Band.
GLASGOW.—An Evening of Chamber Music.
ABERDEEN.—Concert relayed from the Cowdray Hall.

Monday, November 1st.

LONDON.—Military Band Concert; Selection from "The Dynasts."
BOURNEMOUTH. — "Op o' Me Thumb," play in one act.
CARDIFF.—The Merrymakers' Concert Party.
NEWCASTLE.—Orchestral Concert.
GLASGOW.—Address to Glasgow University Students by Sir Austen Chamberlain, K.C.

Tuesday, November 2nd.

LONDON.—Songs with Two Settings.
DAVENTRY.—International Chamber Concert.
BELFAST. — Queen's Island Male Voice Choir.

Wednesday, November 3rd.

LONDON.—"My Programme," by Gladys Cooper.
BIRMINGHAM.—Annual Police Band Concert.
MANCHESTER.—Gems of Opera relayed from Manchester Wireless Exhibition.
GLASGOW.—Paule and Lascelles, Syncopated Duettists.
ABERDEEN.—Scottish Programme.

Thursday, November 4th.

LONDON.—Act II. of "Figaro," played by B.N.O.C., relayed from Theatre Royal, Leeds.
BIRMINGHAM.—City of Birmingham Police Band.
CARDIFF.—"The Last Sinner," play in one act by J. Brunel Evans.
MANCHESTER.—Light Music from Manchester Wireless Exhibition.
NEWCASTLE.—"A Tabloid," one-act play by Arthur Eckersley.
GLASGOW.—A Jew's Idea of an Aberdeen Programme.
ABERDEEN.—"Tamsin's Day in London," by Mabel Constanduros.
BELFAST.—Funeral March of an Elephant.

Friday, November 5th.

LONDON.—Wagner Concert.
BOURNEMOUTH.—A Twilight Programme.
CARDIFF.—A Concert in Bristol in aid of Lord Mayor's Funds.

Saturday, November 6th.

BIRMINGHAM.—Violin Recital by Solloway.
BOURNEMOUTH.—Star Variety Programme.
CARDIFF.—Music Grave and Gay.

Paderewski Again?

Mr. Josef Hofmann's welcome appearance before the microphone last Friday reminds me that that other great pianist M. Paderewski is expected to pay a visit to England very shortly. What about it, B.B.C.?

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The de Groot Contract.

Many listeners will be glad to know that the B.B.C.'s contract with Mr. de Groot, which expired with the broadcast of the famous orchestra on Sunday last, will probably be renewed.

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Home Secretary at the Microphone.

Sir William Joynson-Hicks, the Home Secretary, will broadcast from the Mansion House on November 2nd, when he is attending the final meeting of the Advisory Council of the Wireless for Hospitals Fund.

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Hard Luck on Leeds.

It is hardly surprising that Leeds listeners are inclined to grumble at interference from other stations. 2LS, working on 321 metres, is fairly surrounded by Continental transmitters. To begin with, it is heterodyned by Milan, reputed to be on the same wavelength, and also by Trollhatten on 322 metres. Barcelona also asserts itself on 324 metres and even Helsingfors, on 317.4 metres, is blamed for interference. Leeds is, therefore, sighing for the Geneva scheme, which will place it on 297 metres.

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S.B. in America.

During the last year America has made considerable progress in the development of simultaneous broadcasting. A chain of stations is being formed by the Broadcasting Company of America for the distribution of baseball play reports during the winter, and twenty-one stations throughout the East and Middle West have signified their willingness to co-operate.

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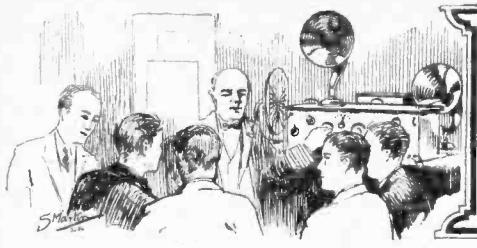
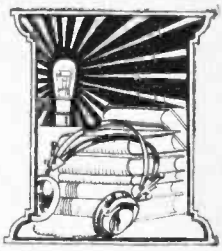
A New Control Point.

The B.B.C. announces that a line repeater station is now under construction at Gloucester, similar to that which was brought into operation at Leeds in March last. The new station, which is expected to be completed on or about November 1st, will be the pivot controlling all the transmissions relayed between Birmingham, Cardiff, Plymouth, and Swansea. A link will be provided via Stoke to allow the four stations first named to be supplied alternatively by Leeds in case of breakdown. The Gloucester station will contain an S.B. board and the necessary amplifiers, the object being to improve the simultaneous broadcast system by providing a medium where music can be re-amplified and corrected for quality. It is not a wireless transmission station, but simply a control point. Distortion and other faults will be corrected and weak signals will be amplified before they are passed on, so that listeners in Birmingham, Cardiff, Plymouth, and Swansea should get improved reception.



NEWS from the CLUBS



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

Noise from a Picture Palace.

To overcome interference from the electrical equipment of a local picture theatre is one of the first tasks demanding the attention of the South Manchester Wireless Society, which held its opening meeting of the session on October 4th.

Designs are under consideration for the Society's receiving set for the coming winter, and the advantages and disadvantages of the various sources of H.T. current are being debated.

The Society's headquarters are at the Didsbury Institute, Elm Grove, Didsbury, where meetings are held every Monday at 8 p.m. Full particulars of membership can be obtained from the hon. secretary, Mr. G. F. Mercer, 5, Ruabon Road, Didsbury.

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Free Valves and Free Lectures.

Members present at future meetings of the Bristol and District Radio Society will have an opportunity of competing for valves, one of which is to be awarded at each meeting with the object of stimulating attendance.

At the Society's meeting on October 8th Mr. Evans (of the B.T.H. Company) gave an interesting demonstration of B.T.H. receivers and loud-speakers.

A course of lectures on "Wireless," free to members of the Society, is again being given by Mr. W. A. Andrews (chairman) at the Merchant Venturers' Technical College on Wednesdays at 7.30 p.m. Hon. secretary, Mr. S. J. Hurley, 72, Cotswold Road, Bedminster, Bristol.

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Transmission Demonstration in Dublin.

During a fascinating demonstration of transmission and reception at the last meeting of the Wireless Society of Ireland, signals were exchanged between the Society's station (GW 12B) at 12, Trinity Street, Dublin, and Mr. J. P. Campbell (GW 14B), at Sutton, using a wavelength of 45 metres. The Society's transmitter incorporates a coupled Hartley shunt feed, using generator D.C. on a LS5 valve.

Those present at the meeting were able to hear the transmissions of both stations on the loud speaker, while messages received were written on the blackboard.

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The Edinburgh Journal.

An enterprising move on the part of various scientific societies in Edinburgh has resulted in the publication of the "Edinburgh Journal" which presents the quarterly transactions of each Society in a way that would be financially difficult if each Society prepared a separate publication.

The October issue includes the Transactions of the Edinburgh and District Radio Society, with particulars of the Society's constitution and history, and a number of interesting papers on wireless subjects, together with a syllabus of future meetings. It is hoped to publish future Transactions in January, April, and October of every year. Hon. secretary, Mr. J. Ingram Watson, 49, Queen's Avenue, Blackhall, Midlothian.

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Lecture on "Transmission."

At this evening's meeting (Wednesday, October 27th) of the Muswell Hill and District Radio Society, Mr. J. C. Bird, B.Sc., will give a lecture and demonstration on "Transmission."

The Society's slogan to the outside world is: "Join early and enjoy the good things in store in the Winter Programme." Intending members are asked to communicate with the hon. secretary, Mr. G. S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

FORTHCOMING EVENTS.

WEDNESDAY, OCTOBER 27th.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown. Demonstration and Elementary Lecture: "Transmission," by Mr. John C. Bird, B.Sc., A.I.C. (G 2JB).

North Middlesex Wireless Club.—At 8.30 p.m. At the Shaftesbury Hall, Bowes Park, N.11. Lecture: "Broadcast Amplification," by Mr. J. H. A. Whitehouse, of the B.B.C. (Open to non-members.)

Edinburgh and District Radio Society.—At 8 p.m. At 117, George Street. Lecture and Demonstration: "Loud-speakers," by Mr. S. Cursiter.

THURSDAY, OCTOBER 28th.

Southport and District Radio Society.—At the Temperance Institute, London Street. Great Wireless Exhibition (Also on Friday, October 29th.) (Admission free.)

FRIDAY, OCTOBER 29th.

Radio Experimental Society of Manchester.—At the Manchester Athenæum. Talk by Mr. Bird, of 2ZY, on "Some Instruments Used by the B.B.C."

Leeds Radio Society.—At 8 p.m. At Collinson's Café, Wellington Street. Lecture: "Magnetism and Electricity," by Mr. W. G. Marshall.

MONDAY, NOVEMBER 1st.

Southport and District Radio Society.—At 8 p.m. At the Temperance Institute, London Street. Lecture: "Radio Drama," by Mr. Victor Smythe, of the Manchester Broadcasting Station.

Leeds Radio Society.—At 8 p.m. At Collinson's Café, Wellington Street. Lecture and Demonstration: "Phototelegraphy," by Mr. F. H. Haynes, Asst. Editor of The Wireless World.

Ipswich and District Radio Society.—At 8 p.m. At 55, Fonnereau Road. Lantern Lecture: "Condensers," by a representative of the Dubilier Condenser Co., Ltd.

Croydon Wireless and Physical Society.—At 128a George Street. Lecture: "Sound and Vibration," by Mr. L. F. Hammond.

Calibrating a Short-wave Receiver.

A lecture on "The Calibration of a Short-wave Set" by Mr. Leonard Hirschfield, B.Sc., evoked keen interest at the last meeting of the Muswell Hill and District Radio Society, which was held at the new headquarters, Tollington School, Tetherdown, on October 6th.

The lecturer demonstrated with a very compact frame aerial portable set, an oscillator, and a short-wave receiver. Picking up the London programme, the lecturer then caused the set to oscillate on the "silent point" of the carrier wave. The oscillator was then adjusted to a harmonic of London, the short-wave set being adjusted to the next harmonic. Working on the assumption that 2LO was on its proper wavelength, the short-wave set was ultimately calibrated down to approximately 19 metres. Testifying to the accuracy of this method, the lecturer mentioned that he had received American 2XAF only a small fraction of a metre away from where the set was calibrated to receive it.

The society's syllabus for October, November, and December is now ready, and will be forwarded, on application to the hon. secretary, Mr. Gerald S. Sessions, 20, Grasmere Road, Muswell Hill, N.10.

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Do You Possess a Wavemeter?

At the Croydon Wireless and Physical Society's opening winter meeting on October 4th Messrs. W. F. Pearson and T. A. F. Iserbyt contributed an interesting talk on the design and capabilities of a wavemeter, mentioning the various types in use, such as the buzzer, the heterodyne or valve, the absorption, the Neon tube, and the Piezo electric.

A Townsend buzzer wavemeter, and also a heterodyne wavemeter, were available for inspection, along with a one-valve Reinartz receiver. The members had an opportunity of setting the buzzer wavemeter at a definite wavelength and of tuning in on the receiver the high-pitched note emitted by the buzzer, thus becoming familiar with the actual working of this useful piece of apparatus.

In view of the early adoption of the new wavelengths by the majority of the European broadcasting stations, the necessity of possessing a wavemeter was emphasised, and members are to be granted every facility for constructing their own instruments.

Hon. secretary: Mr. H. P. T. Gee, 51-52, Chancery Lane, W.C.2.

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.

DETERIORATION OF DRY BATTERIES.

Sir,—Increasing use is being made of dry batteries of large capacity for the supply of H.T. current to receiving sets, particularly by country listeners. Consequently, it is quite time that they should be certain on purchasing a battery that it is a new article and not one which has been in stock for months. Some makers have provided seals to prevent the battery being used before purchase, but the chief trouble is due to deterioration with time Therefore, could not the makers write the date that the battery left the works on the seals, as is done in the case of the photographic film, which must be developed before a certain date, so that the purchaser could see at a glance how long the battery had been standing idle?

Arundel. JOHN B. ROBERTSON.

AMERICAN RECEPTION.

Sir,—I note with interest the letter of Mr. A. S. Watford in the October 13th issue of *The Wireless World re* American reception. I fancy it would be interesting to learn the earliest hour at which U.S. short-wave broadcast stations can be received with an ordinary receiver and average aerial system. On two occasions since October 1st I have received 2XAF on 32.79 metres and/or 22 metres and/or 26.8 metres from 8.30 p.m. G.M.T. (3.30 E.S.T.) with a single-valve "Armstrong" Super on a small indoor aerial at good strength, and speech was readable without aerial or earth. When testing, this station seems to start off by having about fifteen minutes on 22 metres (2XAD), and then going up to 26.8 metres for another fifteen minutes, afterwards settling down on 32.79 metres (2XAF), finishing up about 10 p.m. G.M.T. On Tuesday nights (which is my night for late listening) his prices of apples, etc., boom through on 26.8 metres from 11 p.m. G.M.T. to 12 midnight, after which he works on the 32.79-metre wave, relaying WGY's dinner concert, etc. I would like to know if he works on short waves in the day (here) Saturdays or Sundays, as I fancy he could be received any time if one knew at what hour to look for him. The regularity with which he can be received in the evenings becomes monotonous, as also does 2XG on 35 (?) metres, with his sentences such as "If you want to learn tennis," etc., "Write it down." Perhaps some of your other readers can satisfy my curiosity *re* early working.

Birmingham. A. E. DUCKETT.

SUGGESTIONS FOR BETTER PROGRAMMES.

Sir,—There have always been many people ready to criticise the present policy of the B.B.C., but it is to be hoped that when the present organisation is handed over to the Government they will come forward with solutions to the problem. Here are mine for what they may be worth :—

Alternative Programmes.—Six high-power stations to be erected down the centre line of the country and coupled to the nearest town by land-line. The wider the country from coast to coast the higher the power (5 to 20 kW.)

Better Programmes.—A classified list of broadcast items to be attached to every licence issued, the listener to strike out classes of items which he regards as unsuitable. The list to be retained by the Post Office and broadcast programmes based upon it.

With only six stations higher fees can be paid to artists without increasing the present expenditure.

Oscillation.—Three licences to be issues as follow :

A.—*Licence fee* £1. To be issued only to constructors and experimenters for any set or number of sets. Applicants to qualify for a modified P.M.G. test.

B.—*Licence fee* 10*s*. To be issued for any receiver incapable of oscillation.

C.—*Licence fee* 5*s*. For crystal receivers.

The Government to provide a staff of inspectors. Oscillation traced to holders of A or B licences to involve cancellation.

Interference.—Listening posts to be placed near shore stations to report all ships' operators using more power than necessary for communication. The same posts to listen for and report on broadcasting stations causing interference through being off their wavelength. SPARKS, R.E.

October 15th, 1926.

IDENTIFYING BROADCAST TRANSMISSIONS.

Sir,—In the "Broadcast Brevities" section of your issue for Sept. 8th there is a section dealing with European stations and their identification and asking for suggestions to simplify same.

If every European station were given a number and that number were transmitted, in Morse, using a note similar to 2LO's tuning signal or time signal, *at the end* (not beginning) of each item, identification, to my mind, would be much easier and more reliable.

For the sake of time, I would also suggest that the Morse figures be sent in their abbreviated form. Most people, sufficiently interested, would very rapidly learn the numbers 0 to 9.

My reason for advocating the Morse signal is that I have noticed that when speech from London has been unreadable the six dots for the time signal have been easily readable.

Reasons for it being at the end of an item are several :—

1. It would not interfere with the ordinary announcement.
2. The station would be at its full normal power.
3. The listener's mind is already fixed on the transmission and does not after a lengthy wait have to suddenly adjust itself.
4. No extra time would be taken up, as the interval is there in any case. The numbering to be from 1 upwards to avoid having four or more figures.

Manchester. L. WILLIAMS.

October 14th, 1926.

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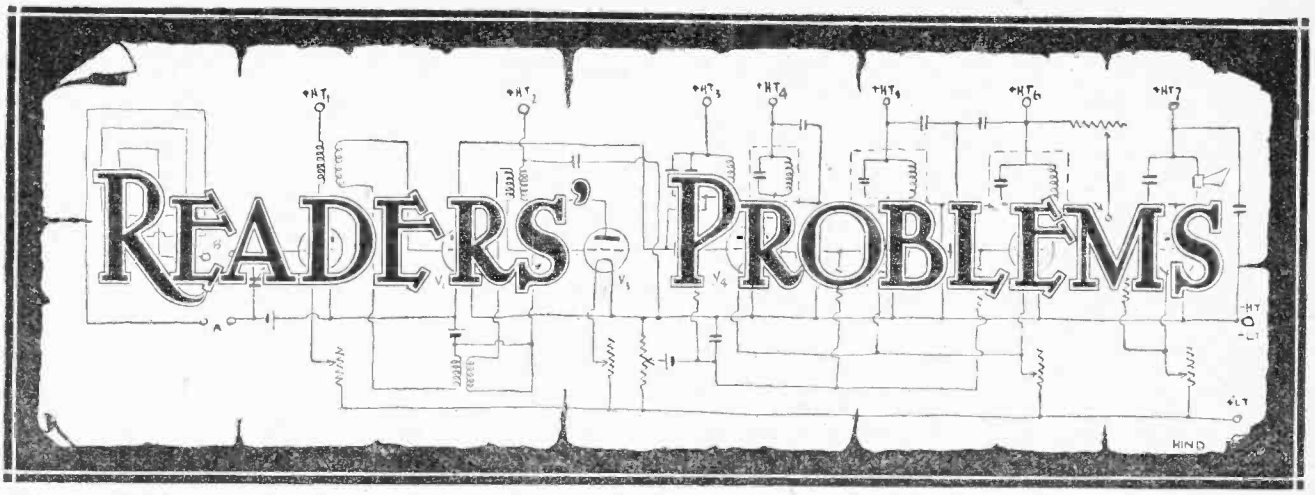
A USEFUL REFERENCE BOOK.

Readers of *The Wireless World* will, no doubt, welcome in convenient book form a reprint of the very comprehensive "Dictionary of Wireless Technical Terms," by S. O. Pearson, B.Sc., A.M.I.E.E., which appeared in our pages between October, 1925, and March, 1926.

This is now published by Messrs. Iliffe & Sons Ltd. in the form of a small and compact volume for the use not only of the great army of wireless experimenters and students who have not the advantage of a training in electrical engineering, but also to those who have been or are now studying wireless. The volume contains ample definitions of all technical terms and expressions commonly encountered, and highly technical language has been avoided as far as possible in the wording of the definitions. An extended system of cross-references makes it possible for the information to be understood by those possessing the minimum of knowledge concerning wireless theory and practice.

The book contains 254 pages, is well illustrated, and, wherever necessary, an explanatory diagram has been added to a definition to enable it to be understood more easily. The price is 2s. net, post free 2s. 3d.



"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 Resistance-coupled Amplifier.

Is there any advantage to be gained by using a low-capacity type of valve in a resistance-coupled amplifier?

T. E. D.

If you mean a resistance-coupled low-frequency amplifier, there is no advantage to be gained whatever, since the inter-electrode capacity of the ordinary four-pin valve is sufficiently small to offer a high impedance at all audio-frequencies. If building a high-frequency resistance-coupled amplifier, then the use of these valves will result in a marked increase in efficiency on the normal broadcasting wavelengths. Indeed, the resistance-coupled H.F. amplifier is of very little use on the normal broadcast band using ordinary valves since the inter-electrode capacities of the valve would shunt away a large proportion of the H.F. energy. Using low-capacity valves, on the other hand, and paying special attention to the avoidance of capacity effects in the wiring does enable us to get this type of H.F. amplifier to function on the broadcasting wavelengths. In Germany, successful H.F. amplification has been obtained right down to 70 metres by using special valves in which the whole of the anode resistances, coupling condensers, etc., are mounted inside the valve, thus reducing capacity effects to an absolute minimum.

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New Lamps for Old.

I have been told that in houses having a D.C. electric lighting system it is possible to charge accumulators at home at no cost. If this is so, can you give me the necessary instructions?

G. B. S.

It is possible to do this by placing the accumulator to be charged in series with the mains so that the whole of the current used for lighting purposes is compelled to pass through the accumulator, and so charge it. Provided that the charging process is confined to the evening when the lights are on normally, no expense is incurred, since obviously the lights would be on anyhow, and no additional energy is consumed. This does not quite represent something for nothing however, since the price paid for the charge is the slight diminution of light obtained, since the six volts back pressure of the accumulator is subtracted from the mains' voltage. This loss of light, however, is too small to be noticeable.

The method of procedure is just to remove any one of the main fuses and find the polarity of each fuse box terminal, using the method recently given in these columns. Then join up the accumulator and fuse to the fuse box terminals, according to Fig. 1.

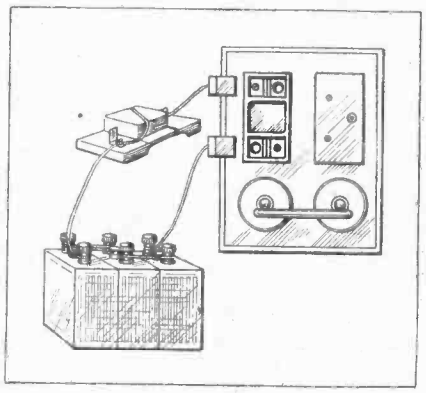

Fig. 1.—Charging batteries from the mains.

The charging rate will not be high, and consequently the accumulator will take rather a long time to charge. Take, for instance, the case of 110-volt mains where normally two 60-watt lamps are in use during the evening. In this case, the total current would be about one ampere, and an average sized accumulator would take about 30 hours to charge, or, in other words, five or six evenings at this period of the year when the lights are on for several hours each evening. In summer time, of course, when lights are used normally for only a short period each evening, it would take considerably longer. Those people who use electricity for heating or cooking are in an ideal position, because normally they have a fairly heavy current passing and can charge even the largest-sized accumulator in a short time and at no cost.

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The "Infradyne" Circuit

I have recently been hearing of the great range and freedom from interference given by the "Infradyne" circuit. In what manner is this achieved?

S. W. A.

This circuit has recently achieved great popularity in America, where it is proving a formidable rival to the normal type of superheterodyne, since it is, of course, merely a specialised form of superheterodyne.

In the normal superheterodyne we change the received wavelength of, say, 300 metres to a much larger wavelength of perhaps 3,000 metres, and then amplify at this much larger wavelength. In the "Infradyne" circuit, instead of changing the original wavelength in an upward direction to 3,000 metres, we change it down to a short wavelength of about 100 metres, and then proceed to amplify at that wavelength. The method of doing this is as follows:—In the superheterodyne, as is well known, local oscillations are generated either by a separate oscillator valve, or otherwise, and these local oscillations are produced at a slightly different frequency to the oscillations set up by the incoming signals. By the interaction of these two frequencies a beat frequency equal to the difference between the two frequencies is formed. Naturally, the beat frequency produced is much lower than either of its two constituent frequencies, and the usual frequency is

that corresponding to 3,000 metres or so. In the "Infradyne," local oscillations are generated in a similar manner, but instead of making use of the *difference* between the two frequencies we make use of the *sum* of the two frequencies, the resultant frequency produced being much higher of course, than either of the two original frequencies, and actually it is arranged that the resultant frequency corresponds to a wavelength between 90 and 100 metres, and amplification is then carried out in an intermediate amplifier designed for this wavelength.

In view of the well-known difficulties of constructing an H F. amplifier to operate efficiently on these short wavelengths it may well be asked wherein lays the advantage. Briefly, the advantages claimed are fivefold :—

1. Freedom from interference by long-wave commercial stations.

2. Any harmonics produced by the oscillator valve when combined with the incoming oscillations produce a resultant frequency outside the gamut of the intermediate amplifier, and so are inaudible, thus doing away with the phenomenon of a station coming in at several places on the dials.

3. Stations are received at one setting only of the oscillator condenser and not two as usual.

4. Freedom from atmospherics and noises from electric mains.

5. Owing to the short wavelength of the intermediate amplifier, the by-pass condenser in the plate circuit of the second detector need not be large, and thus one well-known cause of distortion in the superheterodyne is eliminated.

With regard to the difficulties of employing H.F. amplification on short wavelengths, it should not be forgotten that it is much easier to design a three-stage amplifier to operate on one fixed wavelength of, say, 95 metres than to arrange for it to be variable.

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An Efficient Crystal Set.

I wish to construct a simple but efficient crystal set with which it is possible to make a rapid change from the normal B.B.C. wavelengths to Daventry as required. The receiver must be as selective as possible, not only for the purpose of receiving Daventry quite free from the local station, but also for the purpose of separating two normal wavelength stations operating in the same locality as in the case of the recent two-station test in London. *G. H. S.*

We give in Fig. 2 a circuit which should be suitable for your purpose. It will be noticed that a split coil is used for tuning purposes, the crystal and phones being tapped across only half the tuned circuit in order to minimise the damping effect produced by the crystal, thus improving both selectivity and volume. Similarly, a so-called "auto-tapped" aerial connection is used, thus removing to a large extent the effect of aerial damping, whilst the 0.0003 mfd. fixed series condenser still further increases selectivity, and in most cases will give an actual increase of signal strength owing to the minimising of the damping effect produced in the tuned circuit by the aerial resistances. If used on an indoor aerial experiment should be made with the removal of this fixed condenser, and in the case of a very small indoor aerial, the effect of connecting the aerial direct to the top of the tuning coil might be tried.

It will be found that the value of 0.0003 mfd. given for the fixed condenser will be about correct for both the normal broadcasting wavelengths and for Daventry. If it is made of lower value, such as 0.0001 mfd., selectivity (but not signal strength) will increase on the normal broadcasting wavelengths, but the volume obtained from Daventry will be considerably decreased. If, on the other hand, it is made larger, such as 0.0005 mfd., selectivity will be sacrificed without any compensating gain of volume.

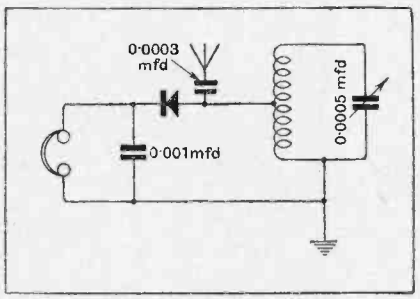

Fig. 2.—An efficient crystal circuit.

The coils require to have inductance values of about 200 microhenries and 5,000 microhenries respectively, for the normal B.B.C. and the Daventry wavelengths, and may consist of commercial split coils such as the No. 1 and No. 3 "Dimic" coils. Alternatively, they may be constructed at home. The coils for the normal B.B.C. band of wavelengths may consist of 60 turns of No. 24 D.C.C. wound on a cylindrical former three inches in diameter. Valve pins may be affixed to the former for the purpose of plugging in interchangeable coils. It will be obvious that a space of almost ¼ inch will have to be made in the two halves of the winding to allow for the fitting of the centre contact valve pin. The long-wave coil should consist of a total of 250 turns wound on a similar former, but obviously a smaller gauge wire such as No. 36 will have to be used.

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Mutual Inductance.

I recently set up a four-valve circuit containing one stage of H.F., using the tuned anode system of coupling. In place of the No. 50 coil specified for the anode circuit I used two No. 25 coils in series, but the set will not tune up to the required wavelength. Can you explain this? *W. H. N.*

You are making the mistake of thinking that two No. 25 coils in series will give you the same inductance as one No. 50 coil. Actually the inductance of the average No. 50 coil is almost 200 microhenries and the inductance of a No. 25 coil about 30 microhenries. The inductance of your two coils in series is therefore only 60 microhenries instead of the required 200 microhenries, if your two No. 25 coils are not within each others' magnetic field. If, on the contrary, your two coils were tightly coupled together so that their mutual inductance was high, then the total inductance obtained would not fall far short of that given by one single No. 50 coil. The inductance can never be quite equal to that of the single coil, however, because it is physically impossible to place the two coils near enough together so that the mutual inductance existing between the two windings is equal to that given by two No. 25 turn windings (or, in other words, a 50-turn winding) wound on our one former. Your remedy is, therefore, to place your two coils side by side in the closest possible proximity, and, of course, in the same magnetic sense, since otherwise their magnetic fields will tend to cancel rather than assist each other, and so reduce the resultant inductance to a figure approaching zero.

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Ohm's Law Again.

Why is it that when short-circuiting a 60-volt H.T. accumulator accidentally the short-circuiting wire becomes rapidly heated up, but on the same thing happening to a new 60-volt dry battery, the wire does not heat up appreciably? Since the voltage is the same in each case, one would expect the same current to flow. *C. M. R.*

This is a problem which is completely answered by Ohm's Law. The heat is caused naturally by a heavy current, and the problem is to find out why in one case the current is so much greater than the other. The reason is that the current flow depends not on voltage alone, but also on the resistance in the circuit, and it must be remembered that whereas the internal resistance of even a new 60-volt dry battery is considerable, that of an H.T. accumulator is practically negligible.