The Wireless World AND RADIO REVIEW

VOLUME XXII

JANUARY 4th—JUNE 27th, 1928

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THE LISTENER

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The Wireless World AND RADIO REVIEW

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THE PAST AND THE FUTURE.

THIS issue being the first of the New Year, it is an opportune moment to look back over the year that has passed and consider in what way 1928 could be made a better wireless year than 1927. One matter at least is outstanding in our mind as a cause for dissatisfaction on the part of the wireless user. We refer to the delay and difficulties in obtaining apparatus at the time it is wanted. Our post-bag bears ample evidence that many of the manufacturers who exhibited at the Olympia Show are at present, three months after the Show, far behind in meeting orders for many of their new lines of components and sets. There are, too, sets and components which were exhibited at Olympia which to-day have not yet appeared on the market, indicating probably that the early samples exhibited were ill-considered in the first instance, and that their production had to be abandoned when the manufacturing side was more closely investigated.

In our issue of last week a correspondent suggested that a solution to the problem of meeting the demand for apparatus at the right time might be found in changing the date of the annual Wireless Exhibition. The Exhibition is compared with the Motor Show, and it is pointed out that the Motor Show is held at the end of what is regarded as the motoring season, at a time when interest in motoring has not begun to fall off, but sufficiently long before the season opens again in the spring to enable manufacturers to get down to production and so meet the demand, even though it may come with a rush. Our correspondent suggests that, if the Wireless Exhibition were held in the spring instead of in the autumn, production could go ahead during the slacker months of summer, so that when winter enthusiasm for wireless was at its height stocks would be sufficient to meet the demand. We commend the suggestion to the consideration of the wireless industry. We feel that it is imperative that some step should be taken to reduce the inconvenience to the public and loss to the industry which is bound to occur so long as matters remain as they are to-day. Probably very few of our readers are without some experience of having to wait for apparatus ordered when apparently there is no real justification for the delay in delivery. Wireless as an industry is becoming more stabilised from year to year, and just as in the motor industry the new models appear for the first time at the annual Show, so we see the same tendency in wireless, new apparatus appearing annually instead of at irregular intervals all through the year.

The need for 1928 is a closer consideration on the part of the manufacturer of the problem of meeting demands with adequate production. Much of the delay in meeting the demand appears to be due to nervousness as to whether a good demand for a particular product will arise, and so too often we find components and sets exhibited and advertised to test out demand before serious production has been started. A change in date of the Show might materially assist.

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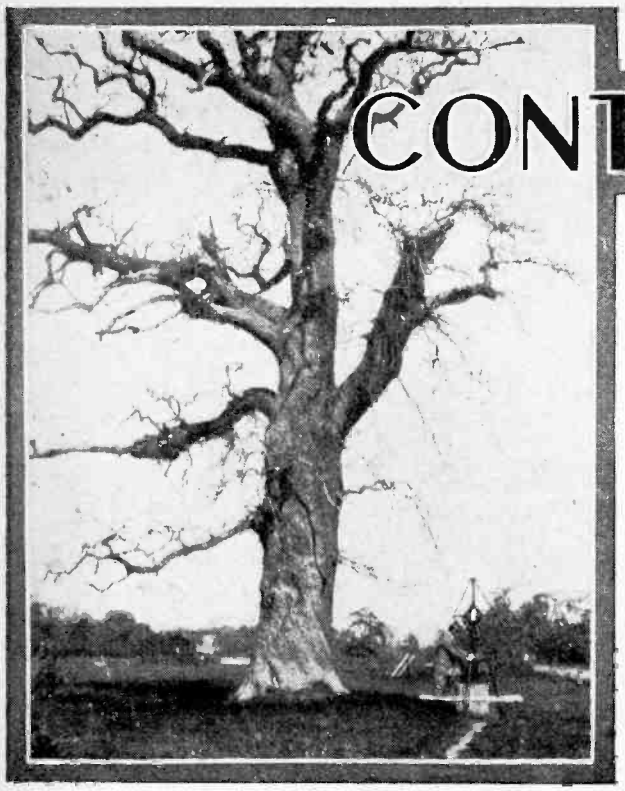
CONTOURS.

THE distribution of signal strength from a broadcasting station is a matter of special importance, particularly to those who are responsible for giving an efficient broadcasting service over a prescribed area. More especially is the subject one of interest to our own Broadcasting Corporation in connection with the proposed Regional scheme, as it will provide a guide as to the best locations, the best distribution, and the requisite number of stations to service the whole of the country. In this issue an interesting article on the Contours of 2LO is contributed. The article is prepared as the result of observations with a travelling van over a long period. Many points of special interest emerge from a consideration of the results obtained; one finds, for instance, that the presence of the Chiltern Hills has no effect in reducing signal strength in relation to distance, but rather it would appear that in that direction the range of 2LO is greatest, whilst considerable absorption occurs in wooded areas or thickly populated districts.



CONTOURS OF 2LO

The Distribution of Signal Strength from the London Broadcasting Station over the Surrounding Country.

By R. H. BARFIELD, M.Sc., A.M.I.E.E.

AN accurate knowledge of the distribution of signal strength in the neighbourhood of a broadcasting station will always be of great interest. The organisers of the broadcasting system will value such knowledge as almost indispensable in enabling them to plan a satisfactory scheme of many stations to cover a large area; the manufacturer of apparatus will utilise the knowledge to specify the range at which his instruments will work, or to advise a purchaser as to what type of set to buy according to the district in which he lives; while the amateur experimenter, or listener, will find it useful to know how favourably he is situated with regard to the strength of signals which he is likely to obtain, or in order to gauge the probable amount of "swamping" from the local station of his attempts to tune in remote stations; finally, we have the scientific interest of the results from the point of view of pure research.

It was the object of the experiments[1] here described to find by practical measurements the extent to which wireless waves are absorbed by the earth as they travel over its surface. Accordingly, a large number of measurements of field strength of the London broadcasting station, 2LO, were made in a large number of places in different directions from the transmitter up to a maximum distance of a hundred miles. The results of these measurements were plotted in the form of curves and also used to construct a radio contour map of field strength distribution, which is reproduced in Fig. 2. These experimental results were then compared with theoretical values obtained from a well-established theory that takes into account the absorbing effect of the earth. Two problems at once arose for explanation. In the first place, it was noticed that the rate of decrease of signal strength varied with direction; and in the second place, the rate of falling off, or attenuation, was everywhere much greater than the theory predicted. Satisfactory explanations of these two peculiarities have been arrived at, and are described in this article. Briefly, they are that the theory takes no account of things growing or erected on the earth's surface, such as trees and houses. The case of trees, in particular, has been investigated, and a method developed for measuring their wave-absorbing properties. It was found by this subsidiary line of experiments, as will be shown, that there is no need to go further afield for an explanation; that is to say, that the

Fig. 1.—The transportable measuring apparatus in use.

[1] A full account of this work was given by the author in a paper read before the Institution of Electrical Engineers on December 7th, 1927.

Contours of 2LO.—

existence of trees in itself provides a satisfactory solution to both the problems.

Description of Measuring Apparatus.

A photograph of the measuring apparatus, erected and working, is shown in Fig. 1. The signals measured were received on a light portable aerial consisting of a mast twenty feet high, on the top of which an aerial wire fifty

local source of oscillations, the current of which is maintained constant and measured by means of a sensitive thermo-junction and microammeter. A change-over switch mounted on the radio-goniometer makes and breaks each field coil circuit alternately. The rotating search coil of the radio-goniometer is connected in a highly damped circuit which, in turn, is coupled to a secondary tuned circuit, and thence a seven-valve high-frequency amplifier with telephone reception.

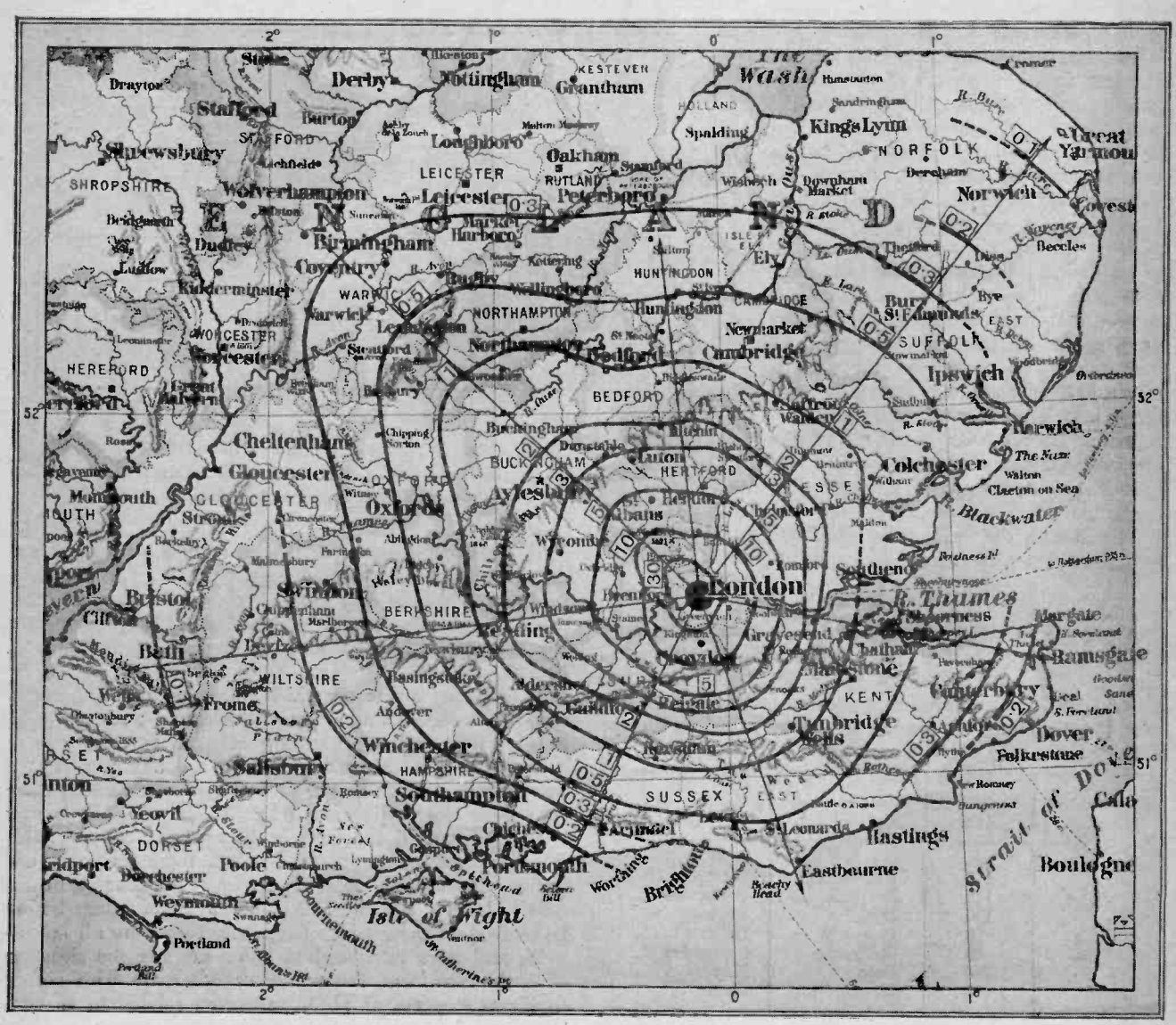


Fig. 2.—Contour map of field strength from 2LO. The radial lines indicate the directions taken by the travelling van, and the numbers represent the field strength in millivolts per metre.

feet long sloped downwards to the table holding the apparatus. The aerial is connected to a single wire counterpoise (see Fig. 3) through one field coil of a standard radio-goniometer, such as is used in the Bellini-Tosi system of direction finding.

Fig. 4 shows the complete diagram of connection; the aerial circuit remains untuned. The other field coil of the goniometer is connected to the output of a screened

The method of operating the set is as follows: With the change-over switch in the aerial position, the signals are tuned in. The switch is then put to the opposite position, so as to disconnect the aerial and connect up the local source, which is now tuned to exactly the same wavelength as that of the signal to be measured. The next operation is to rotate the goniometer search coil, at the same time operating the switch until a position is

Contours of 2LO.—

obtained for which the signal intensities are equal in each position of the switch. The tangent of the angle now indicated by the pointer of the instrument gives the ratio of the current in the aerial to that provided by the local source of oscillations. Since this latter is kept constant, this ratio constitutes a relative measure of the signal strength. These relative values of signal strength obtained in this way were converted to absolute values, in millivolts per metre, by making at one site (Radio Research Station, Slough), a simultaneous measurement both of the absolute value, by means of special apparatus and of the relative value on the portable set. Having done this, it will be seen that all other relative values can at once be converted to absolute values. This second measuring set at Slough was used for the purpose of taking control measurements simultaneously with those obtained on the portable set; these check measurements showed that the field strength from 2LO at Slough remained sensibly constant over the whole period of the experiments. The complete apparatus was fitted into a number of separate metal screening boxes with flexible metallic screened junctions between them. For transport the boxes could be quickly disconnected from one another, and were packed into a light van with the mast, collapsible table, and subsidiary gear; the van also carried the operating staff.

Description of the Field Work.

A good idea of the ground covered during the work can be gathered from the map which shows the results, Fig. 2. Each of the seven radial lines represents one experimental run, which usually lasted two or three days. The journeys are set out in the table below, with the date and distance of each.

Approximate Direction.	Length of Run.	Town Nearest End of Run.	Date.
	km.		
N.	115	Huntingdon	October, 1926
N.E.	140	Norwich	September ,,
E.	110	Deal	August ,,
S.S.E.	90	Pevensey	October ,,
S.S.W.	90	Chichester	September ,,
W.	160	Bath	May ,,
N.W.	160	Birmingham	June ,,

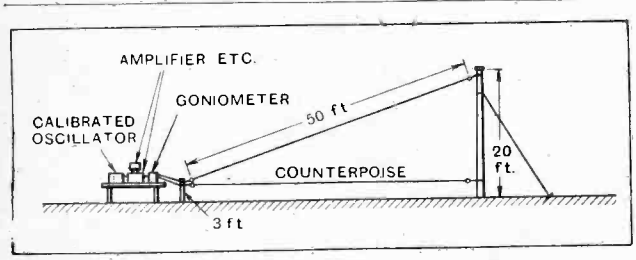


Fig. 3.—Dimensions of aerial and counterpoise system.

If the sea did not intervene, we usually travelled out about a hundred miles, keeping as nearly as possible to the particular line chosen. During the outward run we took one or two measurements only, but kept a sharp look-out for likely sites. On the return run we did the measuring, making an observation once in every five to ten miles, and always checking the measurements made during the outward run.

For example, on the westward run, observations were

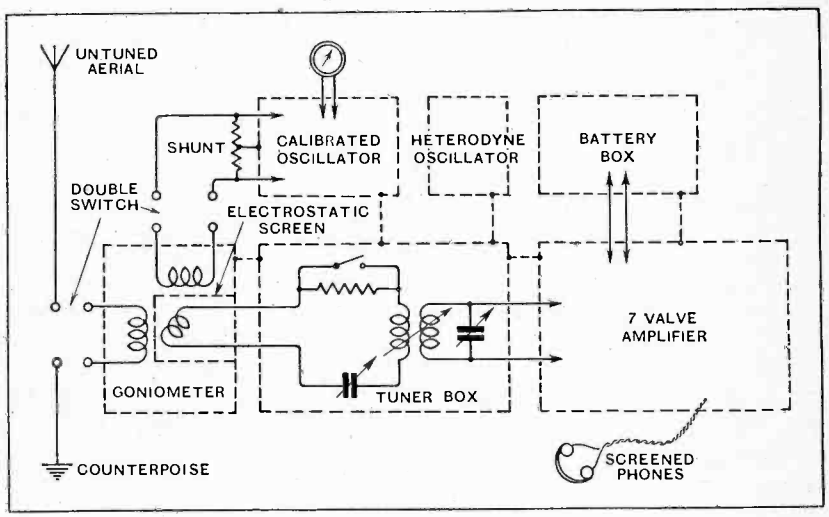


Fig. 4.—Schematic circuit diagram of apparatus.

made at Slough and near Avebury on the way out and on the return, measurements were made at Bath, Chippenham, a second site near Avebury, as a check; between Marlborough and Hungerford; Newbury; near Reading; Maidenhead and Ealing, with a check at Slough.

In choosing a site on which to set up our apparatus, our chief concern was to get well clear of trees and telegraph wires, and so we usually selected an open field or a common. In the spring, before the hay was cut, it was often a difficult matter to find a place fulfilling these conditions and easily accessible with the van. It is well worthy of record that of the many hundreds of fields where we set up our portable mast, there was only one where the farmer objected to our presence. Fortunately, in this case, we had made our observations before he arrived on the scene. Elsewhere they were all hospitable, and were interested to know whether the situation of their farm was favourable or otherwise with regard to signal strength of 2LO, and often related to us with much detail the nature and merits of their own wireless sets.

The map shows that many of the journeys passed over ranges of hills, such as the Chilterns, North and South Downs, Cotswolds, etc. No particular precautions were taken to avoid them in choosing the sites. On crossing the Wiltshire downs, for example, observations were made both on their top and near their foot on the far side, and the results show conclusively the complete absence of any screening effect due to the hills. Again, measurements were made on the highest part of the

Contours of 2LO.—South Downs above Chichester, and found not to be any stronger than those made in the valley. The journeys were not without humorous incidents: on a hot summer day a little boy came up to our portable table, covered with its mysterious tin boxes, and asked for a penn'orth of ice-cream; on another occasion a roadside tea shanty proprietor complained that we were competing unfairly with him, as *he* had to pay rent.

Fig. 6.—Direction-finding apparatus used in investigating the distortion of wave front by trees.

The Results of the Experiments.

The contour map of Fig. 2 sums up practically the whole of the experimental results. It was constructed from the data obtained from the seven experimental journeys which have already been referred to, and are indicated by the radial lines. The contour lines show the distribution of field strength in all directions up to a distance of a hundred miles from the 2LO transmitter; the values are in millivolts per metre; thus, the inner line just skirting London is the 30 mV./metre line, the following are 10, 5, 3, 2 1, 0.5, 0.3, 0.2, 0.1 respectively. For example, the 0.1 contour line is seen beyond Norwich and again beyond Bath. The signals in these regions are, therefore, 1-300 of their value on the outskirts of London.

The general impression which is gained from the map is the absence of any local effect producing divergences

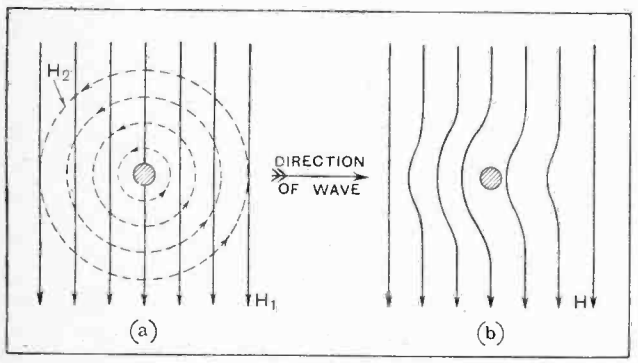


Fig. 5.—Distortion of magnetic field in the vicinity of a tree; H_1 = field due to transmitter, H_2 = field due to tree, H = resultant field.

of wave strength; that is, the lines are remarkably free from minor irregularities.

Another point of great interest is that the contour lines are by no means concentric circles, as would be expected from transmission over a uniformly conducting surface; they are noticeably compressed in the southerly directions and stretched out to the north. This implies that the absorption of the wireless waves is not the same in all directions from the transmitter, being greater to the south than to the north.

Apart from the value of the practical results by themselves, it is of great interest to compare them with theory. Sommerfeld[1] has provided the only satisfactory formula by which this can be done. By means of this, the signal strength at any distance can be predicted from a knowledge of the earth's conductivity. If this is done, it is found that the predicted value comes out everywhere higher than the experimental value as recorded on the map. As an example, at a distance of 50 miles in the southerly direction, the value actually obtained by experiment is about 0.3 mV./metre, whereas its value predicted from Sommerfeld's theory is about 2.1 mV./metre, that is, seven times as great. In the northerly direction the discrepancy is not so large, but is still considerable.

Explanation of Results.

The outcome, therefore, is that we have two curious points to explain: Why do the signals fall off more rapidly to the south than to the north, and why should they everywhere be weaker than the theory predicts?

The answer to the last is almost certainly that the theory takes account only of the absorption by the earth's surface itself. It ignores the energy dissipated in things projected from the surface, such as houses and vegeta-

[1] "Über die Ausbreitung den Wellen im Drahtlosen Telegraphie," *Annalen der Physik*, 1909, vol. 28, p. 665.

Contours of 2LO.—

tion. It is difficult to allow for all the different kinds of objects which may extract energy from the waves, but a casual view of the countryside will give most people the impression that trees must play a very important part, as there are few districts in the area surveyed which are not fairly thickly wooded. It is also significant that there are on the whole many more trees in the counties south of London than in those just north. This must have been noticed by most people familiar with the home counties. It is also made convincing by a comparison of almost any two large-scale ordnance survey maps of the north and south of London. Thus, if the absorption by the trees is of importance, we should expect a greater attenuation of the waves in the south than in the north, and it therefore appears that we are perhaps approaching the common solution to both the above problems.

Testing the Solution.

It was fortunately found possible to provide a practical means of testing the tree hypothesis in a fairly simple manner. The trees over which the waves pass may be considered as upright receiving aerials. Although, of course, they are not tuned to the proper wavelength, they will nevertheless have currents induced in them. If we consider the case of a single tree, we find that this current produces round the tree a local distortion of the electromagnetic field of the waves. The nature of this as regards the magnetic field is shown in Fig. 5. Now the magnitude of this distortion is a measure of the amount of energy absorbed by the tree. To measure this effect, a small portable direction-finder was placed at the foot of the tree under examination, and since this instrument actually determines the direction of the magnetic field at any point, it was an easy matter to map out the field and thus determine the extent of the distortion.

The actual way in which this experiment was carried out is shown in the two illustrations, in Fig. 6 and in the title. In the first, a close-up view of the base of the tree is shown with the measuring set in the foreground; in the second, a more distant view of the carrying out of the test is shown. By making these experiments with many different trees, a general idea of their absorbing properties could be obtained. Thus it was found that a large tree may absorb as much energy as a quarter-acre of the earth's surface.

Rough estimates were then made of the density of the trees in various parts of the country shown on the contour map. From their numbers an estimate of the energy absorbed in the different directions could be made. It was found that by adding the energy absorbed by the earth to the energy absorbed by the trees in a given direction, the predicted value of signal strength came much closer than before to the values found by experiment; in fact, the agreement now was remarkably close.

It thus appears that we need not look further than to the effect of trees to explain both why the attenuation varies with direction and why the signal strength is weaker everywhere than Sommerfeld's theory predicts.

CLUB NEWS.

"Wireless World" Moving-coil Loud-speaker.

Members of the Kensington Radio Society recently enjoyed a lecture by Mr. F. H. Haynes, Assistant Editor of *The Wireless World*, who described and demonstrated *The Wireless World* moving-coil loud-speaker.

New members are welcome to the Society. Applications should be addressed to the Hon. Secretary, Mr. G. T. Hoyes, 71a, Elsham Road, Kensington, W.14.

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Battery Eliminators.

An outstanding lecture given before the Bradford Radio Society was that on December 2nd, when Mr. P. R. Coursey took as his subject "Battery Eliminators." The lecture, which was an abstract from that delivered by Mr. Coursey before the Institute of Electrical Engineers, dealt both theoretically and practically with the fundamental design of battery eliminators, aided by very effective demonstrations and by lantern slides.

Hon. Secretary: Mr. E. A. Cowling, 1,145, Leeds Road, Thornbury, Bradford.

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Coventry Transmitters' Association.

Members of the Coventry Transmitters' Association have enjoyed several interesting lectures during the past few months. A recent lecturer was Mr. Philip R. Coursey, of the Dubilier Co., who dealt with the main uses of a condenser in a valve transmitter, explaining with the aid of slides the various mechanical and electrical differences existing between the various types to suit various conditions.

Other subjects dealt with have been coil-driven loud-speakers and automatic telephone exchanges. The Hon. Secretary is Mr. L. W Gardner, (5GR), 10, Ludlow Road, Coventry.

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Increasing Membership by Novel Means.

Members of the Bristol and District Radio Society who had never before heard a moving-coil loud-speaker received a surprise at the meeting on Friday, December 16th, when a moving-coil instrument, lent by Messrs. Bristol Radios, was demonstrated by Messrs. Weller and Wilson. The reproduction, which was excellent, included both gramophone and broadcast selections of many types of music, including organ, orchestral, and vocal solos.

The Society has inaugurated a membership increase campaign and any member introducing five new recruits will be exempt from payment of subscription for one year. In addition, a prize of a "Gecophone" Cone Speaker is offered to the member who obtains the largest number of new members by January 30th, 1928.

Hon. Secretary, Mr. S. J. Hurley, Arno's Vale, Bristol.

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"Super-Hets" v. H.F. Amplifiers.

A keen discussion on the respective merits of "super-hets" and efficient high-frequency amplifiers such as the "Everyman" type took place at the last meeting of the Southport and District Radio Society. The occasion was a lecture given by Mr. P. K. Carmichael, who dealt with super-heterodyne receivers in a very thorough manner.

The Society now holds a monthly "Beginners' Night" and prior to these meetings a number of interesting questions are collected for discussion.

Hon. Secretary, Mr. G. E. C. Jarvis, 24, Poulton Road, Southport.

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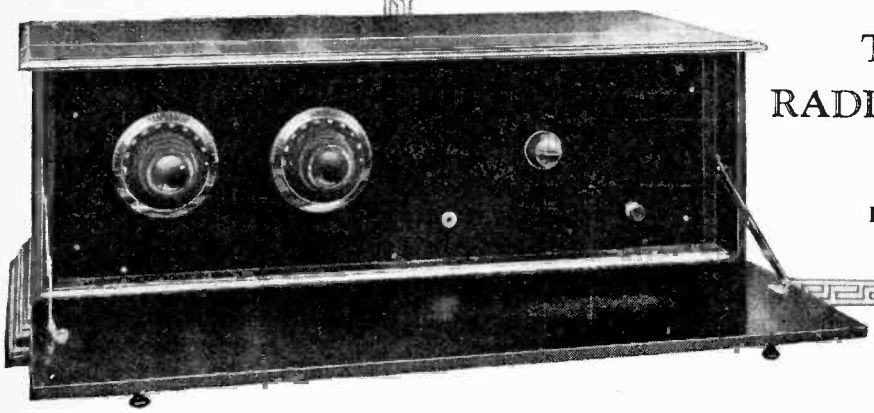
Grid Bias and L.F. Amplification.

The value of grid bias was the theme of Mr. Garside's address at the last meeting of the Tottenham Wireless Society. Apart from the important question of quality in reproduction, the absence of grid bias, said Mr. Garside, increased the upkeep costs, for the life of even the best H.T. battery, if grid bias were omitted, was at least halved. Mr. Garside then outlined the special points of the new Ferranti transformer A.F.5.

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



THREE-VALVE RADIO-GRAMOPHONE RECEIVER.

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

A Standard Dual-purpose Receiver for the Home.

NOWADAYS the standard of performance required from a modern receiver used for broadcast reception in the home is very high, and since the recent interest in electrical reproduction of gramophone records, most users of radio sets prefer to be able to reproduce records on their own loud-speakers with the aid of an electrical pick-up and their own receivers.

It has been pointed out in *The Wireless World* by Denman[1] and others that really high quality, which really involves quite large volume of reproduction, calls for an expensive set owing to the large power supply required for the amplifier valves. On the other hand, it is an undoubted fact that very satisfactory good quality results may be obtained, suitable for the average sized room, with more normal H.T. supplies of 140-180 volts, and, after all, it is in an average size room that most people listen to their radio sets.

On the radio side, the reception of three or four stations on the loud-speaker is usually all that is required for a standard home set, as opposed to an experimental receiver, and it is a *sine qua non* that the tuning in of these stations must be very easy and certain, which, of course, involves non-critical reaction and single knob tuning.

Having tuned in a station, it is sometimes desirable to reduce the volume of broadcast in the loud-speaker, and as altering volume by detuning is not usually conducive to good quality, some other form of volume control must be available.

On the gramophone side, it should be possible, simply by plugging in the connections from the pick-up, to change over automatically from radio to gramophone reproduction, and, of course, *vice versa* by removing the pick-up connections. Here again a volume control is very often desirable.

The above remarks indicate very briefly the desirable qualities in a modern home broadcast receiver, and the receiver to be described in this article has been designed with these points in view.

The Circuit—Gramophone Side.

Two alternative circuits are shown in Figs. 1 and 2—the circuits are identical on the radio side and only differ in the point of application of the input voltage from the gramophone pick-up.

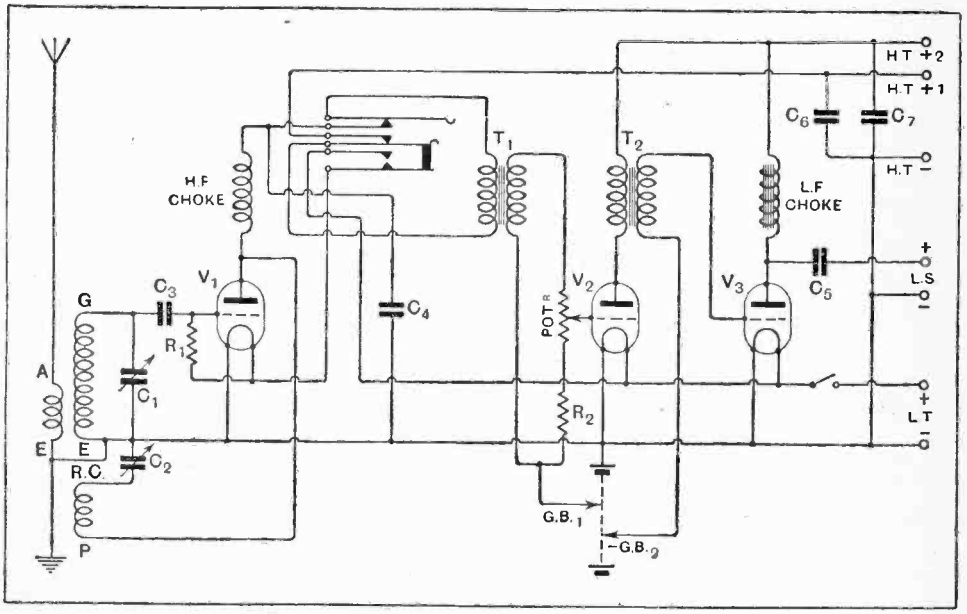


Fig. 1.—Complete circuit diagram. C_1=0.0005 mfd., C_2=0.0003 mfd., C_3, C_4=0.0003 mfd., C_5, C_6, C_7=2 mfds., R_1=2 megohms, R_2=0.5 megohm.

[1] "High Quality Reproduction." *January 26th*, 1927.

Three-valve Radio-Gramophone Receiver.—

Fig. 1 shows an arrangement using two stages of L.F amplification and the switching arranged to cut out the first valve altogether when the pick-up is plugged in, while in the circuit arrangement of Fig. 2, all three valves are used as L.F. amplifiers, and the grid bias of the first valve is arranged to be suitably altered so that the operating point falls well on the straight part of the grid volts—plate current characteristic when the pick-up is plugged in.

Of course, the amplification in the second case will be more than in the first, and it really depends on individual taste as well as the particular type of pick-up, valves, and H.T. supply available which circuit is used.

Taking the circuits more in detail as regards the gramophone input arrangements, in Fig. 1, inserting the pick-up plug into the jack automatically connects the pick-up across the primary of the first L.F. transformer, which

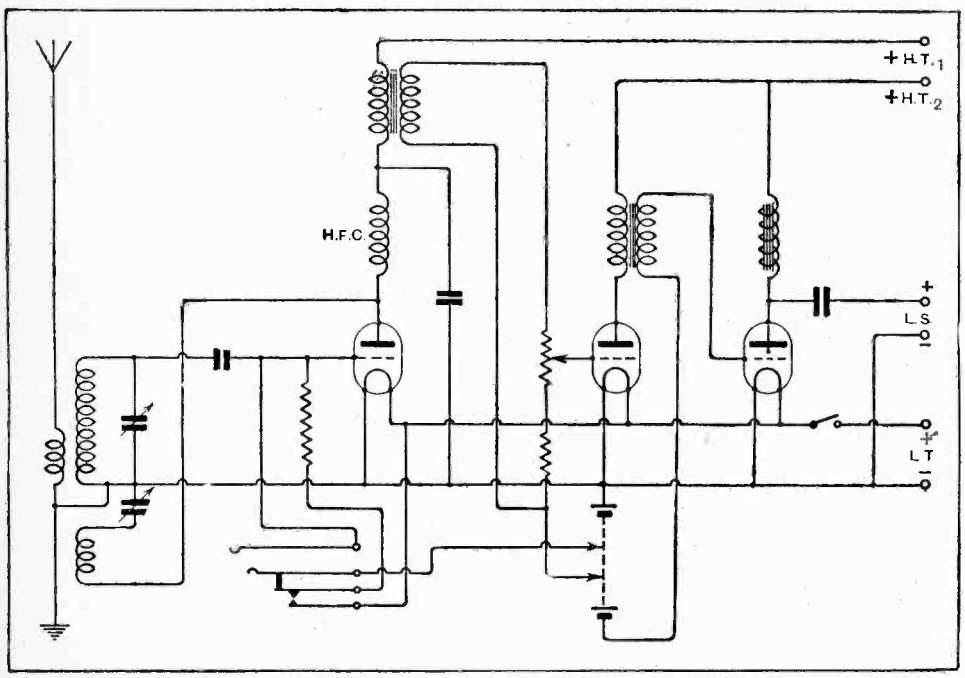


Fig. 2.—Alternative circuit in which three amplifying valves are available for the gramophone input.

is then completely isolated from the rest of the set, and at the same time the positive lead to the filament of the first valve is open-circuited by means of the auxiliary contacts on the jack.

An Alternative Circuit.

In the second arrangement, inserting the pick-up plug automatically connects one side of the pick-up to the grid of the first valve, the other being connected to a suitable position on the grid bias battery, while at the same time the connection between the grid leak and the positive side of the filament is open-circuited by means of the auxiliary contacts on the jack.

The presence of the comparatively low impedance (to H.F.) pick-up, if of the usual electromagnetic type, will usually effectively wipe out or sufficiently reduce any H.F. input from the aerial system, and in any case the first valve is then operating under amplifying and not rectifying conditions. A practical point to which attention should be paid in carrying out the wiring is to make the shorter jack contact (*i.e.*, the one which does *not* operate the auxiliary contacts) the one which is connected to the grid of the valve so as to cut down the possibility of H.F. leakage as much as possible. The block which is used in the jack for operating the auxiliary contacts is usually made of fibre, which is apt to be rather hygroscopic, and although quite suitable for switching D.C. circuits even with high voltage between the ends of the block, it may be found to be a source of serious loss at radio frequencies.

The Circuit—Radio Side.

So many powerful stations are now operating on the lower broadcast band (200-500 metres) that a detector valve with two stages of L.F. and an average outdoor aerial should be sufficient to receive three or four at good strength and quality on the loud-speaker, provided that the reader does not live within half-a-mile or so of his local station.

Some form of reaction control will usually be necessary, and as there are many forms which may be employed a little digression on their pros and cons will not be out of place. For simple reaction control, the reaction setting for just not oscillating should vary either uniformly with the main tuning condenser setting, as shown by the line A in Fig. 3, or the reaction setting should be constant, as shown by the line B. In the first case, the tuning and reaction controls could be linked together and operated by a common knob, a small auxiliary reaction control being preferably used in the case of loud stations to prevent overload of the first valve.

In the second case, no outside reaction control is strictly necessary, though the small control mentioned above will usually be an advantage. The main advantage of reaction controls either obeying curve A or B in Fig. 3, besides ease of control, is that the set can be so designed that it will not oscillate when altering the setting of the main condenser, although full sensitivity can be maintained all over the scale.

Both these conditions are ideal, but it is possible to approximate to the constant reaction setting (B in Fig. 3) in an actual set by careful design and by paying attention to one or two definite principles.

The old form of swinging coil reaction is certainly fairly simple, but it has the unfortunate disadvantages of large space required and the alteration of main tuning

Three-valve Radio-Gramophone Receiver.—

as the reaction is varied by moving the reaction coil. Trying to overcome the latter disadvantage by using a large reaction coil at a considerable angle to the main coil

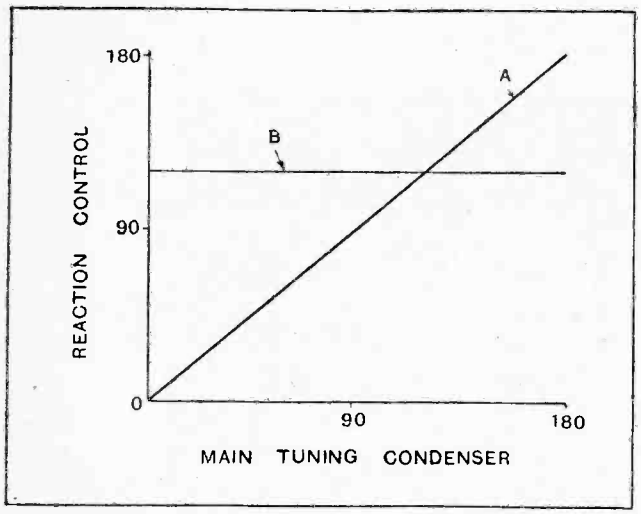


Fig. 3.—Two ideal conditions of reaction control; A, in which reaction setting is exactly proportional to tuning condenser setting, and, B, constant over the whole of the tuning scale.

brings the added disadvantage of a reduction in the wavelength range covered by one reaction coil and may involve uncontrollable oscillation if the reaction coil with its stray capacities happens to tune to the same wavelength to which the grid circuit is tuned.

Reaction Control.

Using a small coil tightly coupled certainly gives a larger wavelength range per coil, but the reaction control is then extremely critical.

Turning to capacity reaction, pure and simple, with a large inductance or H.F. choke in the plate circuit, the reaction control is usually far from constant, especially with a direct-coupled aerial, and even with a loose-coupled aerial it is rather difficult to obtain a control of form A or B over a large part of the tuning range. The reaction scheme used in the writer's "Wide Range" and "The Motorist's Four" sets,[1] although it gives nearly constant reaction over about half the wavelength range, yet the law for the remaining half is much nearer curve A than curve B. This particular reaction control is easy to handle, but the wiring of the H.F. portion of the set requires to be carefully done or trouble may be experienced. A mixture of capacity and magnetic reaction is probably best. The familiar Hartley circuit is the chief example from which many others, such as the Reinartz, have been evolved.

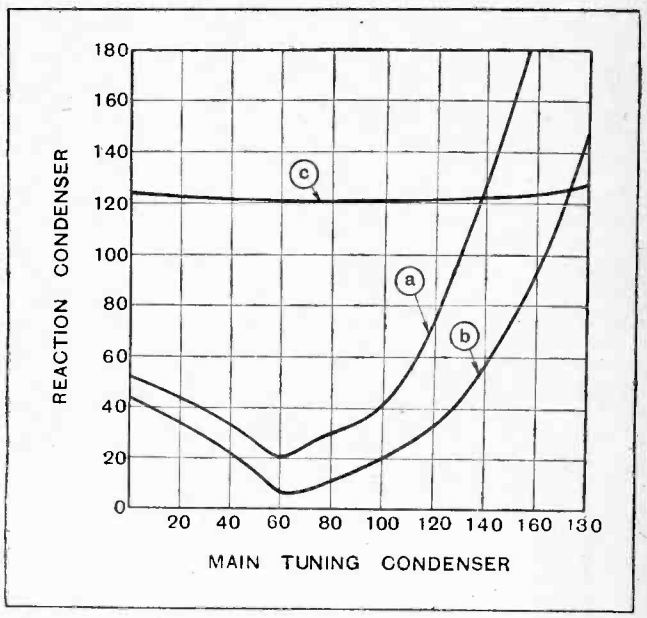


Fig. 4.—Experimental curves of relation between reaction and tuning controls; (a) small capacity, large coil and loose coupling, (b) same as (a) but with increased H.T., (c) large capacity (0.0005 mfd. max.) and small coil tightly coupled.

[1] *The Wireless World*, Sept. 15th, 1926, and Jan. 19th, 1927.

LIST OF PARTS.

3 Valve holders (Pye).
2 L.F. transformers, 3.6 : 1 (Igranic, Type G.).
1 Output filter choke (R.I. & Varley).
1 Variable condenser, 0.0005 mfd., logarithmic type with slow-motion friction drive (Jackson Bros.).
1 Variable condenser, 0.0003 mfd., logarithmic type with slow-motion friction drive (Jackson Bros.).
2 Fixed condensers, 0.0003 mfd. (Dubilier type, No. 620).
3 Fixed condensers, 2 mfds. (T.C.C.).
1 Grid leak, 2 megohms (Dubilier Dumetohm).
1 Grid leak, 0.5 megohms (Dubilier Dumetohm).
1 Grid leak holder (Dubilier Dumetohm).
1 Grid bias battery, 15-volts (Siemens).
1 Volume control, 0.5 megohm (Rothermel, Centralab).
1 H.F. choke (C. D. Melhuish, Ltd., 8, Great Sutton Street, London, E.C.1).
1 Jack (Igranic Pacent, Type P.70).
1 Jack switch complete (Igranic Pacent, Type P.62).
1 Coil former, 6×3in. and six-pin base (Becol. British Ebonite Co., Ltd.).
1 Ebonite panel, 26×8×¼in.
1 Baseboard of 5-ply, 26×8×⅜in.
1 Mahogany cabinet, 26×8×8in., fall front (Carrington Mfg. Co., Ltd., Camco type).
1 Pair large brackets (Carrington).
9 Terminals, ebonite-shrouded (Belling & Lee).
4 oz. S.S.C. wire, 24 S.W.G.
No. 18 tinned copper wire, screws, terminal strips, battery plugs, etc.

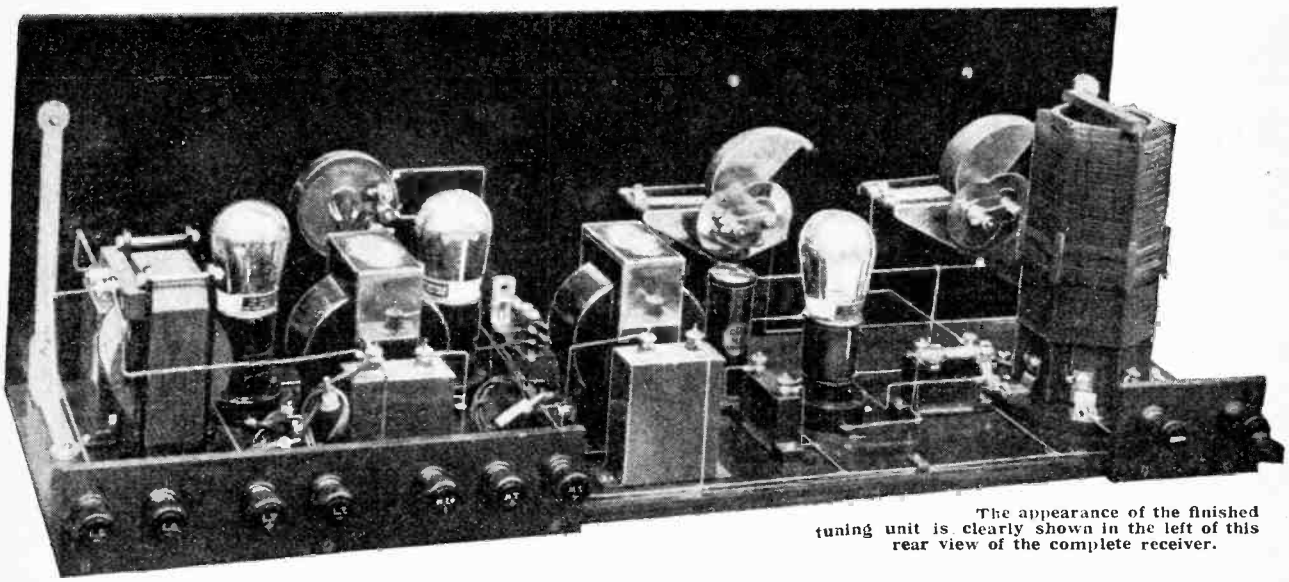
(Approximate cost £10 10s., excluding cabinet.)

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

Three-valve Radio-Gramophone Receiver.—

Here, again, by suitable combination of the capacity and magnetic effects, it is possible to obtain nearly constant reaction, since at one end of the scale the magnetic effect is strong where the capacity is weak and *vice versa*. This is rather a crude way of looking at the operation of a Hartley circuit, but it will serve to illustrate the point.

Curve (*a*) in Fig. 4 shows the relation between reaction condenser and main tuning condenser settings with a large reaction coil loosely coupled and a small value of reaction capacity. Curve (*b*) shows the same arrangement with a larger value of H.T. on the detector valve.



The appearance of the finished tuning unit is clearly shown in the left of this rear view of the complete receiver.

A great advantage in this form of reaction over pure capacity reaction is that one side of the reaction condenser only is "live" and not both; in fact, in the circuit shown in Fig. 1, one side of the reaction condenser (the moving plates) is actually earthed so that no hand effects should be apparent with quite small screening such as is provided by the end plates of modern condensers. The total reaction effect may be made up with a large coil and small condenser, or a small coil and large condenser. The former will show some of the effects discussed in the case of the plug-in swinging coil reaction, especially as fairly loose coupling between grid and reaction coils will most probably be necessary.

This arrangement is obviously far from uniform, although the reaction control is very nice and smooth. By using a small coil tightly coupled, a large H.T. value and a large reaction condenser (0.0005 mfd. max.), the practically constant reaction setting of curve (*c*) was obtained, which is sufficiently good for most purposes.

A further advantage of this form of reaction circuit is that a metal panel may be used if desired, and both variable condensers mounted direct in the panel *without any bushing whatever*.

(*To be concluded.*)

Book Review.

Wireless Direction-finding and Directional Reception.

By R. Keen, B.Eng., A.M.I.E.E. Second and Enlarged Edition, pp. 490, with 323 illustrations. London: Iliffe and Sons, Ltd., 1927. Price, 21s. net.

This book covers in an admirable manner the whole range of directional reception in radio telegraphy, chiefly from the viewpoint of the application of direction-finding to navigation, but including also the use of directional methods for communication purposes. The fundamental theory of direction-finding is clearly explained in simple non-mathematical language, and the various types of practical direction-finder are described with the aid of a considerable number of photographs and diagrams. Two chapters are also devoted to the subjects of "Maps" and "Field and Nautical Astronomy," with which it is essential for the user of the direction-finder to have an accurate working knowledge. As a very reliable and well-produced text-book on direction-finding the work is to be recommended to all who are interested in this subject, whether from the navigational standpoint or merely that of an interested experimenter.

R. L. S. R.

The "Wireless Trader" Year Book and Diary for 1928.

The Trader Publishing Co., Ltd., London, E.C.4, price 5s. 6d. post free for Great Britain, or 7s. 6d. overseas.

The fourth issue of this most useful annual maintains the general features of its predecessors. The first sixty pages are devoted to general and technical information of use to manufacturers and traders, including summaries of the Shop Regulations Acts, Factory and Workshop Acts, Merchandise Marks Acts, and Registration of Business Names Act. A section is devoted to broadcasting matters, the Broadcast Licence, the Marconi Patent Licence, useful information on Patents, Designs, Trade Marks and the Registration of Business Names, and twelve pages of Foreign Import Tariffs. The Technical Data section gives, as in previous issues, a quantity of valuable information in tabular form, together with notes on battery charging and services. The Directory section at the end has been carefully revised and brought up to date. It comprises the trade and professional address of wireless manufacturers, agents, associations and publishers; *bona fide* factors; lists of manufacturers classified under the headings of the goods supplied; a territorial list of factors, and a list of proprietary names, each separate list being printed on different coloured paper for ready reference.

SHORT WAVE ECHOES.

Some Photographic Records of Signals received at Geltow, Germany.

ONE might suppose that with the bridging of the greatest possible distance—half the earth's circumference—the maximum limit of the range of wireless telegraphy has been attained. That this is not necessarily the case has already been demonstrated by reception observations at Geltow, near Berlin, from which it was found that at certain times short waves may travel round *the whole of the earth's circumference*. Further interesting peculiarities have come to light in subsequent reception experiments at Geltow, and it is proposed to give a short account of these in this article.

Method of Measurement.

The observations were made with automatic recording apparatus, consisting of a short-wave receiver and amplifier in conjunction with an oscillograph. The illustrations show records of incoming signals which were registered on a moving photographic paper by means of the oscillograph. To define accurately the times between individual marks, an alternating current of high frequency is simultaneously recorded which can easily be recognised in the lower part of the figures.

Thus Fig. 1[1] shows a dot which was received at Geltow on a wavelength of 15.66 metres from a station in Rio de Janeiro. That two different dots have not been received, but that one and the same dot is concerned, is placed beyond doubt by the method of experiment. The two clearly distinguishable marks *a* and *a'* obviously correspond to the same character from the transmitter, and since the two marks were received with a time separation of 0.137 second, it is beyond doubt that the wave causing the mark *a'* has gone round the earth before being received at Geltow; this is shown schematically in Fig. 2. The interval of 0.137 second is exactly the time required by an electromagnetic wave to negotiate a distance somewhat more than the earth's circumference. It is amazing enough to note the intensity with which the waves are received after traversing this great distance, but the succeeding figures show that even longer paths are traversed by the waves without their energy being too much reduced.

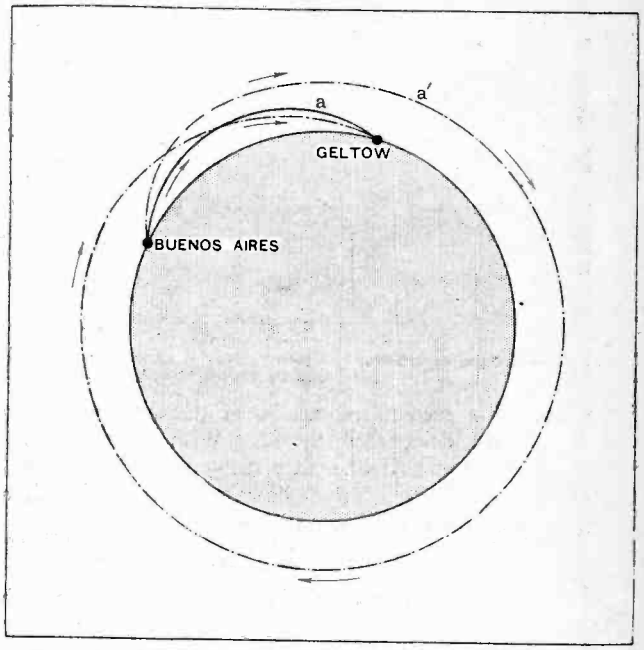


Fig. 2.—Showing track of waves producing the deflections *a* and *a'* in the record in Fig. 1.

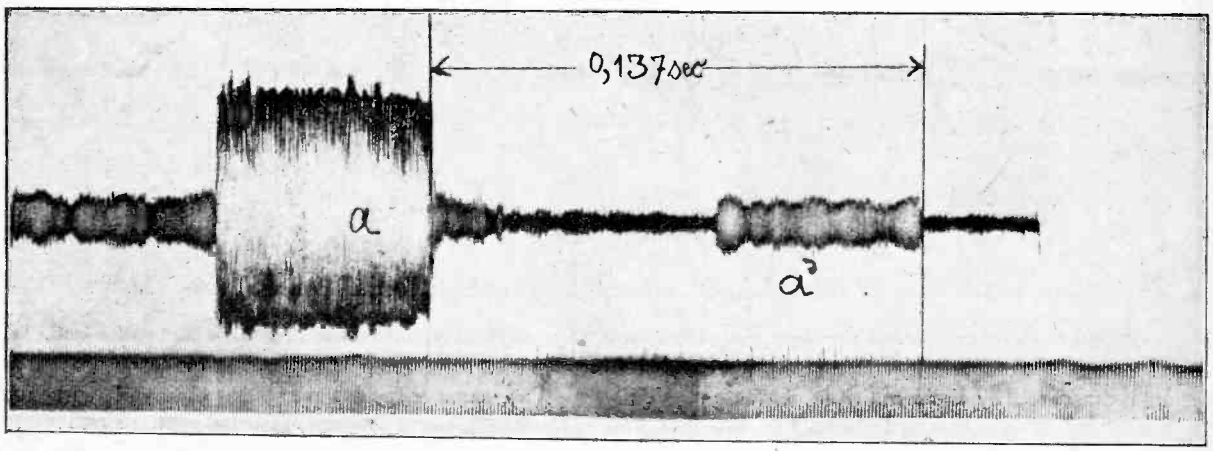


Fig. 1.—Oscillograph record of Morse "dot" sent from Rio de Janeiro on 15.66 metres and received at Geltow, Germany.

Thus Fig. 3 shows another reception record at Geltow of the same transmission. In this case Rio de Janeiro sent two dots, which are indicated by 1 and I. Before

[1] Figures 1, 3 and 4 are taken from the journal *Elektrische Nachrichtentechnik*, published by Weidermannsche Buchhandlung, Berlin.

Short Wave Echoes.—

the second dot is properly registered at the receiver a feebler mark makes its appearance, which without doubt corresponds to mark 1, and which is caused by waves which have encircled the earth. Likewise, after the same time interval a second impression of dot I comes along which may be designated by II. With noticeably reduced energy, but still distinctly recognisable, two marks 3 and III now appear which have encircled the earth a second time before reaching the receiver.

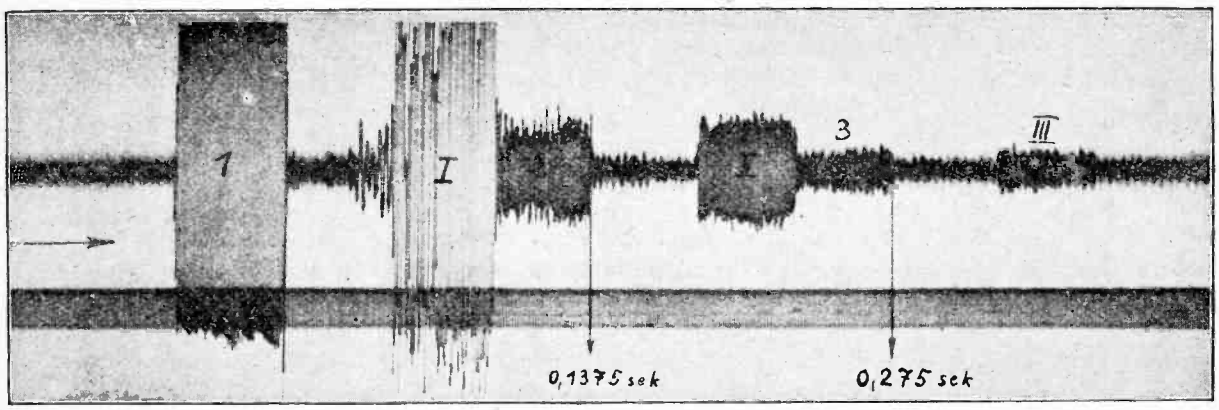


Fig. 3.—Oscillograph record of two "dots" sent from Rio de Janeiro and received at Geltow; the record shows two groups of echoes produced by waves which have travelled once and twice round the earth respectively.

Mutilated Signals.

The process is thus quite similar to an echo; from each individual emission there are received several progressively weakening signals. It is self-evident that the clearness of reception is impaired by these multiple characters. This type of blurring of the received characters was first observed by Dr. Esau several years ago in working between Nauen and Buenos Aires, and by heterodyning the signals it was possible to identify the route taken by each signal.

Finally, in Fig. 4 four different marks are clearly seen which originate from the same two transmitted dots. I and 1 are the two received by the shortest path. I′ and 1′ reached Geltow by the path round the earth in the opposite direction in spite of the fact that the transmitter in Buenos Aires is a beam transmitter. The marks II and 2, likewise III and 3, came finally along the direct path, but after one of two further journeys round the earth.

Apparently the phenomenon is particularly apt to occur when the direct route from transmitter to receiver lies wholly or mostly in darkness.

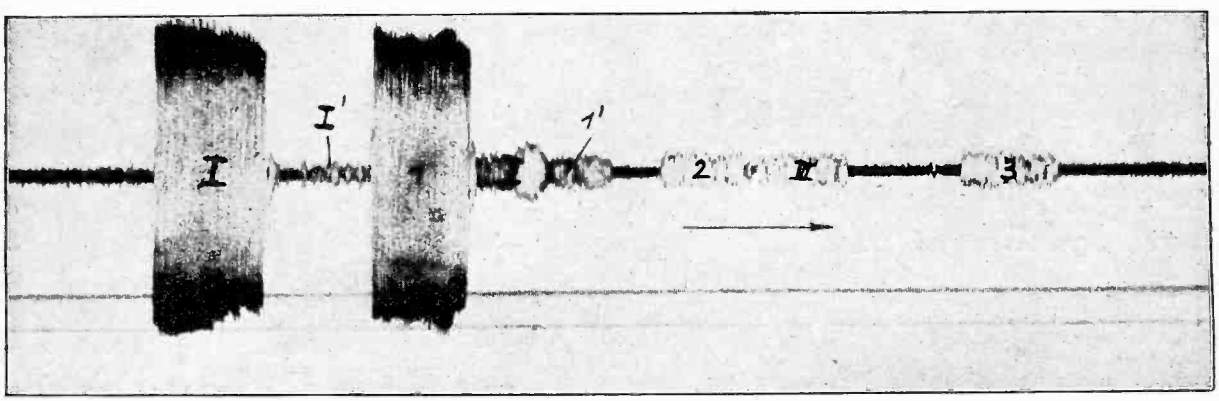


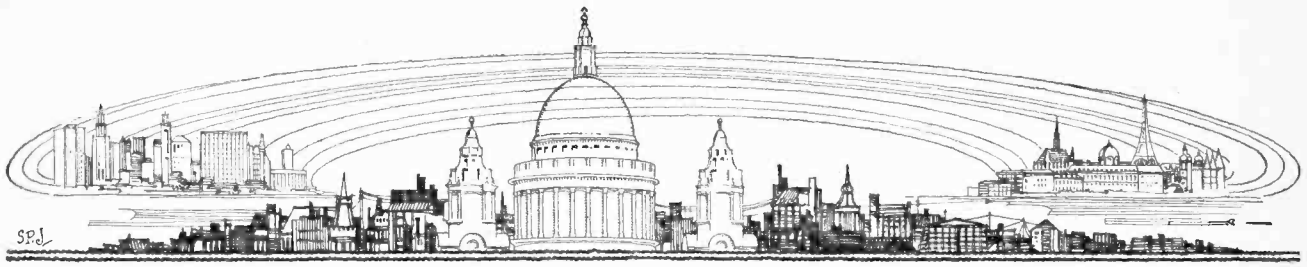
Fig. 4.—Record of two "dots" from the beam station at Buenos Aires showing echoes which have taken alternative paths round the earth.

The same effects have been observed with multiple signals on several wavelengths between 14 and 34 metres.

H. K.

TECHNICAL QUERIES.

The attention of readers availing themselves of "The Wireless World" Free Information Service is specially directed to the Rules of this Department which are printed in the "Readers' Problems" section.



CURRENT TOPICS

Events of the Week in Brief Review.

WIRELESS GIFTS FOR THE BLIND.

Every blind person in the area of the South Beds Society for the Welfare of the Blind received a crystal set as a Christmas gift. The sets are being installed free of charge by members of the Luton Wireless Society.

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GREETINGS BY WIRELESS.

The idea of sending hand-written Christmas greetings between this country and New York proved so popular that the Marconi Company extended this novel service to the New Year. The service enabled messages to be sent in facsimile across the Atlantic at the reduced rate of £8 4s. 6d. for a photo-radiogram measuring 5in. by 4in.

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THE TRANSATLANTIC TELEPHONE.

Suggestions made in this country that the Transatlantic telephone service is a failure are taken lightly by officials of the American Telephone and Telegraph Company, New York, according to a *Daily Telegraph* correspondent. The expectations are that the service will eventually be self-supporting, but that, even if it is not, it will probably be continued. No reduction in the minimum rate of £15 per call is contemplated.

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GOOD FOR NAVAL OPERATORS.

Naval wireless operators at certain coast stations benefit from a new Admiralty Order-in-Council which provides for payment, at the discretion of the Admiralty, of ½d. for every ten words in commercial messages handled by naval ratings in the course of their duty.

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ASSOCIATION OF BRITISH RADIO SOCIETIES.

Growing membership and continued applications for membership from persons residing outside the Manchester area have led the Manchester Association of Radio Societies to change its title to The Association of British Radio Societies. A general committee has been formed to organise an active campaign to secure the affiliation of societies which are struggling along by themselves.

A number of societies outside the Manchester district have recently been admitted to membership, and secretaries of local radio societies who desire further information about the new organisation are invited to communicate with the honorary secretary, Mr. L. A. Gill, Hope House, South Reddish, Stockport.

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LISTENERS WITHOUT A BROADCASTING STATION.

Although there are no broadcasting stations in Rumania, it is officially estimated that there are 15,000 owners of wireless receivers in the country. They rely for their entertainment on programmes from Russia, Poland, Czecho-Slovakia, Hungary, and Jugo-Slavia.

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ARCTIC WIRELESS BOOM ?

The inhabitants of Greenland are better informed than they used to be concerning the doings of the outer world. The station at Godhavn now broadcasts a daily news bulletin at 5 o'clock in the evening, and is heard all over North Greenland and in most of South Greenland. According to a correspondent, the Eskimos are showing a marked interest in wireless apparatus.

BEAM v. CABLES.

From April to October last Beam wireless obtained nearly half the telegraphic traffic between Australia and Great Britain.

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FRENCH WIRELESS TAX REDUCED.

A French official Decree has been issued reducing from 15 to 10 centimes per word (minimum charge, 1 franc) the ship tax on radiograms as regards steamers regularly engaged in service between England and France, and registered in a Channel or North Sea port.

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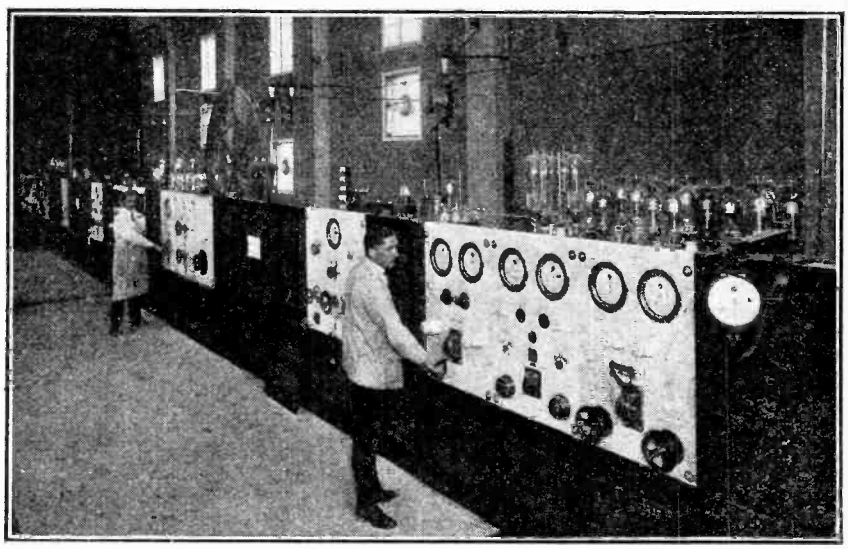
LISTENING IN THE LIBRARY.

A new sphere of activity for public libraries has been suggested by the Bolton branch of the Workers' Educational Association, which has put forward the idea that the local library committee should equip a room with a wireless receiver so that the general public could profit by educational talks and lectures, following these with group discussions.

The committee has replied regretting



FAMOUS GERMAN COMMERCIAL STATION.—A photograph taken in No. 3 Transmitter House at the Koenigswusterhausen telegraph wireless station. The 10-kilowatt valve transmitter working on 2,865 metres is on the extreme right; in the centre is a reserve 2-kilowatt transmitter and on the left the 2-kilowatt "Deutschland Sender."

that at present there is no accommodation available for such a purpose.

If such a recommendation were put before other library committees a more encouraging response might be forthcoming.

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HIS CANCELLED LICENCE.

One of the most disgruntled people in America at the present moment is Eric Palmer, Jun., of Brooklyn, N.Y., whose amateur transmission licence has been cancelled as the result of a letter written to the Government by his father. It appears that Eric has been burning far too much midnight oil, or, rather, current, thus endangering his health without improving his capacity for scholastic pursuits during the hours of daylight.

With the cancellation of the licence came a friendly official letter paying tribute to the work of wireless amateurs, and expressing the hope that when his schooldays were over the boy would devote his time to the development of the wireless art.

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JUST IN TIME.

Among the hospitals which were fitted with wireless just in time for Christmas were the Royal Devon and Exeter Hospital, the Hope Hospital, Pendleton, and the Salford Union Infirmary. It is believed that a large majority of hospitals throughout the country are now radio-equipped.

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SHORT-WAVE TESTS IN MELBOURNE.

3LO, Melbourne, is now transmitting regularly on the short-wave of 36 metres every Sunday from 6.30 to 8.30 p.m. (G.M.T.). The station directors will welcome reports from British amateurs concerning the conditions of reception

TURKISH WIRELESS EFFORT.

A Constantinople message states that the new high-power station at Angora will attempt, on or about January 10th, to get into wireless telephonic communication with London and Paris.

This is a step in the endeavour which the Turkish Government has been making during the last two years to make Angora a big wireless centre, so that commercial business from all parts of Turkey can pass through it. Efforts are being made to establish regular communication with all the principal cities of Europe.

FORTHCOMING EVENTS.

WEDNESDAY, JANUARY 4th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. (light refreshments at 5.30). At the Institution, Savoy Place, W.C.2. "Rotating Loop Radio Transmitters," by Messrs. T. H. Gill and N. F. S. Hecht; "Application of the Rotating Beacon Transmitter to Marine Navigation," by Dr. R. L. Smith-Rose and Mr. S. R. Chapman; "Possible Aerial Arrangements for Rotating Beacon Transmitters," by Dr. R. L. Smith-Rose.

THURSDAY, JANUARY 5th.

Golders Green and Hendon Radio Society.—At 7.30 p.m. At the Club House, Willifield Way, N.W.11. Annual General Meeting. Lecture: "High Frequency Amplification—the Unit System," by Mr. H. F. Smith.

Stretford and District Radio Society.—At 8 p.m. At 6a, Derbyshire Lane. Half Season Review.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Haydn House, Fairlop Road, E.11. Elementary Electricity.

FRIDAY, JANUARY 6th.

Leeds Radio Society.—At the University. Lecture No. 3. "Three-Valve Set," by Mr. A. F. Carter, A.M.I.E.E.

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

Radio Experimental Society of Manchester.—Elementary Class.

TUESDAY, JANUARY 10th.

Bradford Radio Society.—Lecture: "How, Why and When it Works," by Mr. H. J. Barton-Chapple, Wh. Sch., B.Sc.

BLAMING THE SCHOOLBOY.

The schoolboy is again being blamed for the prevalence of oscillation at the present time. It is argued that boys are now away from school and, therefore, that they have unlimited opportunities to desecrate the ether. It is probably true that these opportunities exist, but we consider it unfair to charge the schoolboy with taking advantage of them.

What is a far more likely cause of the present oscillation boom is the general bestowal of new sets which took place at Christmas. Adults are perfectly capable of setting up howls in the ether; indeed, it is safe to say that the average adult is more likely to mismanage his receiver than the average schoolboy, whose knowledge of wireless almost certainly exceeds that of his progenitors.

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WIRELESS AS DOCTOR.

An island in which the inhabitants rely solely on wireless for medical advice, having no resident doctor, is described by Dr. N. L. Schmitt, an official of the National Museum of America, who has just returned from a trip to the island of Juan Fernandez. Here the local fishermen have established a small hospital, with medicines and equipment, and, last but not least, a wireless station. When any of the 287 inhabitants falls ill the symptoms are described by wireless to a doctor in Valparaiso, and in most cases the advice received is sufficient to effect a cure.

CATALOGUES RECEIVED.

A.F.A. Accumulators, Ltd., 120, Tottenham Court Road, London, W.1. Catalogue of Varta accumulators and rectifiers.

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Jellener Industrie-Werk Jellen (Elster), Germany. Illustrated list of metal stampings for transformer shields, condenser plates, etc.

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B.S.A. Radio, Small Heath, Birmingham. Catalogue of valve receivers with leaflet showing December price reductions.

o o o o

The Wet H.T. Battery Company, 12-13, Brownlow Street, High Holborn, London, W.C.1. Book dealing with "Standard" Sac Leclanché wet H.T. and L.T. batteries, and including price list.

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London Radio Manufacturing Co., Ltd., Station Road, Merton Abbey, London, S.W.19. Illustrated leaflets describing the "Orphean" horn loud-speakers.

o o o o

A. W. Knight and Co., 180, Tower Bridge Road, London, S.E.1. Illustrated catalogue of "Kaynite" wireless components, including battery eliminators, transformers, condensers, resistances, etc.

Burndept Wireless, Limited, Bedford Street, Strand, London, W.C.2. Works Publication 130, containing instructions for building eliminators, power amplifiers, and battery chargers with Burndept parts.

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Hobbies, Ltd., Dereham, Norfolk. Leaflets dealing with "Knock Down" cabinets, panel wood, transfer decorations, etc., of interest to the wireless cabinet constructor.

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Philips Lamps, Limited, Philips House, 145, Charing Cross Road, London, W.C.2. "The Story of Mr. Milliamp"—a booklet describing the range of Philips' battery chargers and eliminators.

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Wingrove and Rogers, Limited, Arundel Chambers, 188-189, Strand, London, W.C.2. Booklet dealing with "Polar" receiving sets and accessories.

Camden Electrical Company, Stanley Chambers, Runcorn. Price list of Camden Mansbridge condensers.

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A. H. Hunt, Ltd., Croydon, Surrey. Leaflet No. 155C, containing particulars and price list of Hunt's Hellesen dry batteries. Also leaflet No. 138A, dealing with Hunt's electrical measuring instruments.

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The Ever Ready Company (Great Britain), Ltd., Hercules Place, Holloway, London, N.7. New season's catalogue of "Ever-ready" dry batteries, accumulators, and testing instruments.

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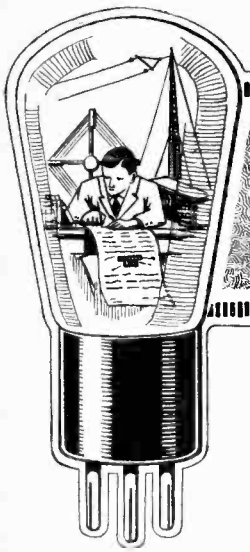
Jewell Pen Co., Ltd., Radio Department, 21-22, Great Sutton Street, London, E.C.1. List R.D.6, covering "Red Diamond" valve holders, coil mounts, phone connectors, etc.

o o o o

General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. New coloured Gecophone loud-speaker folder describing complete range of Gecophone loud-speakers. Also Publication BC4221, a 48-page catalogue of Gecophone radio receivers, gramophone reproducers, components, and accessories.

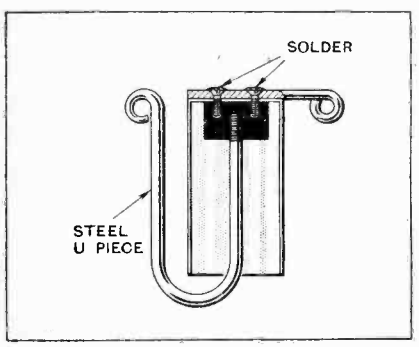


READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

AERIAL INSULATOR.

The insulator constructed in the form shown in the diagram is entirely unaffected by weather, and proof against soot deposits which frequently destroy the insulation of porcelain egg and shell insulators. The insulator itself is a block of ebonite or other insulating material fixed to the inside of a cylindrical metal cover such as a shaving tin. A steel eye is flattened and soldered to the top of the tin, and then drilled to take the insulating screws. The heads of these screws are then soldered over to render the container perfectly waterproof. A steel U piece threaded at



Weatherproof aerial insulator.

one end and provided with a loop at the other is screwed in to the insulating block. The centre of gravity of the insulator being below the level of the eyes keeps the metal container vertical, and so protects the insulator from rain.

It should be noted that an insulator of this type necessarily has fairly high capacity, and if a wire halyard is used other insulators of ordinary type should be connected in series to reduce the capacity to earth. —W. B.

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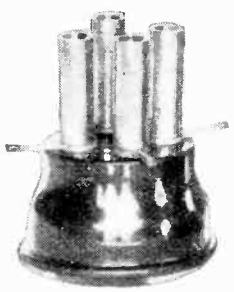
VALVE HOLDER.

The moulded bases of burnt-out valves can be turned to useful purpose as valve holders by the addition of four ordinary valve sockets.

The glass and cement are first



Valve base converted for use as a valve holder.

cleaned out of the base and the contact pins removed. The holes left by the pins must then be enlarged to 4 B.A. clearance to take the threaded base of the valve sockets. These are assembled with soldering tags as shown in the photograph, and the screws underneath the base are cut to the exact length required and secured with shallow lock nuts to reduce capacity.—W. F. C.

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OAK FINISH.

Amateurs who build their own cabinets will find that an excellent stain for oak can be made by mixing Japan black and turpentine in equal quantities. The liquid should be applied with a rag to the well-sandpapered surface, and with two or three coats a rich brown shade will be obtained.—P. B.

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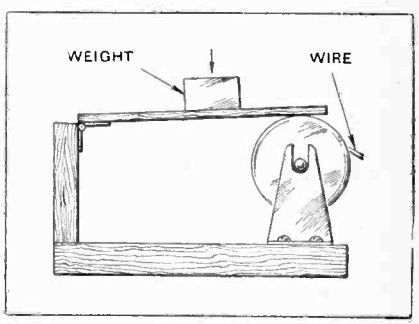
WINDING FINE WIRE.

To prevent the formation of kinks when unwinding fine wire from a reel some form of friction device is required.



Friction device for coil winder.

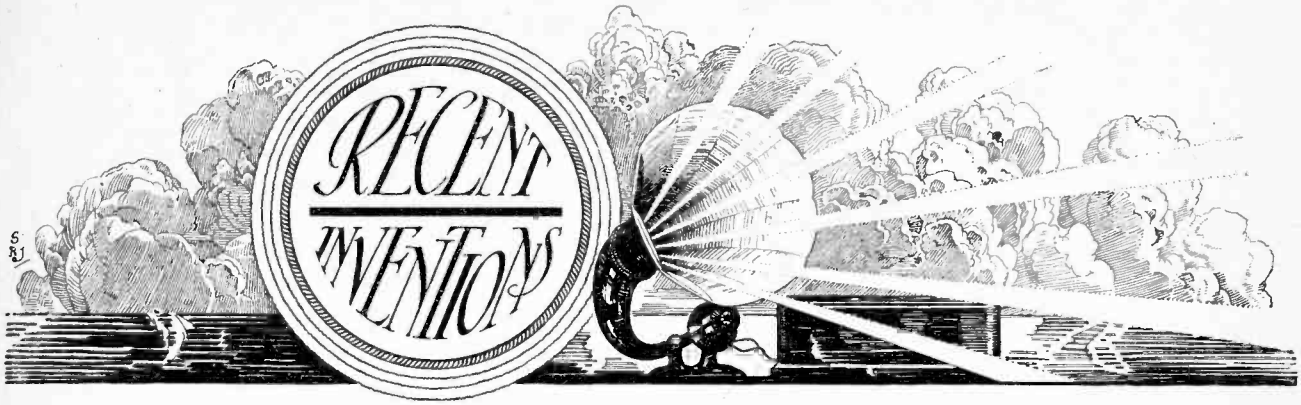
In the diagram the friction is applied to the edge of the reel by means of a wooden arm hinged to an upright support at the back of the baseboard. The pressure is increased by means of a weight, and may be varied by moving the weight along the arm.

With this device the wire will be maintained taut and will not tend to unwind itself on the reel.—A. H. M.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches where necessary, of devices of experimental interest for inclusion in this section. A dull-emitter receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," Dorset House, Tudor St., London, E.C.4, and marked "Ideas."



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

Another "Loftin" Circuit.

Convention date (U.S.A.): December 24th, 1925.

The circuit elements of a high-frequency amplifier are so arranged that there is substantially no reaction due to inter-electrode capacity coupling throughout a wide range of frequency adjustments. At the same time the reactance of the amplifying circuit is kept low, so as to facilitate an efficient transfer of energy from one valve stage to the next. This transfer ratio is also maintained at a constant value over the available tuning range. The arrangement is independent of the dimension and spacing of the valve electrodes, so that one type of valve may be replaced by another without upsetting the balance of the system.

The aerial circuit comprises an inductance L_1 and capacity C_1, and is coupled to a secondary circuit L_2, C_1, C_2 partly through the common condenser C_1 and partly by the magnetic field across the two coils L_1, L_2. By adjusting the polarity of the coils L_1, L_2, the total energy transfer may be made positive or negative, bearing in mind the fact that the capacitative transfer decreases as the signal frequency increases, whilst the magnetic transfer varies in the opposite sense.

The condenser C'_3 in the plate circuit is so proportioned that the sum of the inductive and capacitative reactances and the reactance due to the absorbing or input circuit to the grid of the next valve is substantially zero. More generally the inductive reactance due to the coils L'_1, L'_2 can be so adjusted relatively to the capacitative reactance due to the condensers C'_1, C'_2, and C'_3 as to secure an effective overall reactance which may be either inductive or capacitative or purely resistive in character.

In order to enable the necessary operating voltages to be applied direct to the plates and grids, high-frequency chokes L'_3 and L'_4 are shunted across the coupling condensers as shown.

Patent issued to E. H. Loftin.

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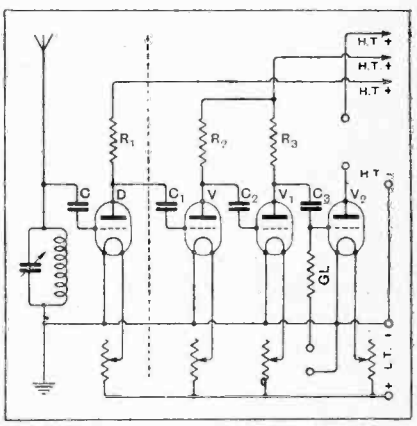
"Grid" Valve Circuits. (No. 276,479.)

Application date: July 7th, 1926.

The grid of each valve is isolated, no leak or biassing battery being used. As shown in the figure, the grid of the first or detector valve D is connected to the aerial through a condenser C, each of the low-frequency stages being similarly coupled through condensers C_1, C_2, C_3, of a value not less than 0.0003 mfd. The

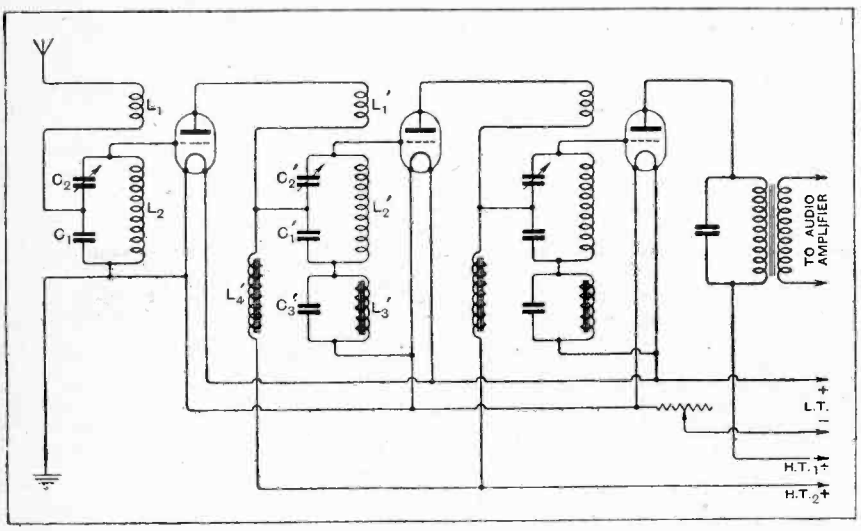


"Free grid" resistance amplifier circuit. (No. 276,479.)

plate resistances R_1, R_2, R_3, are of the order of megohms, 2 megohms being mentioned as a suitable value. A normal high-tension of 60 volts on the first stages and 100 volts on the last is stated to give satisfactory results.

The effect of the high plate resistances is to "ballast" the action of the "free grids," which are normally, of course, unstable when connected in cascade. The elimination of grid leaks and biassing batteries removes a source of damping on the input circuit, and leads to increased selectivity. A special grid leak G L of from 5 to 10 megohms may be provided, in the case of the last stage V_2 of amplification, to relieve excess of grid charge due to heavy loading. To discharge the heavy negative bias thrown on to the grid of the first valve D when the filament is first turned on, the rheostat may be arranged to connect that grid momentarily to the filament circuit, thus removing any temporary paralysis.

Patent issued to P. L. Wostear and R. H. Billingsley.



Loftin H.F. amplifier circuit. (No. 263,804.)

LOW-FREQUENCY OSCILLATION.

Some Notes on Recent Investigations by the Ferranti Research Laboratories.

THE most prevalent cause of L.F. oscillation is the back-coupling that is produced by the source of H.T. having a resistance which is common to the anodes of all the valves; dry cell batteries and D.C. eliminators with potential-dividers probably show the greatest tendency in this direction. The effect of shunting the source of H.T. with large condensers is to ameliorate the conditions, but only such a minute amount of energy is required to be fed back to the detector valve to cause L.F. oscillation (audible or incipient) that even a comparatively low resistance, such as is produced by the length of foil in a reservoir condenser, may be sufficient; in this connection it should be mentioned that some makers of large paper-dielectric condensers tap the foil throughout its length and thus minimise this effect. It is possible therefore that immunity from L.F. interaction cannot necessarily be obtained by shunting condensers across the H.T. The next step is to arrange that any oscillations fed back are out of phase with the normal oscillations thus producing a form of reverse reaction. This is achieved by reversing the connections to the primary or secondary of one L.F. transformer, or where, for instance, three stages of resistance coupling are employed, by substituting other forms of coupling so that no two consecutive methods are alike. This expedient at its best is only a palliative, and in the case of reversing the connections to the transformer may modify its amplification characteristics; furthermore, it may transform an audible whistle or howl into an oscillation above audibility which will cause general distortion.

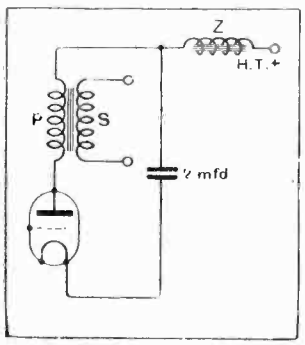


Fig. 1.—Circuit showing method of preventing L.F. back-coupling by the interposition in each H.T. lead of a L.F. choke.

By preventing the A.C. components in the anode circuit of the last valve from passing through the H.T. battery or eliminator by the choke-feed method where the loud-speaker is connected from the anode through a condenser to earth, the chances of oscillation trouble are certainly minimised, but there is still a possibility of feed-back from an earlier L.F. valve.

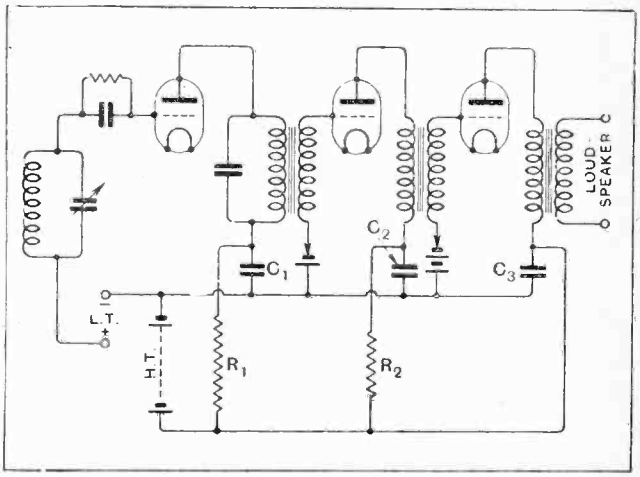


Fig. 2.—A receiver fed from a common H.T. battery through resistances. It is claimed that the tendency to L.F oscillation is eliminated. C_1, C_2 and C_3 are 2 mfd. and R_1 and R_2 are of the order of 25,000 ohms. Tappings are avoided on the H.T. battery which is thus evenly exhausted.

The prevention of L.F. oscillation has been the subject of a great deal of research on the part of Messrs. Ferranti, Ltd., at their laboratories at Stalybridge, and we are indebted to Mr. A. Hall, A.R.C.S., their chief radio engineer, for the following notes. It had been shown that as a result of feed-back when using two stages of L.F. transformer coupling with a common battery the overall amplification was by no means the

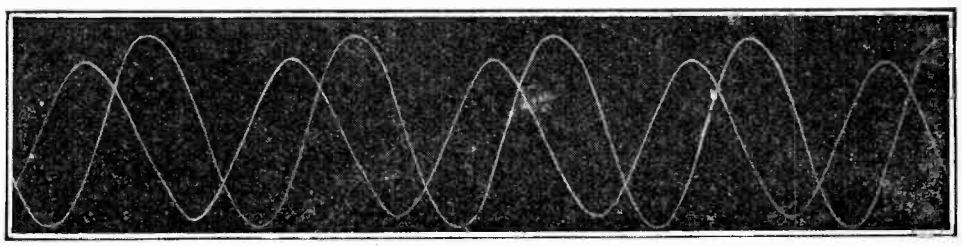


Fig. 3.—Oscillograph photograph of input and output waves of amplifier shown in Fig. 2. There is no evidence of wave-form distortion.

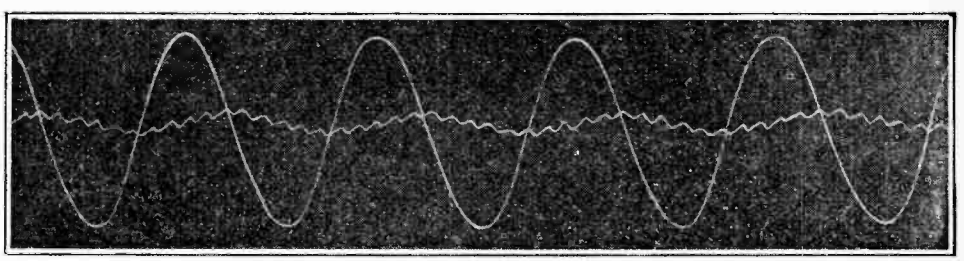


Fig. 4.—Oscillograph photograph of input and output waves of amplifier shown in Fig. 2 with common H.T. battery of 200 ohms D.C. resistance but without anode feed resistances. Note the reduced amplitude of output wave and the H.F. ripple superimposed.

Low-frequency Oscillation.—

product of the two stages as measured separately; in fact, this ideal condition could only be obtained by feeding each anode with a separate battery, or nearly be obtained with a separate H.T. battery for the detector. Low-frequency chokes of high inductance interposed in the H.T. feed circuit of each valve were shown to prevent effectively any back-coupling, provided a shunting condenser was connected to earth as shown in Fig. 1. It was next suggested that, instead of chokes, wire-wound resistances capable of carrying the necessary current would be much cheaper and would fulfil not only the same function of preventing back-coupling and giving results equivalent to a separate battery for each valve, but would also by avoiding the necessity of tappings provide a means of evenly exhausting the whole H.T. battery. It is seldom that the full voltage of an H.T. battery is required for any but the last valve, and by using resistances as already described any required reduction for the other valves can be arranged; to calculate the value of the resistance reference should be made to "Hints and Tips" in *The Wireless World*, dated December 14th, 1927.

Fig. 2 shows an amplifier connected up with anode-feed resistances giving, in fact, an overall amplification which equals the theoretical product of the two separate L.F. stages.

Fig. 3 gives an oscillograph photograph of the input and output waves of this amplifier showing that there is no wave-form distortion. Fig. 4 shows an oscillograph photograph of the input and output waves of the same amplifier, using a common battery of 200 ohms D.C. resistance, but without the anode-feed resistances. The output is a wave of the same frequency as the input, but of much reduced amplitude having a high-frequency ripple superimposed causing a shrill whistle in the loud-speaker. Fig. 5 shows the anode-feed resistance principle applied to a receiver with D.C. eliminator in which it is claimed that no "motor-boating" can occur, and that the amplification curve is just the same as in a

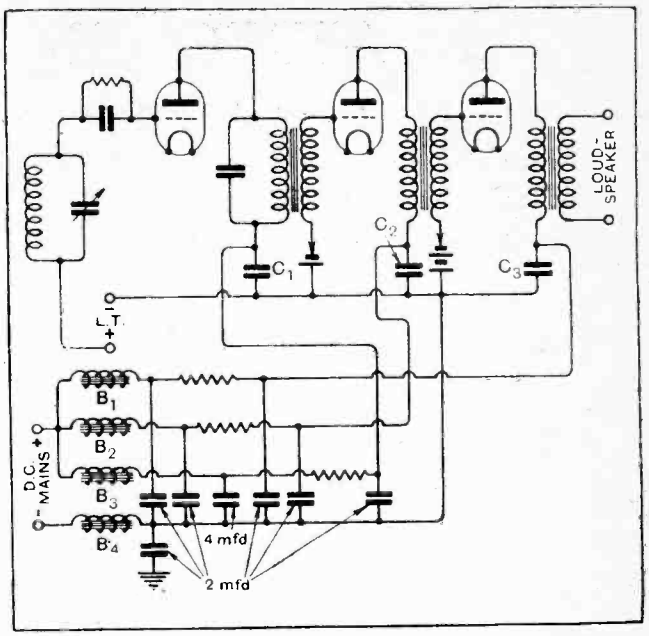


Fig. 5.—The anode-feed resistance scheme as applied to a D.C. H.T. eliminator. The important claim is made that no "motor-boating" can occur and that the amplification curve is the same as in the ideal case where separate H.T. batteries are used for each anode

set fed from separate H.T. batteries to each anode. Every receiver with L.F. stages employing a common source of H.T. is prone to produce a change in wave-form and amplification characteristic due to interaction of which Fig. 4 is an exaggerated case.

Low-frequency oscillation is a fault that is difficult to remedy, especially as it is sometimes evident as an oscillation above audibility which creates an unpleasant form of distortion. The principle of interposing suitable resistances in each H.T. lead is of some importance, and when properly appreciated is likely to become widely adopted.

W. I. G. P.

Greenland Expedition.

Mr. H. E. Smith (G6UH), 31, Wandle Road, Hackbridge, Surrey, tells us that he was in two-way communication on December 21st at 5.45 p.m. with the Hobbs Expedition, West Greenland (NX1XL). The operator informed him that this was the first time he had been able to make contact with a British station. He has an A.C. note on 46 metres. Mr. Smith was working with an input of about 6 watts, and his signals were reported as R3.

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Fading Tests on 45 Metres.

In order to attempt to trace the skip distance obtained on the 45 metre band when using an input power of 5 watts, two London amateurs have arranged to conduct a series of tests for one week, commencing Sunday, January 15th, 1928.

The stations will be G6PP—54, Purley Avenue, N.W.—and G6CL—107, Friern Barnet Road, N.11. Each station will call "Test-Skip—de G6PP" (or G6GL) for three minutes each hour, beginning at 1730 G.M.T. from 6PP and 1830 G.M.T. from 6CL, and finishing at 2330 G.M.T. Direct communication will be worked wherever possible with those replying by wireless.

The co-operation of the German and Danish amateurs has been obtained and, in order to gather as much information as possible, the assistance of British stations (B.R.S. especially) is sought.

These experimenters are endeavouring to organise chains of listening stations radiating in several different directions from London; therefore names of participating operators will be appreciated immediately. A post-card to Mr. J Clarricoats, at 107, Friern Barnet Road, will suffice.

The following particulars are desired from stations co-operating:—

1. Location of station.
2. Type of receiver used. (In order to standardise results, only 2 valves should be used, *i.e.*, 0-v-1).
3. Weather.
4. Notes on the strength of *any* other stations heard around the time of each test. (This is important.)
5. Strength of the test stations' signals with remarks on fading, frequency changes, interference, and atmospherics.

TRANSMITTERS' NOTES

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QRAs Wanted.

2PA, 5FO, 5WP, 5VA.

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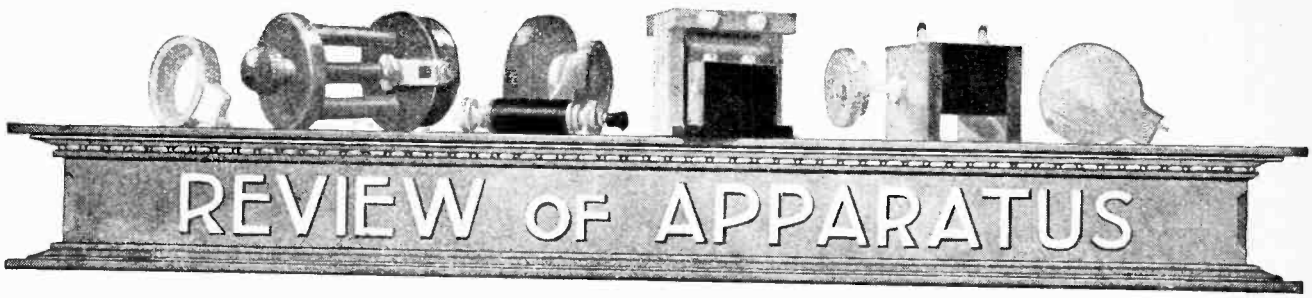
New Call-Signs and Stations Identified.

5BB	E. W. B. Briscoe, Home Lea, The Fordrough, Four Oaks, Sutton Coldfield; transmits on 45 metres.
5UX	(ex 2ASL) G. Hume, 124, Eversleigh Rd., Battersea, S.W.11.
2 AYN	C. E. Harwood, Westley House, Westley Rd., Boscombe.
ED 7FR	H. V. Rodsbjerg, Aagade 132, Flenshoe, Copenhagen.
EP 1BL	C. J. Mumford, Rua Bocage 59, 3D, Lisbon.
VS 2AF	G. W. Salt, Glenmarie Estate, Batu Tiga, Selangor, Federated Malay States.

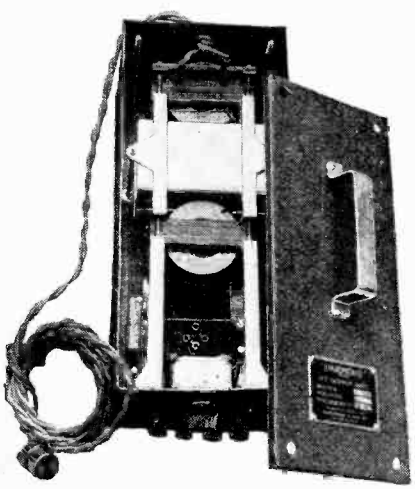


Latest Products of the Manufacturers.

PARMEKO A.C. BATTERY ELIMINATOR.

The principal merit of an A.C. battery eliminator is that the output voltages will be maintained on moderately heavy load, so that, should the anode current taken by a power valve be considerable, there will not be a fall of potential, which, of course, would have the effect of defeating the advantages to be gained by the use of low-impedance valves. The Parmeko rectifier, a product of Partridge and Mee, Ltd., 12, Belvoir Street, Leicester, is liberal in design, both as regards mains transformer, smoothing condensers, and choke, while the valve is a U.5, giving full-wave rectification.

The several sections of the rectifier are assembled on an aluminium frame in such a manner that the input transformer is screened from the smoothing chokes, while the leads passing to the output circuit are remote from the A.C. input, thus avoiding the possibility of ripple being induced into the D.C. circuit. In its general robustness of construction and the liberal values employed, this rectifier is superior to many of the low-priced A.C. battery eliminators. The maximum output voltage is stated as 120, though the actual open circuit potential exceeds 160, and 120 volts is obtained on a load of nearly



Parmeko A.C. battery eliminator. Its several components are supported in aluminium frames.

40 mA. Two lower voltage terminals are also provided, a reduced potential being obtained by voltage reduction through a fixed resistance as well as a variable. Voltage reduction through a resistance is to be recommended, as it has recently been shown that this method avoids back coupling, and tends towards the removal of parasitic oscillation. The eliminator is enclosed in a metal box measuring 5½in. × 6in. × 12½in., and there are no exposed metal parts carrying high voltages. It sells at £7.

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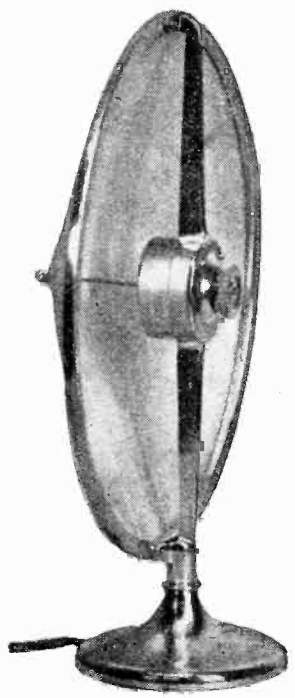
NEW MODEL SFERAVOX.

As a popular model of cone loud-speaker, the Sferavox, obtainable from



The new model Sferavox loud-speaker.

"Sferavox," 130, Fenchurch Street, London, E.C.3, is well known to readers.

In general design it consists of a plated rib support carrying the "drive" as well as a channelled ring which is filled with a particularly plastic form of india-rubber and against which the rim of the loud-speaker rests. The movement is of the differential type, being polarised by three closed magnet rings, the reed moving in a gap. It is interesting to note that a substantial steel rod is used to transmit the drive to the centre of the diaphragm, the aim being presumably to avoid "whip."

The loud-speaker is well finished, sells at the moderate price of £2 10s., and is generally suitable for home use, giving good reproduction with comparatively small input. The tone is good, possessing the pleasing characteristics peculiar to well-designed cone type loud-speakers.

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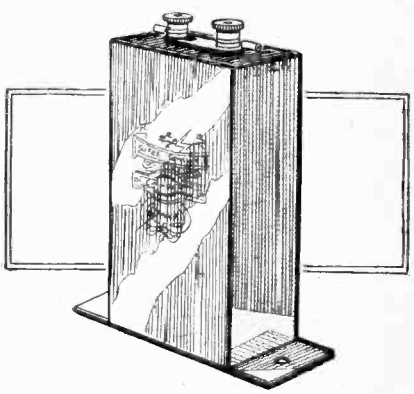
RESERVOIR CONDENSERS.

Bridging condensers suitable for withstanding comparatively high potentials are now manufactured by the Camden Electrical Co., Stanley Chambers, Runcorn. They are of the Mansbridge type, and resemble in general overall dimensions and build the other types already available on the market. Each condenser bears a registered number, and the working potential is stated both for D.C. and A.C. potentials, representing in the case of the latter the peak voltage. They are guaranteed for a period of six months against breakdown.

Camden condensers are British-made, the 2-mfd. 500-volt D.C. test type selling at 3s. 10d., and is suitable for use in a receiving set where the voltage does not exceed 200. The range includes condensers suitable for working on D.C. potentials of 300, 600, and 800, or A.C. poten-



The new Camden Mansbridge type condenser.

tials of 250, 400, and 500, and all capacity values ranging between 0.0001 and 12 mfds. A steadily applied potential 50 per cent. in excess of the rated value failed to damage a specimen condenser. The insulation to capacity ratio, moreover, far exceeded that usually specified.

By Our Special Correspondent

Developments in 1928—B.B.C. and the Snow.—The Daventry Dilemma.—Brighter Talks ? Old Bore's Wireless Almanac.

Looking Ahead.

It cannot be said that 1928 makes a more spectacular entry, from a broadcasting viewpoint, than did 1927. Some interesting developments during the coming year can be foreseen, but there is not that piquant uncertainty concerning the future which greeted the formation of the British Broadcasting Corporation last January. Then the death of the old year also saw the death of the old company; this year sees the Corporation advancing in a majesty which is slightly stereotyped.

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Empire Broadcasting.

The biggest developments that 1928 is likely to see is in the direction of Empire broadcasting. The growth of the regional scheme will be watched with interest, but no great development is promised until the closing months of the year, when the London, and possibly the Manchester, regional stations may make their first transmissions.

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Arrangements of Programmes.

No radical alteration is probable in the timing of transmissions, *i.e.*, the present grouping of different types of programme will continue unchanged, with the possible addition of a daily religious service. I hear that the suggestion is made that such a service, if approved, would find its best niche just after the 10.30 a.m. shipping forecast from Daventry 5XX.

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Broadcasting and the Snowstorm.

Despite the misfortunes of many listeners whose aerials proved unequal to last week's snowstorm, the B.B.C. were extraordinarily lucky. The only interruption caused to tranmissions throughout the holiday occurred at 2LO on the Sunday evening, when the programme was suspended for about a minute while snow was removed from the lead-in wires.

No "S.B." lines were affected, but this may have been due to the fact that most elaborate arrangements had been made in preparation for such accidents! In order that the least possible interruption should be caused by line breakdowns, the engineers were ready to make use of the "wireless link" at a moment's notice. Happily this step was unnecessary.

FUTURE FEATURES.

London and Daventry (5XX).

JAN. 8TH.—Military Band Concert.
JAN. 9TH.—Light Orchestral Concert.
JAN. 10TH.—Vaudeville Programme.
JAN. 11TH.—Musical Comedy Programme.
JAN. 12TH.—Charlot's Revue.
JAN. 13TH.—National Concert conducted by Sir Hamilton Harty relayed from the Queen's Hall, London.
JAN. 14TH.—Popular Concert from The Kingsway Hall.

Daventry (5GB), experimental.

JAN. 8TH.—Religious Service from St. Martin-in-the-Fields.
JAN. 9TH.—Chamber Music.
JAN. 10TH.—The Liverpool Philharmonic Society's Seventh Concert.
JAN. 11TH.—"The Storm," a poetic play by John Drinkwater.
JAN. 12TH.—Hallé Concert.
JAN. 13TH.—A Debate.
JAN. 14TH.—Variety Programme.

Cardiff.

JAN. 10TH.—Modern Welsh Music, by Leigh Henry.
JAN 11TH.—"Heart's Desire," a comic opera en casserole by Mabel Constanduros.

Manchester.

JAN. 12TH.—Hallé Concert relayed from the Free Trade Hall.
JAN. 14TH.—"These Fathers," a play in three acts by James Lansdale Hodson.

Newcastle.

JAN. 12TH.—The Electric Sparks Concert Party.

Glasgow.

JAN. 14TH.—"The Home Breaker," a drama that takes the wrong turning, by A. F. Hyslop.

Aberdeen.

JAN. 12TH.—Auld E'el Night.

Belfast.

JAN 9TH.—Opera Bouffe.
JAN. 11TH.—"No Song, No Supper," a musical entertainment in two acts by Prince Hoare.

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The Daventry Dilemma.

An interesting situation has arisen in regard to 5GB's new aerial, which has not yet come into commission. The tests carried out during the last two or three weeks show that, while the new aerial is definitely superior to the old twin arrangement still in use, it is badly screened in the Birmingham direction by the masts of 5XX.

So the engineers are up against the old dilemma, viz., that Birmingham is satisfied only at the expense of the rest of the country, and vice versa.

A thorough re-arrangement of the Daventry masts promises the only solution; until this is done, listeners outside a radius of thirty miles will wait in vain for the maximum signal strength of which the station should be capable.

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Rugger Broadcast.

The Rugby match between England and Wales will be described to 2LO and 5XX listeners on January 21st.

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Victorian Glories Revived.

Some eminent Victorians will introduce a novelty to 5GB listeners on January 17th, when an attempt will be made to revive the glories of the Victorian period. The music of Sullivan, Sterndale Bennett, Cowen; the poetry of Arnold and Browning, and the work of Darwin, Huxley and other scientists will be incorporated in a running commentary.

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Sixteenth Century Opera.

Monteverdi's opera, "The Return of Ulysses," will be broadcast from 2LO and 5XX on January 18th. Monteverdi was an Italian composer who lived towards the end of the sixteenth century, and his work will no doubt be new to many listeners.

Maxims for "Talkers."

I wonder if "Suggestions to Speakers," the new pamphlet which the B.B.C. has produced specially for the guidance of those who have never broadcast before, will bring about a revolution in the presentation of "talks"?

Some of the instructions might be studied to advantage, even by those who have been broadcasting for quite a long time. Here are a few:—

"Write rather as you would talk to a friend than as you would shape an article for a review or magazine."

". . . try to arrest its (the audience's) attention with your opening paragraph. The formal opening paragraph suitable to an essay is generally out of place in a 'talk.'"

"The great thing is to remember that you are not speaking to a massed meeting. The declamatory note is, therefore, wrong. Hundreds of thousands of your listeners are sitting alone in their own homes, and to find themselves addressed as a public meeting would seem absurd. The note of *intimacy*, as in conversation to a friend, is the note to adopt."

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Speaking Slowly.

One of the most important maxims is surely this: "The speed at which you speak should not be the speed at which you probably read aloud, but the much slower and less regular speed at which you probably talk."

All these hints are valuable, and if every speaker took the advice, many talks would be much more acceptable. But the "if" is a big one!

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The New Charlot Revues.

André Charlot, who is producing a series of revues for the B.B.C., will give the first three on January 12th, 19th and 21st. The popular producer will make a bold bid to discover by the make-up of the first few of his series what listeners prefer.

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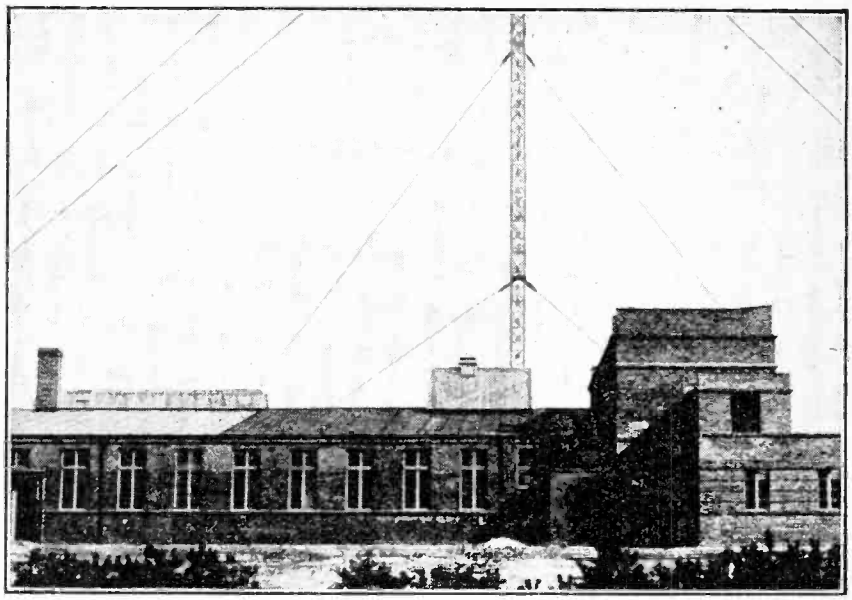
"Athalie."

Mendelssohn's oratorio, "Athalie," will be broadcast from 5GB by the Birmingham Studio Chorus and Orchestra on January 15th. The principals will be Stuart Vinden, Marjorie Parry, Rispah Goodacre and Maud Gill.



WESTERN EUROPE'S BIGGEST STATION.—Part of the station building and aerial at Zeesen, near Konigswusterhausen. The new station, which uses a power of 40 kilowatts on a wavelength of 1,250 metres, will shortly supersede the original station at Konigswusterhausen.

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Old Bore's Wireless Almanack.

Undeterred by the severity of the weather, the B.B.C., and other uncontrollable forces, Old Bore has seen fit to produce his annual Table of Prognostications for the coming year. The following is a brief extract:—

January.—47 letters in daily Press proving that B.B.C. programmes have deteriorated. 47 letters in daily Press proving the opposite.

February.—High-minded journalist pens fearless exposure of B.B.C.

March.—B.B.C. still going strong. High-minded journalist receives cheque from editor.

April.—Definite rumours regarding regional scheme. B.B.C. says "No."

May.—Prominent publicist attacks broadcasting. Receives cheque.

June.—A Bishop says: "The possibilities of broadcasting are enormous."

July.—Cowcaddens listener hears KDKA on crystal set. Spanish priest invents pocket wireless set.

August.—Celebrated actress discovers that Marcosmul valves are best (Advt.). Pudsey bath attendant draws current from rubbed onions.

September.—Definite rumours regarding regional scheme. B.B.C. issues denial.

October.—Potters Bar listener hears local regional station and dies.

November.—Pudsey bath attendant confesses fraud.

December.—High-minded journalist attacks B.B.C. and is taken on staff. Good will everywhere.

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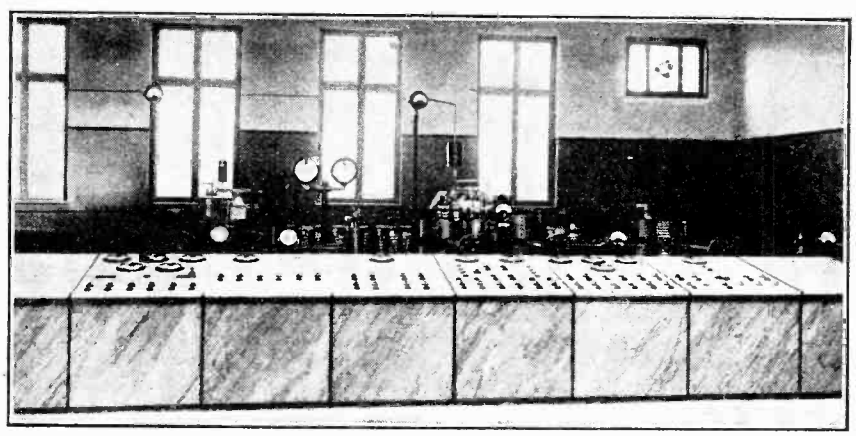
Perils of Political Radio.

America, or a section of America, is finding that the entry of broadcasting into politics is fraught with uncomfortable complications. It is the Democrats who are most perturbed at the present moment, for they foresee the time, not far distant, when the Federal administration of radio will be in the hands of the Department of Commerce. Now the Secretary of Commerce, Herbert Hoover, is a candidate for the Presidency, so the Republicans (say the Democrats) will have a decided advantage in the use of radio during the forthcoming Presidential campaign.

The general opinion is that broadcasting will have a very powerful influence on the electorate



THE S.B. SWITCHBOARD AT ZEESEN.—As the Zeesen Station relays programmes from most of the leading stations in Germany, very elaborate "S.B." arrangements have been made. The photograph shows the novel form of switchboard.

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.

IDENTIFYING STATIONS.

Sir,—There are two sides to every question, and I must say that I am frankly surprised to find that none of the letters published in your correspondence columns on this subject takes the stand that any signal, musical or otherwise, transmitted during the intervals of a normal programme, would be highly undesirable.

Now one of the advantages of being, shall I say, a genuine experimenter is that one does occasionally obtain superb results. It is then that one's faculty as an imaginative listener is allowed scope and it is no exaggeration to say that by turning out the light and settling in a comfortable armchair one may enjoy a programme of some two or more hours' duration without once being "brought back to earth with a bump," due to mechanical or electrical imperfections in one's apparatus.

Those members of the B.B.C. whose duty it is to arrange the programmes undeniably rely upon an absence of distractions to the listeners when setting out to create a certain atmosphere, and it is my belief that the nearest approach to silence that can be obtained is desirable during the intervals.

Every station has an identification signal already—its carrier wave—and after a very few hours' use any modern receiver may be calibrated with an accuracy quite sufficient to enable stations to be identified.

To obtain the required degree of selectivity for long-distance reception, and to be quite sure that one does not add to the general mêlée of cat calls usually associated with a weak carrier wave, some type of neutralised H.F. amplification is almost a necessity at broadcast wavelengths. This gives us at least one tuning condenser the setting of which is sensibly independent of all factors but the frequency of the incoming signal, and it is a simple matter to plot the frequency (or wavelength) of any particular station, which has been identified, against the dial reading of that condenser. In quite a short time a sufficient number of stations will have been plotted to enable a smooth curve to be drawn on which any other station can be interpolated.

Your contemporary, *World Radio*, gives a reliable and up-to-date list of stations in order of wavelength, which is useful for this work.

D. KINGSBURY.

London, S.W.20.
December 18th, 1927.

Sir,—Would not the repeated transmission of a series of notes leaping from octave to octave, as suggested in your editorial of December 14th, become a form of "Chinese torture" for local station listeners? As a "wireless tourist" I welcome this scheme of identification, but feel such signals would detract from the entertainment pleasure of local stations.

J. DAVENPORT-WINDLE.

Southall.
December 19th 1927

MORSE INTERFERENCE.

Sir,—I have read with great interest the letters of your two correspondents, Mr. T. B. Wilson and Mr. Maurice Child, on the subject of Morse interference. I take it that neither of these gentlemen is a marine W.T. operator. As one of this fraternity who appreciates the very real and intense annoyance caused broadcast listeners who get more "da-di-da" than music, I should like to make a few observations from the viewpoint of the men who keep the 600-metre watch at sea.

In the first place, C.W. is definitely unsuitable as a calling medium. Tuning is too sharp, and the danger of missing a call altogether is too great. Mr. Child's idea of a daily check of the transmitted wavelength is good in theory, but not of much use in practice. Operators, although technically equal in having passed an examination which is internationally uniform, do actually vary enormously in degree of competency. The standard in the British service is high, but the same cannot be said of some foreign services. Does Mr. Child know that many foreign vessels equipped with W.T. carry no certificated operator, but are operated by some member of the deck department who claims no skill in what is only a side line to him. To expect these men to keep a C.W. transmitter rigidly anchored to any predetermined wavelength is asking too much.

Another disadvantage in the use of C.W. by ships working shore stations is the absence of any distinctive note. Every coast station has its distinctive voice by which it can be identified before its call signal is heard. When a coast station sends CQ, it is because it has something to transmit that all ships within range should copy, and the distinctive note gives it a very good chance of being copied. The point is that the coast station transmission is usually the important transmission, and a distinctive note identifies it.

To one other thing in the letters of most of your correspondents I must take exception. That is the lumping together of spark and I.C.W. as if they were both equally bad disturbance producers. Now this is very far from being true. An I.C.W. transmitter is infinitely more sharply tuned than a spark transmitter, and much less likely to interfere with a broadcast programme. A B.C.L. within twenty miles of a medium power spark transmitter can suffer untold interference, whilst being unaware of the existence of an I.C.W. transmitter equally near, working on the same wavelength and using the same power as the spark transmitter.

A few suggestions as to how ship and shore stations may get about their business and yet leave broadcasting room to breathe might now be in order.

First, I suggest the absolute prohibition of the use of any wavelength below 600 metres by ship and shore stations. Probably the biggest single cause of interference to the B.C.L. is ship spark working on wavelengths between 300 and 600 metres.

Secondly, the complete suppression of spark transmission by ship and shore stations for any purpose whatsoever except the sending of the distress signal. All ship and shore stations to be capable of transmitting on any wavelength between 600 and 800 metres, on either I.C.W. or C.W.

Thirdly, the raising of the stand-by wavelength from 600 to 700 metres, and calling on this wavelength to be conducted on I.C.W. After establishing communication, transmission to be effected on C.W., either on 700 metres or some wavelength between 600 and 750 metres.

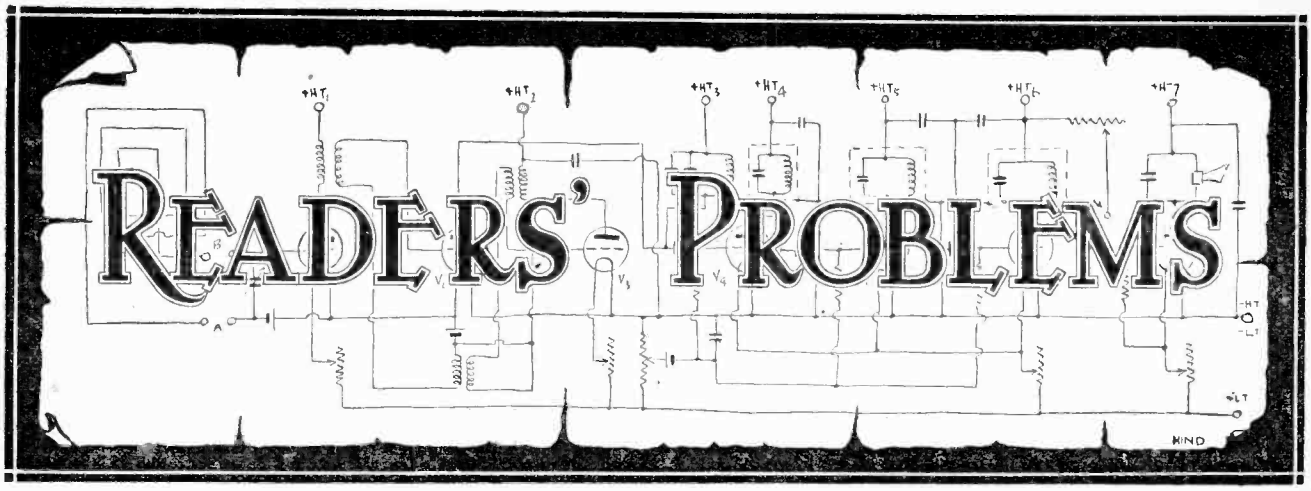
Fourthly, the reservation, as at present, of 800 metres for D.F. work.

I think it will be agreed that the above suggestions, if put into operation, would result in the practical elimination of Morse interference, and what is equally important, not make conditions worse for ship and shore communication, but actually improve them.

It would be interesting to know what others think of these suggestions.

LOUIS AUDIGIER.

s.s. Gloucestershire. Marseilles.
December 10th, 1927.



READERS' PROBLEMS

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

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

A Telephone Extension.

It is desired to run an extension lead for telephones from a single valve receiver. The length of the wires will be about 100ft. On testing the arrangement it was found that, although adequate strength was obtained when the telephones were connected to the receiver, at the distant point reception was very weak. Can you explain the cause of this and advise me as to the best method of obtaining good reception at the extension point? W. S.

The reason that reception is unsatisfactory when the telephones are connected to the extension leads is that, owing to the D.C. resistance of the wires, there is a big drop in voltage along the leads, with the result that the potential at the anode of the valve is very much lower than that of the H.T. battery.

In all cases where extension leads are fitted, it is recommended that either an output transformer or a choke capacity output circuit should be incorporated, and this could be arranged in a manner similar to that described from time to time in the pages of this journal. By the adoption of this arrangement, the high tension supply is localised to the receiver and H.T. battery, and will not have to pass through the long extension leads.

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An Eliminator Question.

I have a D.C. battery eliminator which is marked to give an output voltage of 100. *I realise that this voltage is rather low, but would it be possible to use the instrument for supplying H.T. to the "Everyman Four"?* N. S.

As you say, the voltage is low, and consequently the permissible grid swing on your output valve would be limited, and you would therefore have to make use of the volume control on nearby stations. However, we cannot definitely say that your eliminator would be suitable because you do not state the value of load at which the eliminator will maintain a voltage of 100. The total plate current consumption of the "Everyman Four" receiver is somewhat under 20 milliamperes. If your eliminator is only rated to give an output of, say, 10 milliamperes at 100 volts, then when you attempted to draw 20 milliamperes from it the voltage would fall considerably. Another point is that your chokes may not be designed to carry a current of 20 milliamperes, with the result that their inductance would come down to a very low value when this current is passed through them, and they would therefore cease to act properly as smoothing chokes, and a loud hum would probably occur.

RULES.

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

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

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

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

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

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

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

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An Impossible Proposition.

I have a detector and two L.F. receiver with cumulative grid rectification and reaction. Can I control volume by inserting the variable rheostat in the filament circuit of the detector valve as you do in the case of the H.F. valve of several of your receivers? P. R. L. K.

You cannot control volume in this manner. If you are working with a fairly close degree of reaction coupling you will find that immediately you attempt to dim the filament the valve will probably burst into oscillation. We would add also that you cannot control volume by inserting variable rheostats in the filament circuits of either of the L.F. valves, or you will cause bad distortion when you dim the filaments.

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What Value of Grid Bias?

I have built a three-valve receiver, and propose to use a Mullard P.M.2 valve in the output stage. Must I buy a 16½*-volt grid battery, or will one of the smaller* 9*-volt type suffice?* T F. S.

With this valve there is no necessity to use a grid battery of a higher voltage than nine, but we think that in the interests of quality it will be preferable for you to use the P.M.252 type valve in the output stage in place of the P.M.2 and then you would need the 16½-volt grid battery. The P.M.252 type valve will, of course, handle a much greater grid swing than the P.M.2 type, and is therefore, more suitable from the point of view of quality for the final stage of a three-valve receiver, especially on the local station.

A Handy Two-valve Set.

I wish to build a two-valve detector and L.F. regenerative set, which can be employed on either an outdoor aerial or a frame aerial. I wish to use plug-in coils, and shall be glad if you will give me a suitable circuit and tell me the coil particulars to use on 2LO and on 5XX. V. R.

We give in Fig. 1 a diagram which should meet your needs. Using the receiver on an ordinary outdoor aerial, it is best to connect the aerial to A, whilst B and C must, of course, be joined together. The grid coil on normal broadcasting wavelengths can be a No. 50 and a No. 250 on 5XX. The reaction coil value depends upon the degree of damping present in the circuit; a No. 35 on 2LO and a No. 100 on 5XX should be about correct under average conditions.

If using a small indoor aerial, connect it to B instead of A, but using a frame; the connection between B and C will have to be removed in favour of a frame aerial of suitable inductance value. The grid coil is now only necessary for the purpose of securing regenerative effects, and since the damping in the circuit will be low, 20 or 25 turns on the normal broadcasting band, and about 50 turns on 5XX should be ample. However, if the same frame is used for the reception of 5XX as is used for 2LO, the grid coil will have to be much larger, as it will have to serve the purpose of a loading coil, and a No. 200 coil will probably be required.

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Should the H.T. be Disconnected?

When studying the circuit diagram of the various receivers which have appeared in "The Wireless World" from time to time, I notice that the on-and-off switch does not always disconnect the H.T. and L.T. Would it not be advisable to arrange this so that all battery circuits are broken? W. A. P.

When the filament of a valve is not glowing, the space between the electrodes has practically infinite resistance, with the result that no current will flow from the H.T. battery, and it is therefore unnecessary to incorporate a switch so that this can be disconnected.

o o o o

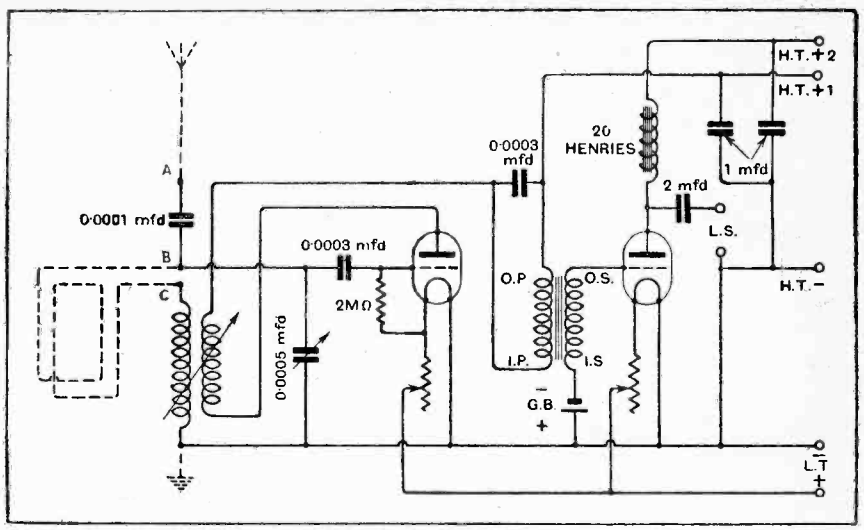

Fig. 1.—Two-valve receiver for use with frame or open aerial.

A Simple Rejector.

I have a two-valve receiver, detector and L.F. amplifier (circuit diagram enclosed), and although this gives good results from the local station, it is impossible to receive distant broadcast free of interference from the local station. I do not wish to rebuild the set, and should be obliged if you can suggest any slight modification which would enable Daventry, 5GB, to be received without interference from the local station. C. S.

A loosely coupled aerial circuit is recommended in cases where the receiver is not sufficiently selective under all conditions, but if the requirement is to eliminate the local station only, then a wave trap or rejector circuit can be employed. Fig. 2 shows theoretically how this arrangement could be incorporated in a receiver, or if "plug-in" type of coils are used, and these are external to the cabinet, then the rejector could be made separate from the set and not a component part thereof. Assuming that the coil L_2 is a commercial type of centre tap plug-in coil, L_1 the reaction coil, and L_3 the rejector coil, then these three coils could be mounted in a three-way coil-holder with the rejector condenser C_2 in close juxtaposition to its coil.

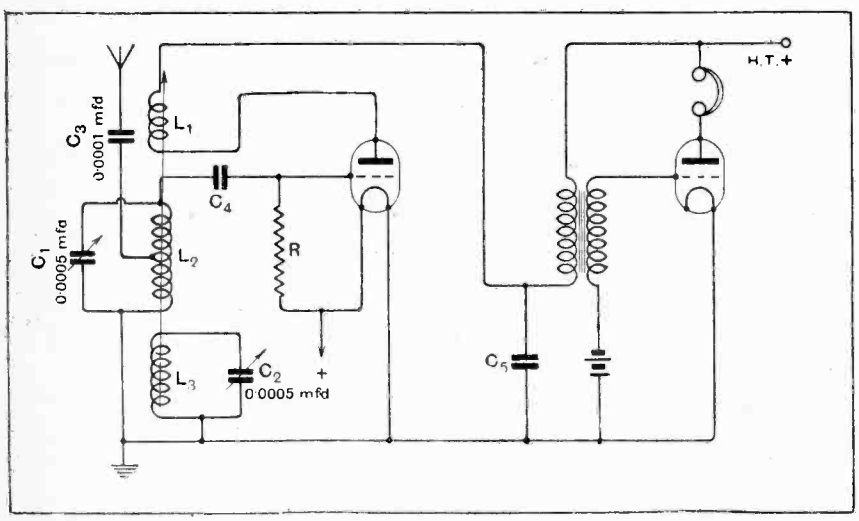

Fig 2.—Rejector circuit for eliminating interference from the local station.

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Valves and "Two H.F. Everyman" Receiver.

Is it possible to use any other type of valves than the six-volt range in the "Two H.F. Everyman" receiver, and what valves do you recommend? G. W.

There can be no objection to the use of two- or four-volt valves in this receiver, but it is essential to choose valves with characteristics closely resembling those recommended by the author. For example, in the two-volt range the Mullard P.M. 1H.F. could be employed in the two H.F. positions, and a P.M. 1A as detector, while either the P.M. 252 or Marconi D.E.P. 240 would be suitable for the last stage. In the four-volt range typical examples are Marconi D.E.L. 410 for the H.F., D.E.H. 410 detector and Mullard P.M. 254 in the last stage.

o o o o

Valves for H.F. Amplification.

Can you tell me what would be the effect of using a valve of 8,000 ohms impedance in the H.F. stage of the "All Wave Four" in place of the valve specified in the article? F. R.

Owing to the low impedance of the valve, the first result would be greatly diminished selectivity. A valve of this impedance will not have a very high amplification factor, and consequently sensitivity will be greatly reduced also. The effect of such a substitution would be, in fact, to give an all-round reduction in efficiency, and it is not advised.

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BROADCASTING CONTROVERSIAL MATTER.

UNDER the Licence and Agreement between the Postmaster-General and the Governors of the British Broadcasting Corporation the Postmaster-General exercises some control over the matter broadcast, for he is entitled to require the Corporation to refrain from sending any broadcast matter (either particular or general) which he may specify by notice in writing to the Corporation from time to time. Exercising this authority, the Postmaster-General originally instructed that controversial matter on topics political, religious or industrial should not be broadcast. The subject of the broadcasting of controversial matter has always been one of considerable interest, and recently it has received prominence as the result of an expression of opinion by several prominent persons that controversial matter should be introduced into the programmes, and it would appear that the Governors of the Corporation are themselves divided in their opinions as to what course should be adopted.

Why Controversy is Favoured.

There is, of course, a constant demand for something new and original, and when the programmes fail to provide the variety which the public may have anticipated, then a suggestion that controversial matter should be introduced to brighten up and give more life to the programme matter is naturally heralded with considerable enthusiasm. To authorise the broadcasting of controversial matter is to permit, at the discretion of one or two officials responsible, the conduct of a potential means of distributing intelligence and influencing public opinion perhaps far greater even than the united Press of the country. When we consider, in addition, that the broadcasting service is a monopoly, we realise what a grave responsibility rests with any authority which may make the decision that controversial matter is legitimate material for broadcasting.

Comparison with the Press.

In order to arrive at any conception of the effect that might be produced by the adoption of such a course, we have to imagine for a moment the position if this country had only one newspaper and that the policy of that paper were directed by a small group of individuals comparable in numbers and status with the present B.B.C. authorities. However cautiously the B.B.C. authorities might act in the endeavour to put both sides of every controversial question to their listeners, we believe that it would be humanly impossible to avoid, even in spite of their utmost endeavours, a persuasive influence pervading the character of the programmes reflecting the personal tastes or prejudices of the programme organisers.

A Question of National Importance.

It must not be inferred that the point of view we take is that because the introduction of controversial broadcasts may have far-reaching consequences that it is therefore better to take the easier course and decide once and for all that controversial matter must be excluded from the programmes. What we feel very strongly is that the problem should be tackled with our eyes wide open, realising the gravity of the decision to be made, and the responsibility which will be thrust upon whoever is required to direct the proper balance of controversial broadcasts. Already it is recognised that the broadcasting service wields an enormous influence upon the public—perhaps more especially upon the younger generation which will grow up to depend probably to a far greater extent on broadcasting than older members of the community, to whom it is a comparatively recent innovation. Once the step is taken of withdrawing the ban on controversial matter it will be a very much more difficult task to restore it, and therefore we would urge that no decision on this important matter should be made without the fullest opportunity first being given to considering it in all its aspects. It is not a responsibility which should be thrust upon the Postmaster-General as an individual, nor upon the Governors of the B.B.C. It is, in our opinion, a matter which should receive the close consideration of some much more representative body.

IDENTIFICATION OF STATIONS.

The Official Attitude Towards the Transmission of Special Signals between Items.

By Capt. P. P. ECKERSLEY.

Almost from the earliest days of broadcasting "The Wireless World" has consistently urged that some simple means should be introduced whereby the different stations could be identified in their transmissions. In the article on this page Capt. Eckersley contributes his views on the subject and we feel sure that he will be read with great interest.

MANY people's ingenuity has been exercised since broadcasting began in devising a code whereby listeners may immediately identify the distant or foreign stations they may be listening to. Both as engineer to the B.B.C. and as member of the European Committee I am always being asked to recommend this or that code or to give my opinion whether or not a code is necessary. It would seem desirable to settle or, at any rate, discuss, the latter point, first, because if I could prove that no code is necessary in the general interest, it would be redundant to debate the kind of code that should be used!

In my opinion, no code is necessary, because the interests of the great majority would be prejudiced by its introduction. The great majority of people listen most of the time to the local station. Of this majority a few listen mostly to the local station and sometimes to a "tame" foreign or more distant station that comes through so well that it is worth listening to. A minority of listeners search the ether through and through, and comb out some queer noises. They want to know where these noises come from; they therefore want to have it made easy for them to find out, and they therefore want an identification signal, being quite unable to recognise the language or catch the words of the announcements.

These "searchers" are a minority. Naturally, one does not want to prejudice their enjoyment if they can be satisfied without spoiling local station broadcasting. Unfortunately, a code is bound to ruin local listening, because in essence it insists upon the mechanical and technical side of broadcasting, and spoils its artistic value.

I can best illustrate my point by describing a code signal system in action. I settle down to listen to a concert. The concert is excellent, and shortly I melt into the spirit of the music. The climax draws near, and with an ecstasy of sound leaves me. And then someone immediately starts sending Morse or ringing bells or hooting or making some foul and discordant noise.

Surely one would be surprised if at the Queen's Hall after each item someone rang a bell, three longs, two shorts, and followed it by a thin note played on a trumpet. Surely broadcasting is only a way of giving concerts, not a hobby to amuse a few technically minded people.

A play could be ruined by this code signal system; even to-day the cheerful voice of the announcer too soon after a play's end has spoilt the dramatic value of a climax. The ending of Cyrano de Bergerac is impressive; you will remember Cyrano's dying speech to Roxanne and his final "I still have my panache" . . . and dies. But add on pip ponk, pip ponk, per pip, per pip ponk, and the climax is apt to be spoilt!

And why these ugly noises peeping in and out among lovely sounds? Simply because a listener in Czecho-Slovakia may know that the concert he has heard is radiated by (say) 5GB. He will not know what orchestra has played, or where it has been playing; all he will assume is that it is an English orchestra. He may be wrong, because it is possibly a German orchestra playing in Belfast and conducted by a Frenchman. If he has listened to a play he will not understand one word, or if he understands English he will understand the announcement, provided he has heard the play clearly enough for it to be appreciated.

One of the chief advantages of the code system is said to be that it will enable listeners who do not understand foreign languages to answer the question, "What station was that?" I question, even disregarding the claims for artistic unity upon the part of the local listener, whether he is going to be helped by knowing what station is radiating what he hears. Helped as a searcher, yes; but I mean truly helped to enjoy the programme more. Music is universal; it is good, bad, or indifferent, and it makes no difference where it is radiated from provided it is clearly heard. Perhaps it is said that music is better from the Continent. That may be, but how is the music any better because the hearer knows where it is coming from? Talk has an intrinsic interest in its point of origin, but if the listener does not know the language how is he helped in knowing what the language is? It may be Esperanto from Lithuania or French from Canada for all a code could help him!

For all this I am sure that listening to foreign programmes has a value, because if they could be

Capt. Eckersley with one of the standard B.B.C. wavemeters issued from Brussels after the Geneva Wavelength Conference. Similar instruments have been sent to all the important European stations.

Identification of Stations.—

clearly heard we can give the best of everything to everyone: Germany for its orchestral playing, Vienna for its opera, England for madrigals and ballads, and so on. But direct listening to foreign and distant stations, automatically identified or not, never gives a rendering worthy of the original.

We are working hard in an endeavour to link up Europe by telephone cables and other continents by short waves, where the local station will become a radiator of the world's talent, and the need for ugly mechanical noises for identification will give way to the announcer telling us what we are to hear and where from. This seems to me to be the only sane development towards better broadcasting.

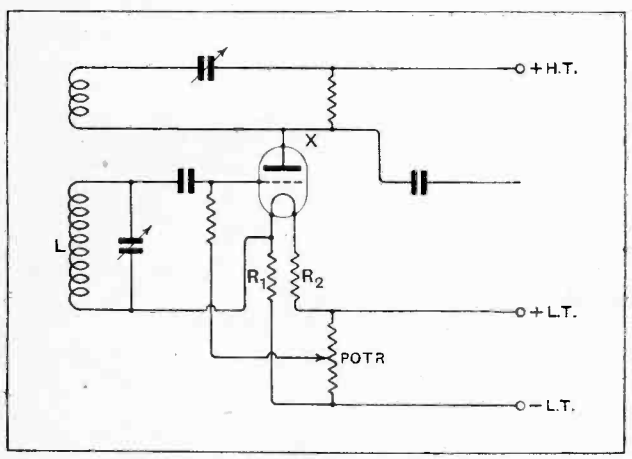
If, finally, the technician argues that he can do better research work on the purely technical side if he can know the station he is receiving, I can only say that a list of stations and a wavemeter will be a sure guide. I also question what research work is necessary on the subject of receiving very weak stations on very multi-valve sets. A qualitative statement would dismiss the subject.

ALTERNATIVE GRID AND ANODE RECTIFICATION.

A Simple Method of Changing Over without Switching.

MANY of those who are constructing, for the first time, a receiver embodying anode bend rectification, fear that a considerable loss of sensitivity to faint signals will result, as compared with grid rectification. Actually, this fear is not quite groundless, as even when one of the modern high-amplification valves is to be used as anode rectifier, in conjunction with Litz coils of very low resistance, some loss of ultimate sensitivity to very faint signals is incurred. It is convenient, then, to be able to change at will from anode to grid rectification, so that the advantages of both types of rectifier may be available.

The diagram shows the simplest arrangement for so doing, and is arranged to suit receivers in which a two-volt valve is used as the detector in conjunction with six-volt valves elsewhere in the set.



Circuit for alternative grid or anode rectification.

It will be observed that the only extra component required is a potentiometer, while all leads brought to the panel are at earth potential, so that the addition of this device involves no high-frequency losses whatever. In this arrangement the grid-condenser and leak required for grid rectification are retained when anode rectification is in use; this is certainly unorthodox, but a little consideration will show that the application of the negative bias through a leak can make no difference to the operation of the rectifier. The change-over from grid to anode rectification is made simply by adjusting the potentiometer; with the arrangement shown the filament accumulator provides a sufficiently wide voltage range from which to select the optimum voltage for either purpose.

The total resistance of the two fixed resistors R_1 and R_2 must be so chosen that the correct current is passed through the filament of the valve, and their *relative* values will depend on the precise limits of grid bias that are required. In the case of valves in which grid current begins to flow as soon as the grid is made slightly positive, R_2 may be omitted, the whole resistance being concentrated in R_1, when the range of grid-bias available by adjusting the potentiometer will be from -4 to $+2$ volts. For such valves the latter value is the highest that is likely to be required. For valves in which the grid current starts only when the grid is made considerably positive, as, for example, in valves of the "Short-path" type, it is necessary to obtain about $+3$ volts for grid rectification. This can be achieved by making R_2 about one-third the value of R_1, so that one volt is dropped across the former and three volts across the latter, thus giving an available range of grid-voltage from -3 to $+3$.

On changing over from anode rectification it will be found, especially if the coil L is of low resistance, that the extra sensitivity of the grid detector is disappointingly small, since the damping due to grid current reduces the voltage across the tuning coil, and so masks the increase of sensitivity that would otherwise be apparent. To extract full value from the arrangement shown, it is therefore necessary to add reaction, into the coil L, as is indicated in the figure, to compensate for this extra damping. A radio-choke may be inserted, if necessary, at the point X of the diagram. It will be found that the reaction control, if correctly set for grid rectification, need not be touched on changing over to anode rectification, as the decrease in plate-current automatically cuts off most of the reaction effect.

If a valve rated for the full accumulator voltage is used as detector, it will, of course, be necessary to break the lead connecting the potentiometer slider to the grid-leak, and bring the ends out to two terminals in order to insert a small grid battery, as "free" grid-bias can only be obtained under the conditions shown.

A. L. M. S.

NOVELTIES FROM OUR READERS

VALVES FOR IDEAS

Practical Wrinkles for the Wireless Workshop and Experimental Bench.

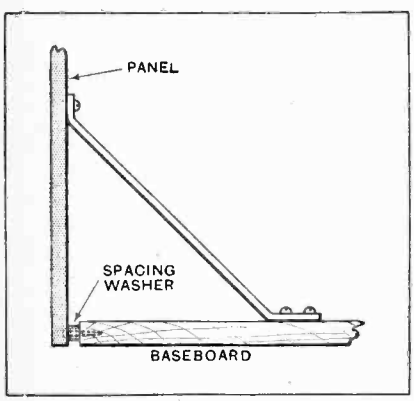
DISTORTION INDICATOR.

For those who do not possess a milliameter an ordinary cheap magnetic compass placed so that the needle or card is deflected from pointing to the magnetic North by the magnetic field of the output choke will oscillate whenever overloading the valve causes variations in its anode current.

R. N.

BASEBOARD HINT.

During the wiring of a receiver a certain amount of debris is produced in the form of short bits of bare connecting wire and strips of solder, which must be removed if they are not to cause trouble at some future



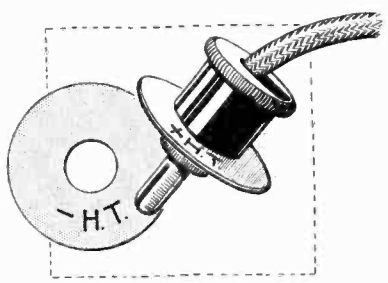
Panel spaced from baseboard to facilitate removal of surplus solder.

date by working into a position where they may produce a short circuit.

In order to facilitate the removal of this metal from the finished set it is a good plan to insert spacing washers between the front panel and the edge of the baseboard, as shown in the sketch. By shaking the set vigorously and tilting the baseboard, any loose pieces of wire and solder will find their way out through the gap.—A. C. S.

MARKING WANDER PLUGS.

To avoid the possibility of mistakes when inserting wander plugs in H.T. and grid bias batteries, they should be clearly marked in some way. It is usual to attach a label to the flexible lead, but a better method is to



Identifying wander plugs.

attach the identifying label to the wander-plug itself.

For this purpose ordinary disc labels, as used for identifying terminals, may be used. The central hole must be enlarged if necessary, and the disc clamped underneath the insulating knob of the wander plug, as shown in the sketch.—J. H. H.

oooo

DIAPHRAGM FLANGE.

A flat edge can easily be formed on a drawing-paper loud-speaker diaphragm by placing it apex upwards in a shallow vessel filled with water to a depth of about $\frac{3}{16}$in.

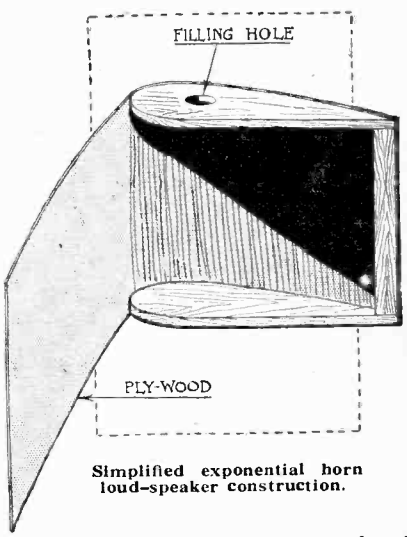
After an immersion of about one minute, place the cone on a flat surface with a weight at the apex to make the damp edge spread, and leave until dry.

The resultant edge will be about $\frac{1}{8}$in. wide and perfectly even and flat. —A. H. T.

oooo

EXPONENTIAL LOUD-SPEAKER HINT.

In building the folded exponential loud-speaker horn described in the November 23rd, 1927, issue, some difficulty may be experienced in building up the pear-shaped blocks.



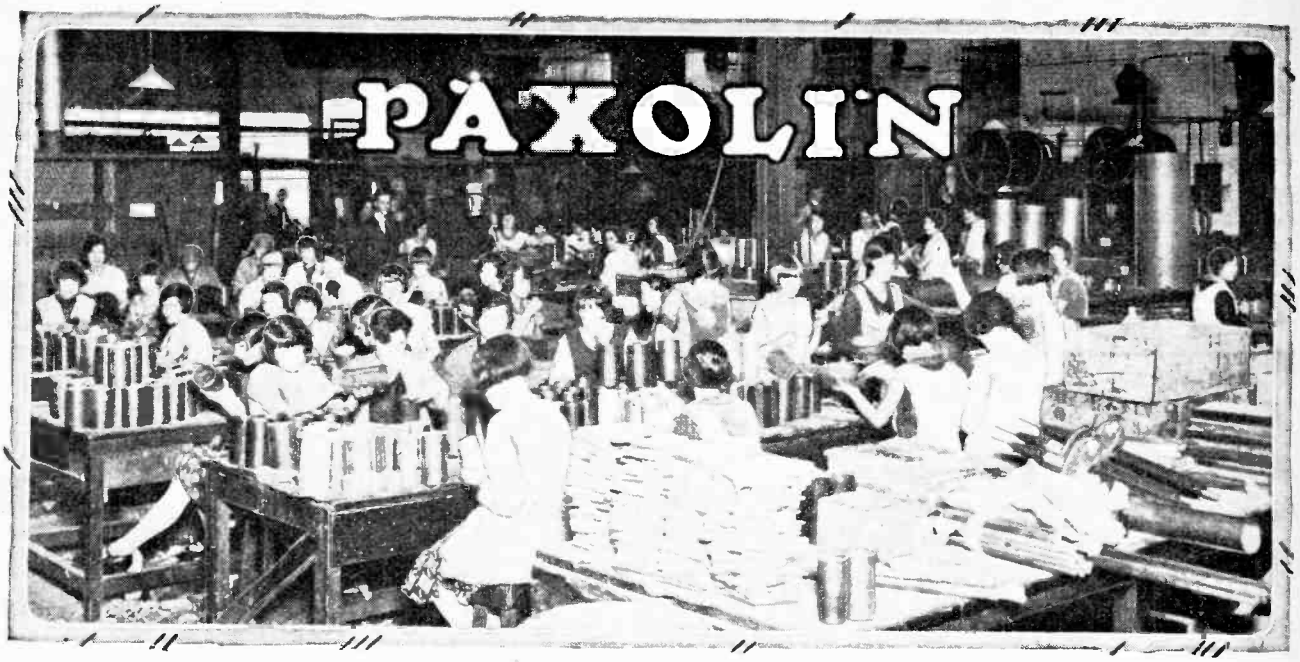
Simplified exponential horn loud-speaker construction.

These can be conveniently made of 3-ply wood in the form of boxes, as shown in the sketch. To prevent the interior from resonating the box should be filled with dry sand through a filling hole in the top; internal battens may be necessary if the sides show any tendency to bulge.—R. W.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A dull emitter receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," Dorset House, Tudor St., London, E.C.4, and marked "Ideas."



A Survey of its Properties and Manufacture.

NOW that high-frequency amplification is capable of quantitative analysis, a knowledge of the dielectric properties of insulators when placed in a high-frequency field is of some importance. The ever-increasing efficiency of modern components and methods of coupling bring to light small deficiencies in insulators which have hitherto passed unnoticed because of their *comparative* unimportance. Immunity from surface leakage and surface deterioration combined with an absence of all trace of metallic or other adulterants as a basic quality for an insulating medium, which must also have a low power factor and be of high electrical and physical strength, is the ideal at which to aim, provided that the resulting material is cheap and can be easily worked by the wireless amateur.

Paxolin has become well known in the broadcast wireless industry as a support for inductances carrying H.F. currents. In designing the "Everyman Four" it was found that no two coils of similar winding data gave quite the same figures for high-frequency resistance when wound on certain formers not belonging to the bakelite board type; it was further noticed that after a time had elapsed the H.F. resistance changed, suggesting deterioration of surface. This lack of uniformity in characteristic does not exist in the case of Paxolin, which, owing to its physical strength, can safely be made into formers with $\frac{1}{16}$in. wall for coils of 3in. or 4in. diameter. That Paxolin formers have proved satisfactory for highly developed H.F. inductances is shown by the excellent results obtained by readers with the "Everyman Four" receiver and its later modifications, for which many thousands of formers have been constructed.

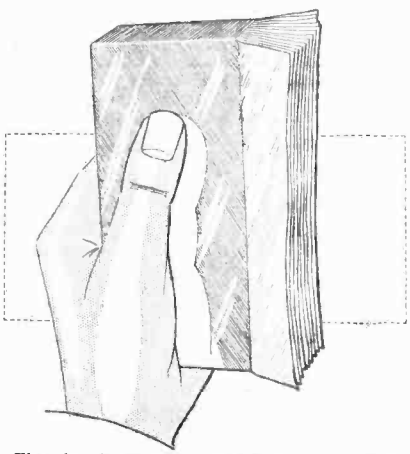


Fig. 1.—A Paxolin panel in which the pressing process has not been applied to the extreme edge; note the laminations.

Before describing the manufacture of Paxolin it will be as well to trace the history of this and other closely allied compounds. Some years before the war a foreign inventor, by name Dr. Baekeland, showed that a substance very similar in its properties to natural resin could be produced by an organic chemical action known as "condensation" between formaldehyde and phenol (carbolic acid), the name Bakelite being given to it in due deference to its inventor. Bakelite must now be considered as a generic name for any substance containing synthetic resin of this nature as a basis. If the resin be dissolved in some solvent, such as methylated spirit, and the bakelite varnish so formed be applied to sheets of paper which are subsequently highly compressed into sheets or tubes, the resulting laminated product is generally known as bakelite board, and by far the largest output in this country under the registered trade name of Paxolin comes from the Micanite and Insulators Co., Ltd., of Walthamstow. Care must be exercised in differentiating between moulded bakelite and Paxolin; the former substance is not handled by the Micanite Company, and is made by moulding under pressure a heated mixture of synthetic resin and wood meal or asbestos meal to which various colouring agents are generally

Paxolin.—added. Amateurs will be well acquainted with the appearance of this material, as it is used for the containing cases of small fixed condensers and many other components. Paxolin cannot be moulded in the same sense, but can be pressed into simple shapes which are only restricted in variety by virtue of the nature of the substance being laminated and requiring in its manufacture many tons pressure, which can only be applied easily in one plane.

It must not be imagined that Paxolin is by any means a new product, as heavy-duty insulators of this material were being turned out in 1912, and the makers have been actively engaged in fulfilling Admiralty contracts for insulation for use in transmitting and receiving equipment for many years; this should provide sufficient evidence of durability and power to withstand the effects of extreme changes in temperature and atmospheric conditions.

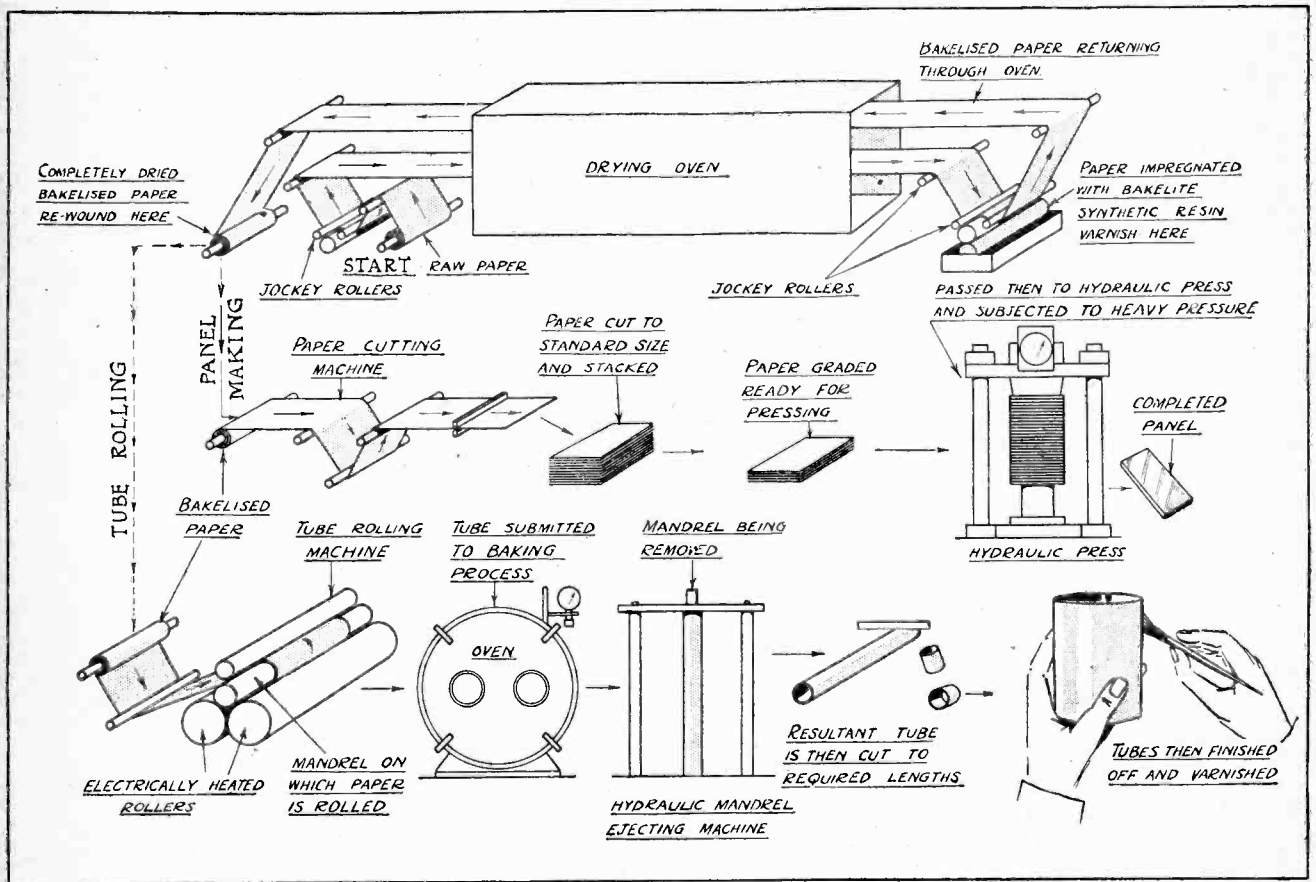


Fig. 2.—Schematic drawing showing the successive manufacturing processes employed in the production of Paxolin boards and tubes.

The successive manufacturing processes are shown in the schematic diagram (Fig. 2). The impregnating or varnishing of the special grade of paper from which Paxolin board and tubes are made is carried out on varnishing machines equipped with long steam-heated ovens (Fig. 3), the raw paper, unwound from large rolls, being led over a series of rollers through a dipping bath of bakelite varnish and then passed through the ovens to be finally rewound, treated and dried, on to spools ready for use. The varnish is made in large quantities by crushing the synthetic resin until it passes a sieve of $\frac{1}{8}$in. mesh and by dissolving the resulting powder in methylated spirit in steam-heated stirring machines; this is followed by filtration and distribution to the various paper-treating plants. The bakelised paper can be either cut into sheets for panel manufacture or rolled around mandrels to make tubes or formers. Taking the processes for panel production first, it will be seen from the schematic diagram that the treated paper is cut into sheets of the required size by a guillotine and then weighed in batches of so many sheets to check against a pre-determined weight-to-surface-area ratio; this procedure is important as it fixes the number of sheets which will produce a board of exact thickness after a pressure of hundreds of tons have been applied.

The treated sheets are now subjected to the tremendous pressure of about $\frac{1}{2}$ ton per sq. in. in a steam-heated hydraulic press (Fig. 5), wherein an equivalent total weight of about 800 tons is applied; in order to give some idea of the magnitude of this pressure it may be mentioned that a spanner which was inadvertently left in the press was found to be embedded $\frac{1}{32}$in. into the steel plates. The pressing process for each panel or board is conducted between well-polished metal surfaces which impart to the finished article a highly glossy surface without necessitating the application of varnish. Such a surface is extremely desirable as there is a minimum of small interstices for the retention of dust particles and salts

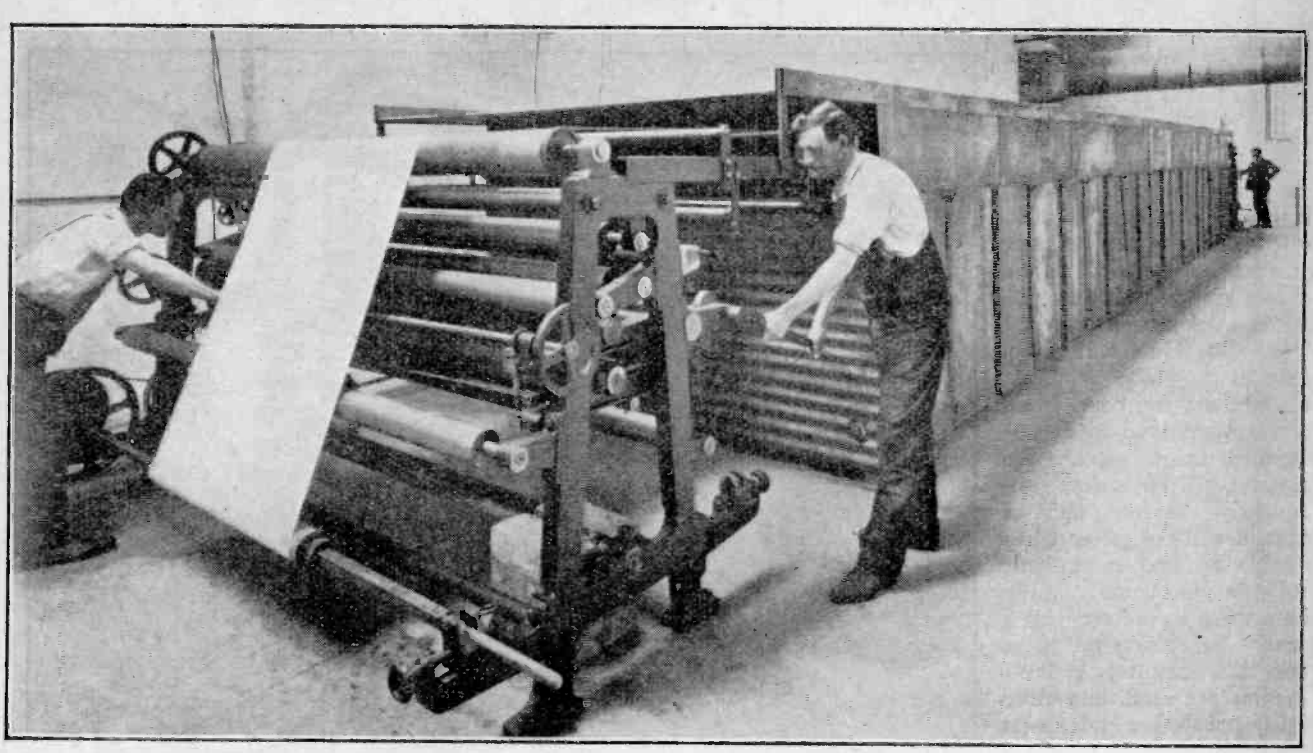


Fig. 3.—Paxolin paper varnishing machine equipped with steam-heated oven 75ft. long.

which eventually might form a continuous conducting layer. The sketch in Fig. 1 shows a panel where the pressing process has not been carried to the extreme edge, the paper laminations can be seen, but it must be made clear that under the terrific pressure applied a panel consists of an extremely hard homogeneous substance which cannot easily be split up into thinner sheets by applying a knife to its edge.

The production of tubes and formers is shown as an alternative to board-making in the schematic diagram

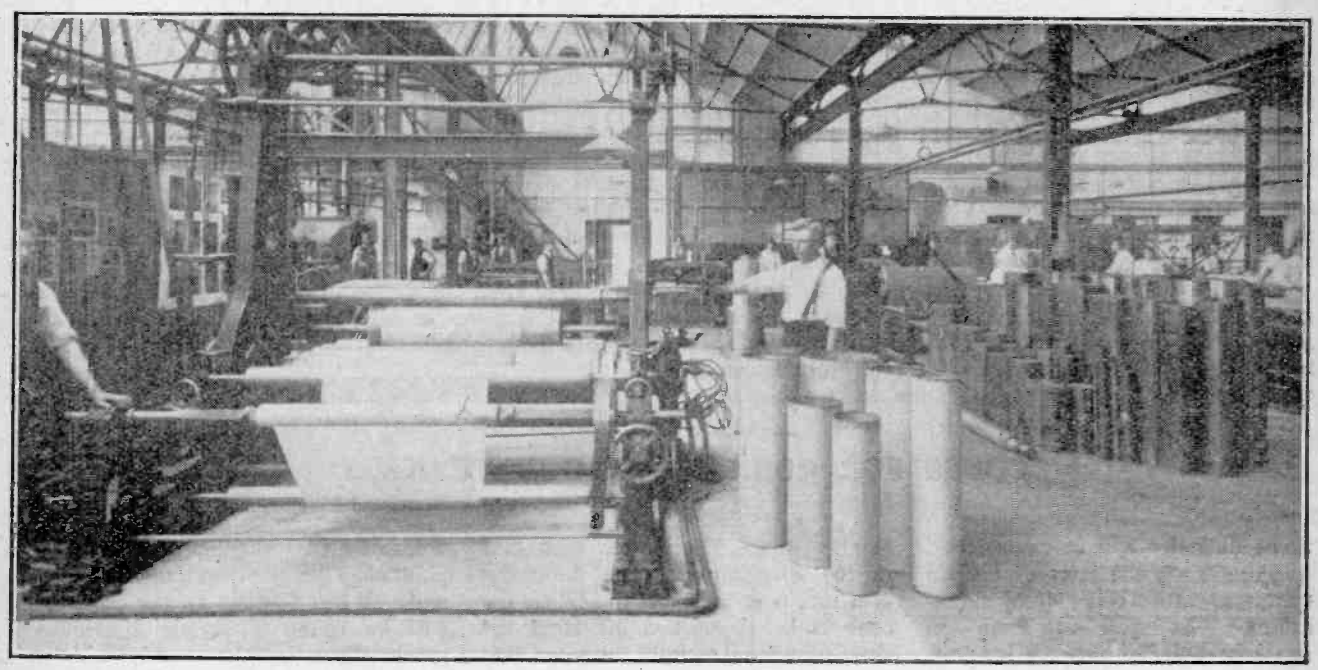


Fig. 4.—A tube-winding machine. The bakelised paper is slowly wound round mandrels against which electrically-heated rollers apply a heavy pressure.

Paxolin.—(Fig. 2). To obtain a tube of any diameter from $\frac{1}{16}$in. to 35in., and of any thickness of wall, bakelised paper is slowly run over a series of hot plates to expel all residual moisture and is then rolled under great pressure by electrically-heated rollers on to a mandrel until the required thickness is obtained (Fig. 4). While still on its mandrel the tube is heat-treated for many hours in an underground oven to a temperature below which the material will not soften subsequently; in fact, finished Paxolin will not soften when a soldering iron is applied, and the material simply chars when in contact with a flame. To release the tubes from their mandrels hydraulic rams are used, and since highly-polished metal sheets cannot be easily employed on the insides and outsides of the tubes to produce a glossy surface, varnish is applied and formers of the required length are cut off, dried, and are then ready for use.

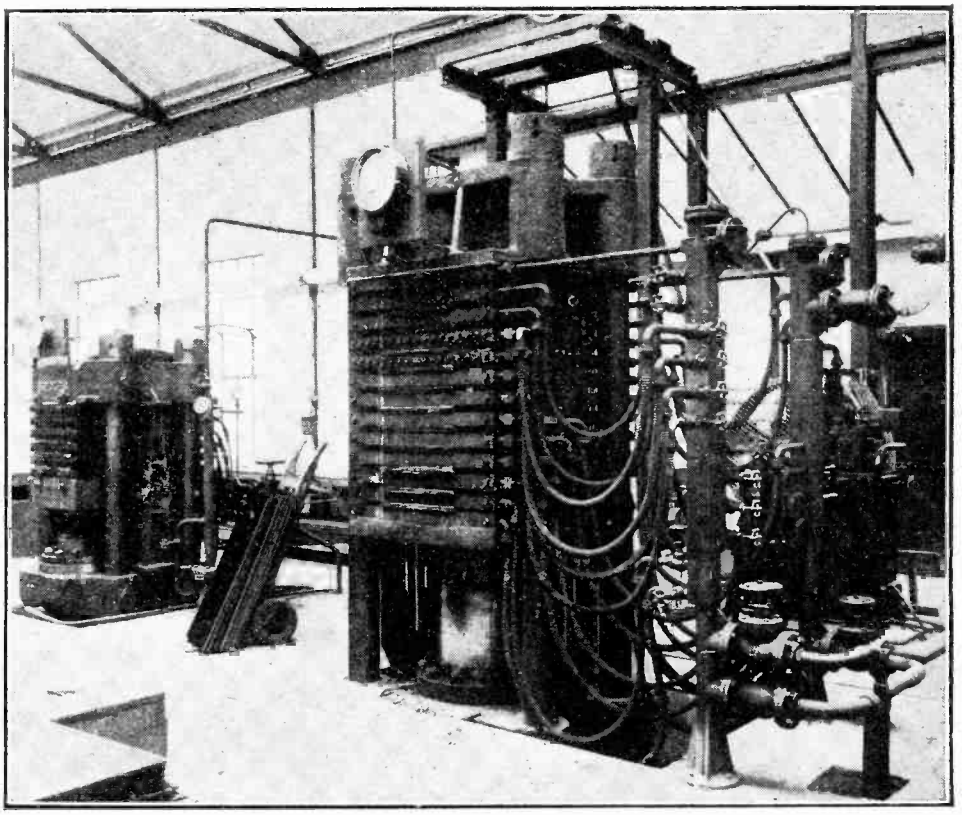


Fig. 5.—A steam-heated hydraulic press which exerts a pressure of 1/2 ton per square inch or an equivalent total weight of 800 tons. The treated paper sheets form a hard homogeneous substance which has excellent dielectric properties.

If fabric be bakelised, compressed and treated in the same way as paper, an extremely hard fibre results which has not very good insulating properties, but is sufficiently hard to be used for clutch linings and gear wheels such as those which drive the camshaft in a motor car engine, with the advantage that the wearing properties are practically as good as steel but far greater silence in operation is obtained.

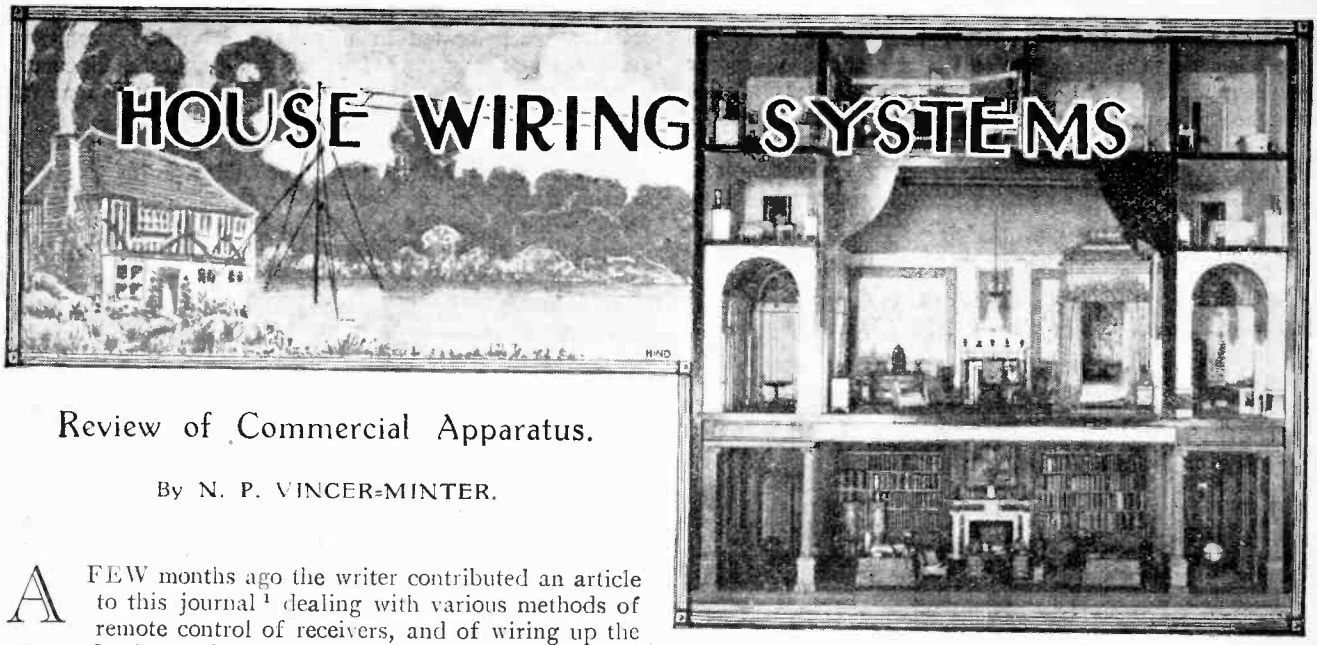
Paxolin panels can be finished in mahogany, black or the brown colour that is natural to resin, are easily worked on a lathe, and have a consistency that is somewhat harder than oak; the material is a little more difficult to saw and drill than ebonite, but provided the panel is backed with wood, and the drill is rotated fast and too much pressure is not applied, no difficulty will be found. The chief advantages of using Paxolin for formers and panels appear to lie in the fact that the surface does not deteriorate, is non-hygroscopic and is unattacked by ozone, sunlight and the salt-laden air of the seaside. The tensile strength of the material is such that panels $\frac{1}{8}$in. thick (which are cheap) will fulfil all the requirements of a set of normal proportions. Careful investigation of the whole series of manufacturing operations will show that there is no possibility of traces of metal being introduced, and tests show that the electric strength is such that the minimum one minute breakdown voltage at 90° C. is 300 volts per mil.[1] The desiderata for a good insulator for radio work were given at the commencement of this article, and from the properties described it should be apparent that Paxolin is an insulator of considerable interest to the amateur. W. I. G. P.

[1] A mil is $\frac{1}{1000}$in.

CONES FOR COIL DRIVE LOUD-SPEAKERS.

A Useful Tip.

Some difficulty will be experienced in pushing back the apex of conical diaphragms for coil drive loud-speakers. As well as from an appearance point of view, it is essential that the fold should be neat and concentric, to enable the coil to be fixed with its axis in line with that of the diaphragm. The following is a sure way to success. When the cone is being marked off from the sheet of paper, a circle corresponding to the position of the fold is "embossed" by means of the pen point of a compass, or, better still, a point may be filed up from a small nail. When folding up the paper it will be found a simple matter to obtain the correct formation immediately. Of course, the embossed line should come inside the fold.—H. D.



HOUSE WIRING SYSTEMS

Review of Commercial Apparatus.

By N. P. VINCER-MINTER.

A FEW months ago the writer contributed an article to this journal [1] dealing with various methods of remote control of receivers, and of wiring up the rooms of a house for this purpose. At the conclusion of that article it was intimated that the subject would be continued in a future issue with a discussion concerning the various remote control systems sold by manufacturers, either as complete outfits or in the form of separate components. Owing to the comparative imminence of the big wireless exhibitions at Olympia and at Manchester, the preparing of the article was deliberately delayed in order that the writer might be in a position to test out the various remote control components which it was confidently anticipated would make their initial appearance at these exhibitions. These exhibitions have now been held, and it must be confessed that they were extremely disappointing from the point of view of apparatus of the type mentioned. Scarcely any new remote control devices were to be seen, and practically all those that were exhibited were new models by the few enterprising firms who already manufactured this class of instrument.

It seems almost certain that the ultimate set of the future for the ordinary citizen will be one which can be stowed away in the cellar or the attic and operated from any room in the house. At the present moment it is simple enough to design a receiver which can be put in a remote part of the house, and by operation of a simple switch device, in any room of the house, any of three programmes brought in. This is done by providing the receiver with three separately pre-tuned circuits, any of which can be brought into use by pressure of a button in a distant room. Readers living in the Home Counties, for instance, should be able to initially tune these three circuits to 2LO, 5GB, and 5XX, and obtain any of these stations literally at the touch of a button, as only one pair of wires need be used in conjunction with an ordinary electric bell push in each room, it being possible to switch the set on in one room and off in any other room using the system shown by the writer in Fig. 2, page 208, of the August 17th issue of this journal. In view of the fact that at present 5XX acts mainly as a repeater of 2LO, perhaps it ought to be said in the case of readers in Greater London, only two stations would be available, but there are many situations in this country where three stations can be received at good volume and quality, using simple apparatus.

[1] *The Wireless World*, August 17th, 1927.

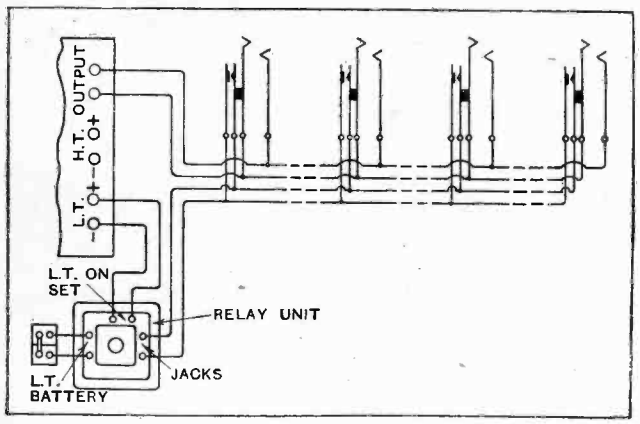


Fig. 1.—Connections of the "Lotus" system.

Programme Selection.

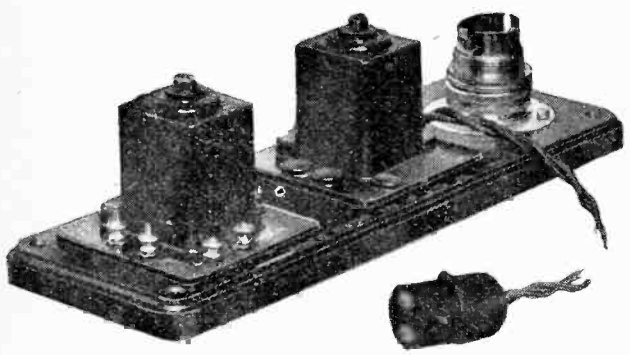
In the not too distant future it will be possible, by using H.F., to build a receiver which can receive half a dozen stations at good strength in this manner. Indeed, a receiver of this type was exhibited at Olympia by the British Radio Corporation, in which eight different stations could be received by moving switches and without retuning. This was done by arranging several switches in the receiver for changing over each of the two H.F. stages, these switches being coupled together in an ingenious manner and operated by one switch lever on the panel. True, this receiver embodied no remote control device, but the fitting of it with remote control involves no problem of wireless at all. It is merely a case for the exercise of a little straightforward mechanical and elec-

House Wiring Systems.—

trical ingenuity. So far as the writer is aware, there is only one set on the market in which an actual change over can be made from one programme to an alternative programme by means of remote control, and that is made by Messrs. Wingrove and Rogers, Ltd., but no H.F. stage is used. Still, there are many localities in which it is possible to receive two stations clearly without an H.F. stage.

Switching Battery Eliminators.

It would appear that in many quarters the view is held that with the coming of the set which is entirely driven



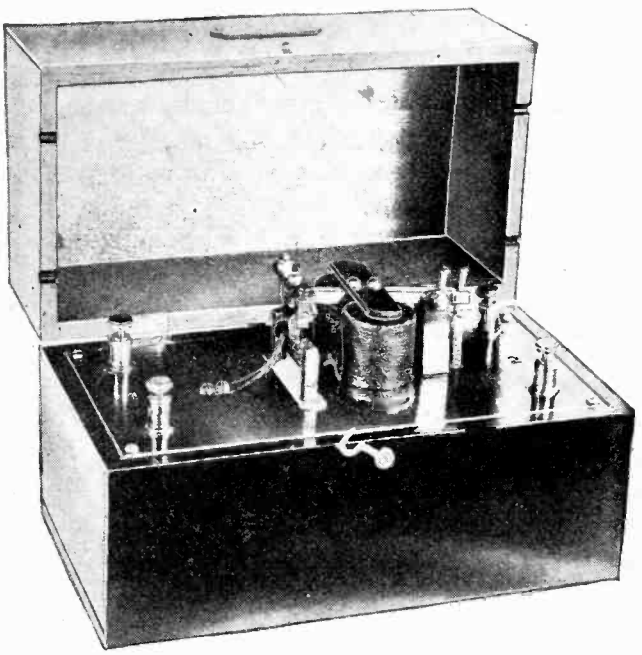
This "Lotus" unit also controls the H.T. battery eliminator.

from household mains the remote control unit is doomed, since the set will be merely switched on or off by any household switch. Such a view is rather foolish, because if the set were in the cellar one would not wish to go to the cellar and operate the switch every time to switch on or to switch off. True, one could extend the switch wires to a convenient room in the house, but this would not enable the set to be switched on in one room and off in another, which, as the writer pointed out in his previous article on this subject, is a very desirable feature. Surely the best thing to do, instead of extending wires dealing with a possible 250-volt pressure to various rooms, would be to have the cellar switch operated by a remote control unit, and then low voltage wires (3 volts) could be extended to various rooms and use made of the "push button" system in each room. There is actually a device on the market which is mainly intended for addition to the ordinary electric light system to enable a hall light to be switched on at the top of the stairs and then off again in the actual hall itself, etc., without actually altering the electric light wiring system itself, and this would be ideally suited to the purpose. It operates from a 3-volt supply, and is marketed by Messrs. I. Calvete, Ltd., under the name of "Teleswitch."

Admitting for the moment, however, the published arguments of that school of thought which considers that the all-mains set will put many of the present-day remote control devices out of court, this fact only emphasises the need for the production of improved types of remote control apparatus, for we shall still need to arrange for separate tuning circuits in our receiver, so that we can instantly change over from one programme to another by pressure of a button in any room of the house. In the writer's opinion, the remotely controlled "programme selector" set located in a cellar and driven entirely from the mains is the set of the future, and the sooner suitable remote control apparatus is put upon the market the better.

Now it will be remembered that when discussing various systems of house wiring and remote control in his previous article the writer divided the systems into two main groups—the "parallel connection" type and the "series connection" type, full diagrams of connections of installations representative of each of these types being given.

With regard to the first system, there is at least one firm who supplies the whole outfit in one complete "kit," namely, Messrs. Garnett, Whiteley and Co., Ltd., who market it under the name of "Lotus." The actual method of connecting the "Lotus" outfit to any existing receiver is shown in Fig. 1. Although not absolutely essential, it would probably greatly add to the neatness of the wiring in a permanent installation if the wooden casing and capping so much used in electric bell work were adopted. This casing has two grooves, and it is suggested that the two loud-speaker wires be run in one groove and the two relay control wires in the other groove. A somewhat similar arrangement is marketed by Messrs. Arclite, Ltd. With regard to the "Lotus" outfit, there is one very important point which is worthy of notice, and that is that this firm also provides a relay which cuts off the H.T. battery eliminator as well as the filament battery. In the case of a receiver employing dry cells or accumulators for H.T. supply, the breaking of the filament circuit automatically completely switches off the H.T. battery also, as when the filament is cold the valve forms a gap in the H.T. circuit. There is no need to provide a separate H.T. battery switch or to remove the wander plug, as many suppose. As for those who argue that this pre-

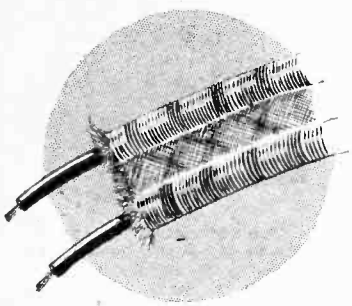


The "Gamage" relay has proved itself a reliable instrument for controlling L.T. current.

House Wiring Systems.—

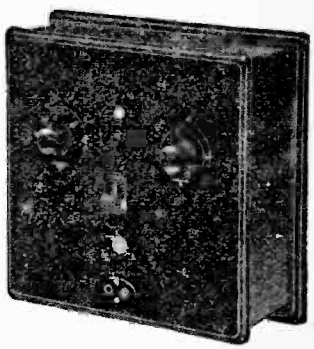
caution is necessary because there may be a leakage in the set, through, for instance, a faulty dielectric in one of the H.T. battery shunting condensers, the reply to them is that if such a defect exists in the receiver the proper thing to do is not to waste money in the purchase of an H.T. battery switch but to correct the fault at once or trouble will be caused when the set is in operation.

Now in the case of a D.C. battery eliminator, although the valves in the receiver cease to act as conductors immediately their filaments become cold, there is current flowing all the time through the potential divider, and in the case of an A.C. eliminator, even if the secondary windings of the transformer are all "opened," there will still be current flowing through the primary winding, for even in the best of transformers a certain amount of current, small though it may be, does flow through the primary winding when the secondaries are not "loaded." The mains circuit must, therefore, be broken, and the only firm, apart from the makers of "Lotus" relays, who appear to have realised this fact is Messrs. J. Runbaken, Ltd., who make provision for switching off the eliminator in their "Quixo" apparatus. The "Quixo" apparatus, however, makes a radical departure from ordinary methods, in that it is pneumatically instead of electrically operated. It is worked on exactly the same principle as the gas lighting system in the case of a modern house situated in a district where electrical mains are not available. In this case the lights are switched on and off by means of a plunger switch at the door (which operates a single pneumatic relay), making the system equally as convenient as electric light, no matches being required. "Quixo" apparatus is thus entirely independent of electrical power for its operation, which is certainly an advantage in avoiding complications in an "all-mains" set. Apart from the firms mentioned, the writer is not aware of any marketing complete apparatus for this system, although it would be possible to purchase relays and suitable wall-mounting jacks separately.



The "Harbro Easy-Fix" wire.

With regard to the second scheme, no firm sells a complete "kit" for this, although fortunately all the parts can be purchased separately. The triple jack blocks can consist of the Igranic "Multijacks," for instance, whilst the relay can be either the Gamage relay, the "Teleswitch," or the "Quixo." The two latter have been already mentioned. Any other type of relay *not* of the constant current type, such as Messrs. Leslie Dixon's clockwork relay, could also be used. With regard to the volume control across the separate jacks, there are a large number on the market made by various firms. The "Duvolcon," the "P.D.," the "Marconiphone," and the "Centralab" are a few among many which would be highly suitable. With regard to the volume control plug, so far as is known, no British firm markets one of these, which is a great pity, as they are of the utmost utility and very effective. good type of American origin can, however, be obtained from the Rothermel Radio Corporation of Great Britain, Ltd.



The main "Burndept" control unit.

With regard to wire for use in house wiring systems, it is highly desirable that lead-covered cable (the lead coverings being bonded and earthed) should be used in a permanent installation for all wires connecting to relays, etc. For long loud-speaker extension purposes, however, it is necessary to employ wire in which a low capacity exists between it and the lead casing, and between it and the other wire if it is double wire cable. Undoubtedly the best type of wire to use for this purpose would be the special lead-covered low-capacity wire used so much in commercial direction-finding apparatus. This wire is of extremely low self-capacity, and the actual wiring inside the lead casing is spaced with paper in a

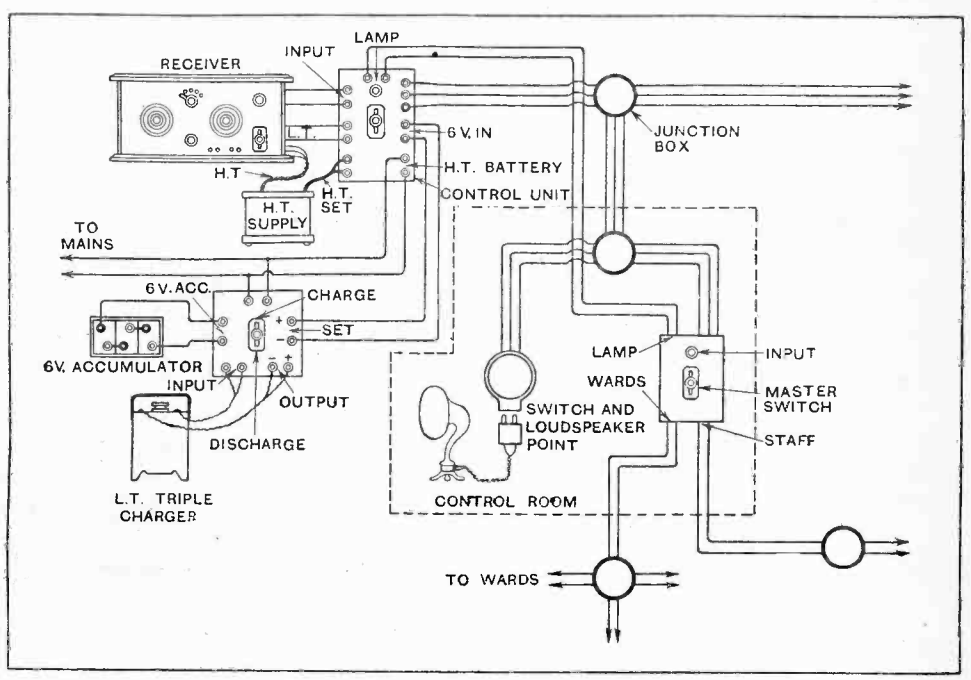


Fig. 2.—Connections of the control apparatus in the Burndept "Auto Broadcast" system.

House Wiring Systems.—

very special manner. This wire, however, is not easy to obtain, and the ordinary lead-covered wire would probably have to be used. It cannot be too strongly emphasised that when any length of the ordinary lead-covered wire is used it is highly desirable that only a low-impedance loud-speaker be used. The so-called "120-ohm" loud-speaker would be suitable, although the expression "120-ohm" refers purely to the D.C. resistance. Needless to say, a step-down output transformer would have to be used. This precaution does not in the least lower the self-capacity of the lead-covered cable, but of course it

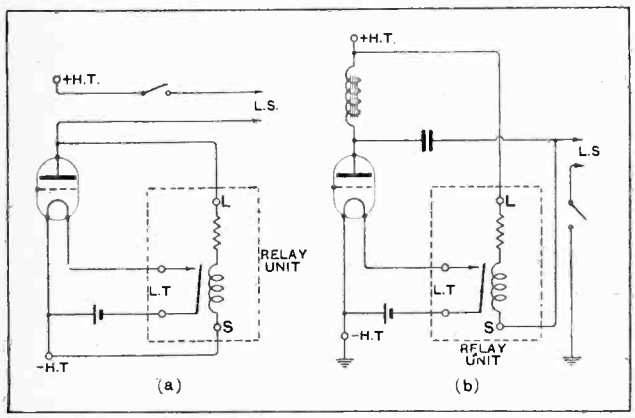
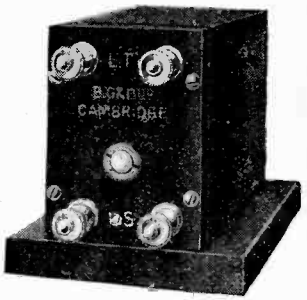


Fig. 3.—Circuit connections of the "Teletrol" system; (a) for loud-speakers connected directly in the anode circuit and (b) for choke-capacity output.

avoids the evil effect of it. In temporary installations, ordinary "lighting flex" can be used, but on no account should double-laid bell wire be used for loud-speaker extension work, or results from the point of view of quality will be disappointing, owing to the high self capacity between the two conductors of ordinary double bell wire. It is far greater than in the case of "lighting flex" or the so-called "red and black flex." Another excellent thing to use would be the "Harbro Easy-Fix" wire, which is specially made for loud-speaker extension purposes, and has a very low self-capacity: moreover, it is extremely inexpensive.

We are now in a position to consider house wiring systems and "gadgets" which differ in principle from those systems considered by the writer in his previous article. Undoubtedly the most comprehensive scheme existing is that sold by Messrs. Burndept Wireless, Ltd., under the name of "Auto Broadcast System." It is a very elaborate system, equally applicable to the ordinary household or to the largest hospital, and space forbids a complete and detailed description of it. In the same way as other systems already mentioned, the first loud-speaker to be switched on brings the receiver into operation, and the set is not switched off until the final loud-speaker is cut out. In addition, special loud-speaker points are fitted in which the turning off of the loud-speaker switch has no power to switch the set on. This device is intended for fitting in rooms of disciplinary institutions, such as workhouses, or in the servants' quarters of a household or similar situation where it is undesirable for the potential user to switch on the receiver when desired. Some idea of the method of operation of this very comprehensive system may be obtained by a careful study of Fig. 2. It will be seen that the installation includes a trickle charger for the L.T. battery, the H.T. supply being obtained from a special mains unit, although it is possible to use batteries if desired. It is intended that such devices as the battery eliminator, the control unit, etc., be placed in a distant part of the building; the master switch shown in what is termed the control room, is intended to be in some such place as the matron's room of a hospital, giving her complete power to cut off reception from the wards and the staff independently. It should be noted that where three wires are shown, these feed rooms in which the occupants have power to switch the set on and triple lead-covered wire is used, twin lead-covered wire being used for extending the loud-speaker to those places where it is not desirable for a control of the set to be had. Another point is that it is possible to use telephones at their proper strength side by side with a loud-speaker working at full volume. In this respect, it is similar to a home-made system discussed by the writer in the August 17th issue of this journal. Possibly the greatest appeal of this equipment is that it may be obtained complete with special twin or triple lead-covered wire, and special junction boxes in which provision is made for preserving the continuity of the lead covering (a great advantage where "noises" from electric tramway systems or power mains are experienced) and special switches, control units, etc.



The "Teletrol" relay is neat and compact, and takes little current.

Another most interesting and also comparatively inexpensive system is the "Teletrol" unit made by Messrs. Bailey, Grundy and Barrett, Ltd. The system is extremely simple, and yet, as is often the case where simplicity rules the roost, highly effective. It may be used either with or without a choke-filter output circuit, and it possesses the great advantage that, if the latter method is adopted, only one extension wire is needed be-

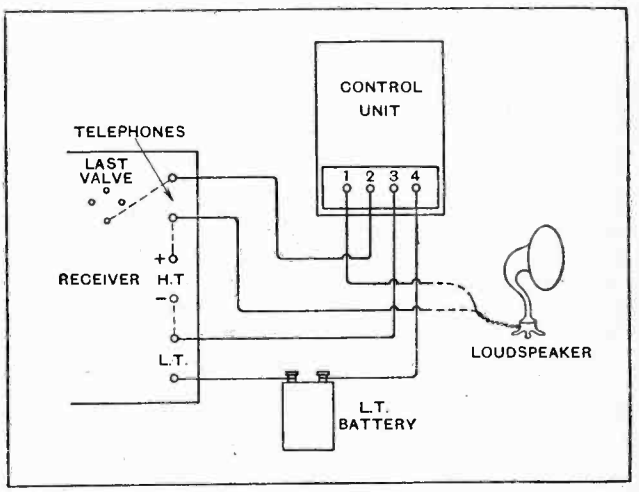
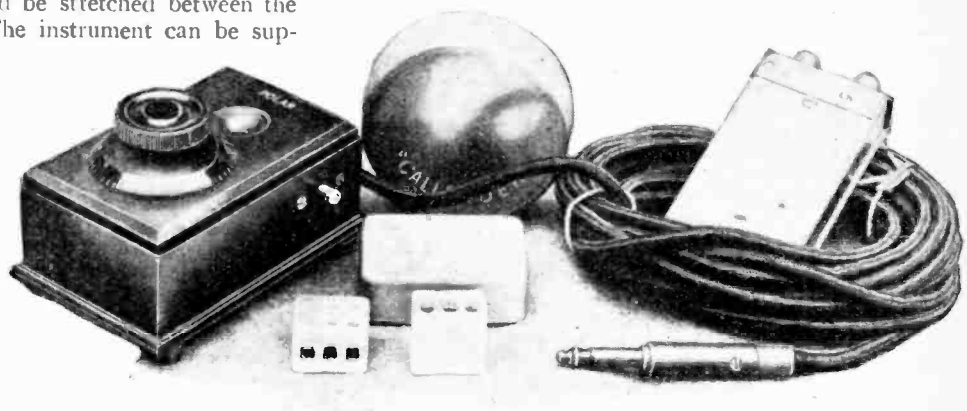


Fig. 4.—Connections of the Lissen "Telepathic" remote control relay.

House Wiring Systems.—

tween set and loud-speaker, and this wire serves the purpose not only of connecting up the loud-speaker, but also of switching on the receiver and switching it off again when the loud-speaker is disconnected or unplugged from a simple wall socket. The advantage of this single wire system cannot be too strongly emphasised from the point of view of eliminating capacity effects in shunt with the loud-speaker, and consequent loss of the higher musical frequencies. In this respect, it is similar to the system outlined by the present writer in an article published in the issue of this journal dated February 10th, 1926. It is highly convenient also in a case where a loud-speaker point is required to be fitted in a summer-house or similar structure at some distance from the house, as only a single overhead bare wire need be stretched between the roof of the two buildings. The instrument can be supplied complete with wall jacks if desired. The method of its operation can be clearly understood by a study of the two simple circuit diagrams (a) and (b), given in Fig. 3. It may be mentioned that a receiver incorporating this unit was described with full constructional details in *The Wireless World* for January 19th, 1927. Another ingenious device working on a somewhat similar system is the Lissen "Telepathic" control, connections of which are shown in Fig. 4.



The "Polar" programme selector and volume control with junction boxes.

Messrs. Wingrove and Rogers, Ltd., who are now the sole distributors of "Polar" apparatus, also supply special apparatus for house wiring systems and remote control, including junction boxes of various types, and special lead-covered wire. Of special interest, however, are the combined junction boxes and plug-in points. With regard to the lead-covered wire, this firm particularly advise that low-resistance loud-speakers be used on house wiring systems, and many other firms follow their example. This is a very wise precaution in cases where it is intended to extend the loud-speaker to any great length without the use of special types of wire which have already been referred to; for short distances, however, the ordinary "2,000-ohm" loud-speaker is suitable. This firm also supply a complete four-valve set which can be placed in a remote part of the house, and previously tuned to the wavelength of any two desired stations, such, for instance, as London and Daventry, two complete tuning circuits being provided. It is then possible, provided that the house has been suitably wired, not only to switch the receiver on and off from any room in the house, but also to change from one programme to another, and to control volume without ever going near to the receiver.

There are, of course, a large number of miscellaneous relays, etc., made by firms such as Messrs. Siemens Bros. and Co., Ltd., sold mainly for other purposes, such as ordinary house telephone systems, which can be adapted to serve in a remote control house wiring system. In addition, there are a large number of instruments, such as the Igranic battery eliminator, which do not exactly come into the category of a remote control system, but could be readily adapted to it. This particular eliminator is switched on or off by a button situated on it, and, obviously, this could be operated by a similar device situated at a distance, the eliminator being located in the cellar or loft of a house.

CATALOGUES RECEIVED.

Ferranti, Ltd., Hollinwood, Lancashire. Pamphlet No. Wa406, dealing with Ferranti radio meters. Pamphlet No. Wa411/4, giving battery eliminator diagrams.

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Mullard Wireless Service Co., Ltd., Mullard House, Denmark Street, London, W.C.2. Pamphlet WA12, dealing with the P.M. grid leak.

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J. H. Taylor & Co., Macaulay Street, Huddersfield. "Reliability Wireless Guide," No. 999, a price list of the leading lines of wireless components.

o o o o

The Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C.4. Leaflet describing the Ediswan local station eliminator and the Ediswan L.T. accumulator charger for A.C. mains.

Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. 32-page catalogue and price list of Dubilier condensers, resistances, toroids, H.T. supply units, etc.

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British Thomson-Houston Co., Ltd., Rugby. Catalogue of B.T.-H. receivers and loud-speakers.

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A. G Franklyn, 3, Boar Lane, Leeds. Leaflets describing the "Pegasus" receivers.

A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5. "All About Cossor Valves," a booklet covering the Cossor range.

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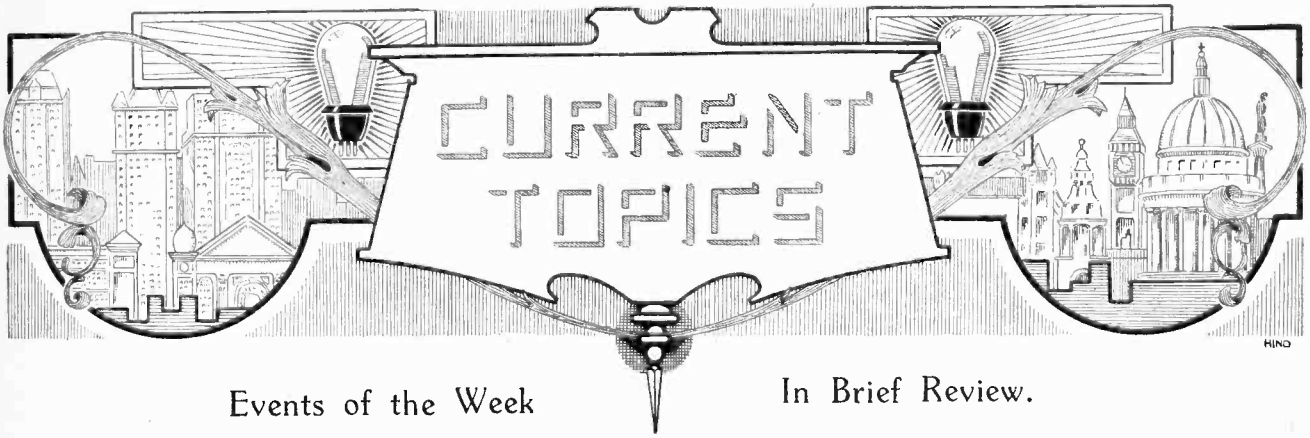
Sydney S. Bird & Sons, Limited, "Cyldon Works," Sarnesfield Road, Enfield Town, Middlesex. Price list of *Cyldon* short-wave condensers.

o o o o

The Benjamin Electric, Ltd., Brantwood Works, Tottenham, London, N.17. Illustrated leaflet dealing with the *Benjamin* "Majestic" H.T. battery eliminator.

o o o o

Falk, Stadelmann & Co., Ltd., 83-89, Farringdon Road, London, E.C.1. Catalogue No. 586, Season 1927-28, of *Efesca* wireless components and *Efescaphone* receiving sets.



Events of the Week In Brief Review.

THE MILLIONS WHO LISTEN.

The increase in the number of broadcast licences from January to November, 1927, was 188,261. The total number current at the end of that time was 2,366,520. It is estimated that this represents an actual audience of between ten and twelve millions.

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LOUD-SPEAKERS IN A CRYPT.

The famous church of St. Martin's-in-the-Fields has such large congregations that many people can find accommodation only in the crypt, where they hear the service through loud-speakers. A permanent Marconiphone address system is being installed.

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CONTINENT TO SHARE TRANS-ATLANTIC 'PHONE ?

The possibility that European countries may be linked up with the Anglo-American telephone service is being discussed by officials on both sides of the Atlantic. There have already been test calls from America to several European cities. The fact that the present service is not self-supporting is an argument for drawing revenue from the Continent.

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BRITAIN'S BIGGEST FAIR.

A practically complete catalogue of the London section of the British Industries Fair has already been issued, six weeks before the opening of the Fair on February 20th. In past years the Fair has been strongly supported by wireless firms. It is stated that this year's "B.I.F." will be the biggest yet held.

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WIRELESS WORLD AND RADIO R.

A course consisting of ten lectures, with practical demonstrations, on Alternating Currents and Electrical Oscillations, is being given by Dr. D. Owen, B.A., F.Inst.P., at the Sir John Cass Technical Institute, Jewry Street, Aldgate, London, E.C.3. The first lecture was given yesterday (Tuesday), and the remaining lectures will be on Tuesdays from 7-8.30 p.m. The course fee is 20s.

The syllabus includes the generation, propagation and reception of electric waves; measurement of signal strength; resistance, inductance and capacity; oscillatory valve circuits; the shielded valve; the quartz resonator, etc.

WIRELESS SCORES AGAIN.

During the Christmas storm period the telephone lines between London and Paris were out of action, and the only satisfactory means of communication was by wireless.

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BRITISH WIRELESS MARINE SERVICE.

The two British marine wireless companies—the Marconi International Marine Communication Company, Limited, and the Radio Communication Company, Limited—have come to an agreement to amalgamate their operating and inspection services. A joint service department of these two companies has been organised under the name of British Wireless Marine Service, which will in future deal with all matters relating to the appointment of operators to ships, the organisation of marine telegraph traffic, the fitting, maintenance and repair of ship wireless installations, and the provision of wireless service depots for ships in all parts of the world. The effect of this fusion of wireless service should be greatly to the advantage of British shipowners.

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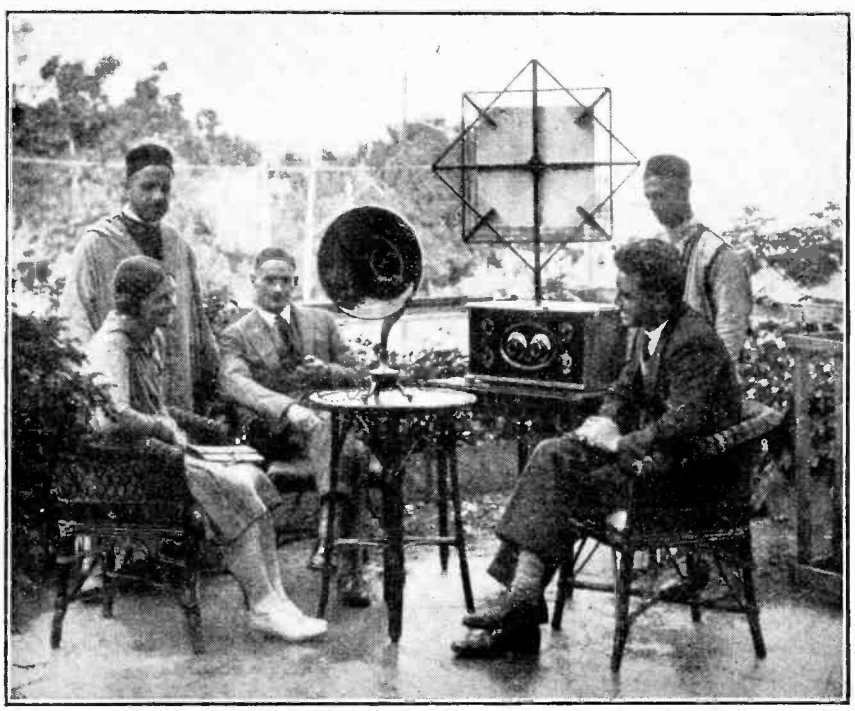
CROYDON AIR PORT STATION.

Among the developments in connection with the new London Air Port at Croydon—which was officially opened on January 9th—is the provision of an entirely new wireless station. This is being erected for the Air Ministry by Marconi's Wireless Telegraph Co., Ltd., to replace the one that has done duty there for the last seven years.

The new station will consist of a group



IN SUNNY TANGIERS. Miss Gleitze, who is attempting to swim the Straits of Gibraltar, photographed at her hotel at Tangiers while listening to a European broadcast programme with a Burndept seven-valve superheterodyne.

of four 3-kilowatt wireless transmitters operated in conjunction with a wireless direction finding receiver. The transmitters will be capable of telephonic and continuous wave and interrupted continuous wave telegraphic transmission, the wave range being from 800 to 2,000 metres. Independent drive circuits will be incorporated to maintain constancy of frequency and wavelength. The direction finder is arranged so that, if required, two or more circuits can be operated on different wavelengths for the reception of telephony and telegraphy on the same aerials.

In order to keep the neighbourhood of the aerodrome as free as possible from obstruction, the wireless masts and transmitters are being erected two or three miles from the Air Port and operated by the "remote control" system.

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AN INTERESTING APPOINTMENT.

Those of our readers who are motoring enthusiasts, will be interested to learn of the appointment of Mr. H. Massac Buist to the Editorship of our sister journal *The Autocar*. There are few motorists of experience to-day who are not familiar with the ability of Mr. Buist, who has long been internationally recognised as the foremost British motoring journalist.

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WIRELESS SCHOOL WITH TEN STATIONS.

The R.A.F. Electrical and Wireless School at Flowerdown, Winchester, which was recently inspected by Air Vice-Marshal Sir John Higgins, K.B.E., C.B., is equipped with ten wireless out-stations, which are replicas of stations used in time of war.

The wireless course combines lectures with practical work. Beginning with the construction of tools, the pupils proceed to simple metal turning work, and eventually they are able to make component parts of wireless sets, such as valve-holders, condensers, and variometers. Before their instruction is finished the men and boys are sent to the Detached Flight at Worthy Down, where they experience practical air operating, being required to transmit and receive messages from the ground during a two-hour flight. This ordeal appears to hold no terrors, for it is reported that in the last Entry of Aircraft Apprentices there were no failures!

FORTHCOMING EVENTS.

WEDNESDAY, JANUARY 11th.

Stretford and District Radio Society.—At 8 p.m. At 6a, Derbyshire Lane. "5SS Calling."

THURSDAY, JANUARY 12th.

Leyton and Leytonstone Radio Society. At 8 p.m. At Haydn House, Fairlop Road, E.11. Super regeneration.

FRIDAY, JANUARY 13th.

Leeds Radio Society. At the University. Lecture by the Igranic Electric Co., Ltd., "Recent Developments in Radio Reception."

South Manchester Radio Society. At the Co-operative Hall, Wilmslow Road, Didsbury. A Paper on "Pure Reception," by Mr. J. Baggs, of the Manchester Radio Scientific Society.

Kentish Town and District Radio Society. At 8 p.m. At the Kentish Town Men's Evening Institute, Carlton Road L.C.C. School, N.W.5. Re-opening of Wireless Classes.

Radio Experimental Society of Manchester. Special Elementary Class with Simple Instrument Work.

Wigan and District Technical College Radio Society. Lecture: "Rectifiers and Eliminators," by Mr. C. H. Wilding, Grad. I.E.E.

Sheffield and District Wireless Society. Opening Meeting of Session.

MONDAY, JANUARY 16th.

Hackney and District Radio Society. At 8 p.m At Electricity Showrooms, Lower Clapton Road, E.5. "Junk Sale."

TUESDAY, JANUARY 17th.

Bradford Radio Society. Lecture: "Gramophone Pick-ups," by Messrs. S. G. Brown, Ltd.

PORTABLE SET FETCHES £110.

A three-valve portable set realised the sum of £110 at an auction conducted on January 3rd by Mr. George Graves, the well-known actor, at the Stable Lads' Tournament in aid of St. Dunstan's funds at the National Sporting Club. The set was an "Alphian 4."

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OBITUARY.

We regret to record the death on December 16th, 1927, of M. H. L. Etienne, Director of the International Bureau of the Telegraphic Union, Berne.

M. Etienne, who was born at Brenets, Switzerland, in 1862, succeeded Col. Emil Frey as the head of the International Bureau in 1921.

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SHORT WAVE CRISIS IN U.S.

What can be described as a Short-Wave Conference opened yesterday (Tuesday) in Washington. The conference is in the nature of an emergency meeting summoned to cope with the formidable situation which has arisen owing to the mass of applications for licences for transmission on the short-wave band. The Federal Radio Commission has been inundated with requests from all classes of operators, amateur and commercial.

In considering these applications the Commission is faced with the necessity of making provision for certain services, such as aircraft beacons, compass stations, etc., which use short-waves exclusively. Nor must they forget to reserve certain short waves for the use of aerial navigation. It is hoped that public hearings on the whole subject will be of benefit to the applicants, and at the same time provide the Commission with information and guidance in a very awkward matter.

International Amateur Tests.

We understand from the American Radio Relay League that it is intended to conduct a further series of International Tests between amateurs in the United States and Canada and their fellow-transmitters in other parts of the world on similar lines to those carried out last May.

The new competition will open on February 6th and close on February 20th. Prizes will be awarded to the American or Canadian amateurs who receive the greatest number of replies from other countries to the test messages sent out.

Full particulars may be obtained from the A.R.R.L., 1711, Park Street, Hartford, Conn., and are also published in the December issue of "Q.S.T.," their official journal. Briefly, the rules to be observed by European amateurs taking part are: (1) The reply to any particular test message received must be sent to *another* U.S. or Canadian station and *not* to the original sender of the message; (2) such replies must consist of at least ten words, including the reference serial number; (3) each reply must be differently worded; and (4) "ham abbreviations" are not allowed.

TRANSMITTERS' NOTES

General Notes.

Mr. A. L. Sledmere, 60, Rue Saint-Antoine, Paris, is willing to listen on wavelengths of 5 metres and upwards at any time by arrangement, preferably on telephony. He is especially interested in experiments connected with the skip distance phenomena on short waves.

Mr. Herbert A. Bartlett, "Dundon," Hatfield Road, Torquay, Devon, is willing to stand by for tests at any time on waves from between 17 and 100 metres and, in the near future, down to 10 metres. His station number is BRS122, and as he was for eight years a professional operator, anyone desirous of carrying out tests may be assured of efficient assistance.

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Belgian Amateur.

A new station, EB 4ED, is licensed in Antwerp, and has been operated by the Rev. William Thomas, of the Methodist Evangelical Mission at Eglise du Christ, 9, rue Bex, since December 18th. Transmissions on a wavelength of 250 metres every Sunday from 10.00 to 11.30 and 18.15 to 19.00, and on Thursdays from 18.15 to 19.00 G.M.T. Religious services and musical programmes are broadcast, and reports from England will be heartily welcomed.

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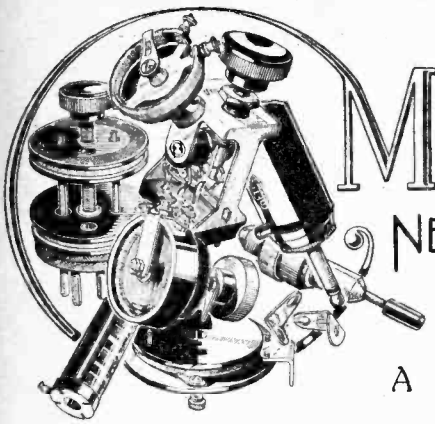
Spanish Amateur Stations.

We are indebted to Mr. Miguel Moya for a revised list of Spanish amateurs, and the following are the QRA's which supplement or correct the lists already published in *The Wireless World* and the R.S.G.B. Diary and Log Book:—

EAR 9 C. S. Peguero, Zurita 9, Zaragoza. (Change of address.)
EAR 10 F. Roldan, Avenida Reina Victoria 17, Madrid. (Change of address.)
EAR 61 J. R. Sanchez, Provenza 276, Barcelona. (Correction.)
EAR 63 F. Balsells, Etanislao Figueras 16, Reus. (Change of address.)
EAR 72 A. Martinez, Antillón 16, Madrid.
EAR 73 M. C. y J. Mangrané, Mallorca 152, Barcelona
EAR 74 V. Herrero, Egusquiza 5, Irun.
EAR 75 A. S. Morales, Ferreras 4, Puerto de la Luz (Gran Canaria).
EAR 76 J. M. C. Moro, Zeit 8, Valencia.
EAR 77 M. G. Cobos, Javier Sanz, 18, Almeria.



MANUFACTURERS' NEW APPARATUS

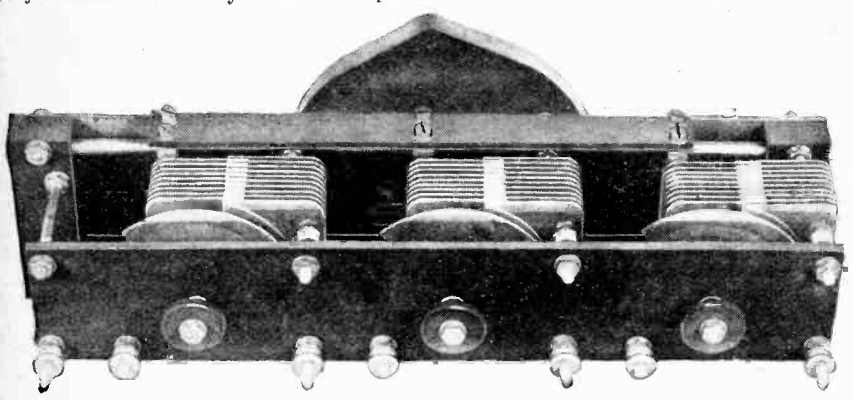
A Review of the Latest Products of the Manufacturers.

NEW RIPAULT TRIPLE GANG CONDENSER.

Readers are familiar with the lateral action condenser developed by Ripaults, Ltd., King's Road, London, N.W.1. In place of the half-disc type of revolving plate an almost rectangular shaped plate is employed, the moving plates being arranged on a pair of guide rods and operated by means of a cam drive. The law of a condenser constructed in this way in which the moving plates advance laterally against a cam is controlled by the cam contour rather than the plate shape. This form of lateral movement condenser lends itself admirably to the linking together of several condenser sections for providing simultaneous tuning control. The fixed sections are mounted upon ebonite bars attached to a channelled brass frame, while the centre moving section is linked by a pair of rigid ebonite strips to the moving plates of the two outer sections.

It is customary to bring the several tuned stages into step by adjusting the settings of the tuning condensers on a common shaft, though in this case the adjustment is made by means of separately controlled plates arranged to separately adjust the capacity values. If the plates follow a logarithmic law the former method is the correct one for compensating for differences in the inductance values of the several tuning coils, though it assumes that coil self-capacity and other stray capacities are of equal value in each stage. The method employed in the Ripault condenser rather assumes that the inductance values of the coils will be identical, which is, of course, a safe assumption, so that the single-plate capacity control to each section compensates for the small differences of circuit capacity which are certain to exist.

This three-section condenser occupies less space than the revolving spindle type, and the sections are conveniently arranged for wiring to the several tuned stages. Although screening between the sections is not conveniently possible, the mounting plate is insulated from the plates of the condenser and serves as a front screen. The condenser is operated by a friction driven dial.



The new Ripault condenser for simultaneously controlling three tuned circuits. The plates move laterally.

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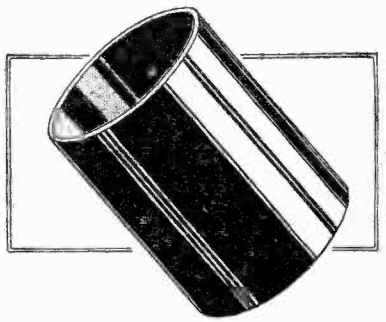
RADION TUBE FOR COIL CONSTRUCTION.

Readers will be interested to learn that a new form of insulating tube suitable for the construction of solenoid inductances is obtainable from the American Hard Rubber Co. (Britain), Ltd., 13a, Fore Street, London, E.C.2. Their well-known form of Radion ebonite is employed, and the principal merit of the new tube is its thin wall of $\frac{35}{32}$ in., and polished face. Ebonite tube as usually purchased is generally $\frac{1}{8}$in. thick, while both inside and outside surfaces are unfinished and are rough, and it is not at all uncommon to find that the tube is not perfectly cylindrical.

This tube is supplied in a convenient diameter of $3\frac{1}{4}$in., and it is already cut off into 4in. lengths, the ends being perfectly finished, so that the former is ready for winding.



The new thin walled Radion ebonite tube. The outer face is polished and the ends finished smooth.

TRADE NOTES.

Radielle Battery Eliminators.

Messrs. Hawkins and Soffe, manufacturers of Radielle Battery Eliminators, have formed a limited company under the title of The Radielle Co., Ltd. The registered office is 18a, Haverstock Hill, Chalk Farm, London, N.W.3.

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A. J. S. in India.

We learn that Messrs A. J. Stevens and Co. (1914), Ltd., the manufacturers of radio receivers and accessories, have concluded arrangements for the distribution of their products throughout India by Messrs. The Bombay Radio Co., 73-5, Marine Lines, Queen's Road, Bombay.

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Self-regenerative H.T. Batteries.

Some interesting figures regarding the performance of Ripaults H.T. dry batteries under varying conditions are contained in a leaflet recently issued by Messrs. Ripaults, Ltd., King's Road, London, N.W.1, who state that they will be pleased to forward a copy of this leaflet to any *Wireless World* reader who makes application to the above address.

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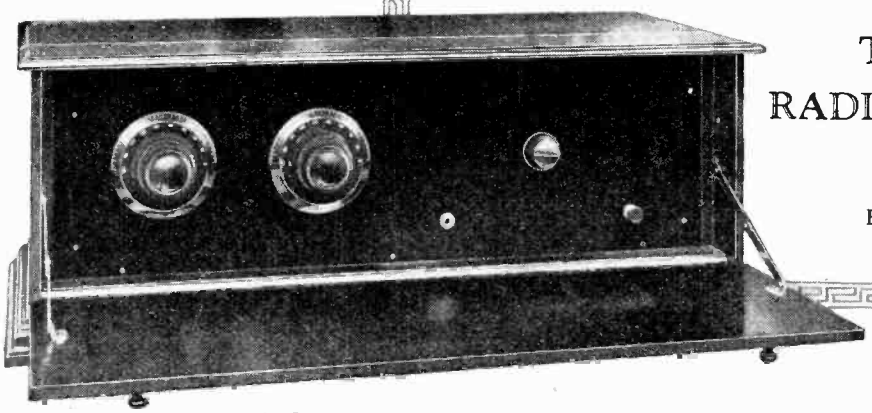

THREE-VALVE RADIO-GRAMOPHONE RECEIVER.

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

Constructional Details and Operation Notes.

(*Concluded from page 10 of previous issue.*)

THE next part of the circuit to be considered is the first L.F. coupling, and here the only disadvantage of the small coil—large condenser reaction scheme becomes apparent.

From the L.F. point of view the reaction condenser is effectively in parallel with the output side of the valve and thus in parallel with the impedance in the plate circuit of this valve—*i.e.*, across the primary of the L.F. transformer

Now, while extra capacity in parallel with the primary of the transformer will probably assist low-tone reproduction by resonance effects, it will do nothing to help the higher frequencies, and will almost certainly tend to cut them down. The writer has elsewhere shown that the higher audio frequencies are in any case cut down in the tuning circuits, so that more reducing is all to the bad. To help matters a little a H.F. choke of as high an inductance as possible is inserted as shown in the plate circuit of the first valve, and a very tiny condenser of not more than 0.0001 mfd. shunted across to earth to make quite sure that no radio-frequency currents get into the L.F. side.

This H.F. choke is also useful on the radio side, though not strictly necessary as a rule.

Volume Control.

One of the most suitable, and certainly the most convenient, forms of volume control in a L.F. amplifier is a high-resistance potentiometer across the secondary of the first L.F. transformer, provided that this potentiometer is perfectly silent in operation.

Also, in general, a volume control is not required to reduce the output completely to zero, but only to diminish the volume. To obtain this effect, a fixed grid leak is used in series with the potentiometer, and the two connected in parallel with the secondary of the transformer.

If a half-megohm potentiometer is used, and a half-megohm leak as well, the voltage input at minimum setting of the control will be half that at maximum setting, and with a quarter-megohm leak the voltage input can be reduced to one-third.

A suitable high-resistance potentiometer is the "Centralab," which is perfectly silent in operation owing to its peculiar construction, in which no sliding contact on the usually delicate resistance element is involved.

Construction.

The first component to make is the plug-in coil for aerial, grid, and reaction, all being wound on the same former—a "Becol" 3in. in diameter and 6in. long.

The ribs on the former should preferably be grooved with 18 turns per inch on which to wind the wire. The grid coil L consists of 56 to 60 turns of 24 S.W.G. single silk-covered wire; the aerial coil is wound over this on ebonite spacing strips in the manner often described in *The Wireless World*, and consists of 14 turns of No. 38 S.W.G. The reaction coil is wound with No. 24 S.W.G. single silk wire, and consists of approximately 23 turns commencing about $\frac{1}{8}$in. from the end of the grid coil. All the coils are wound in the same direction, and the connections of the ends are shown in Fig. 5. When wiring up it is very easy to remember that the outer ends of the main coils go to grid and plate of the first valve respectively, so that the other ends must go to earth and the live side of the reaction condenser respectively.

This arrangement ensures that the E.M.F. fed back into the grid circuit from the reaction coil is in the right sense.

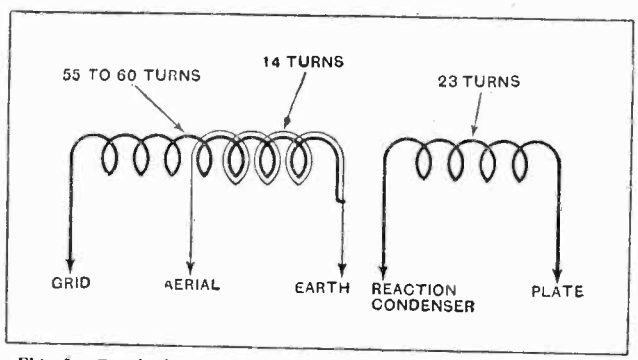

Fig. 5.—Particulars of the tuning coil windings which are supported on a "Becol" former 3in. in diameter and 6in. long.

Three-valve Radio-gramophone Receiver.—

The panel may be made of any desired material, ebonite, wood or metal, according to the choice of the reader. If a metal panel is used it may have to be bushed for the input gramophone jack if the latter uses the hole in the jack as one connection, as most of them do. The dimensions and positions of holes in the panel are shown in Fig. 6.

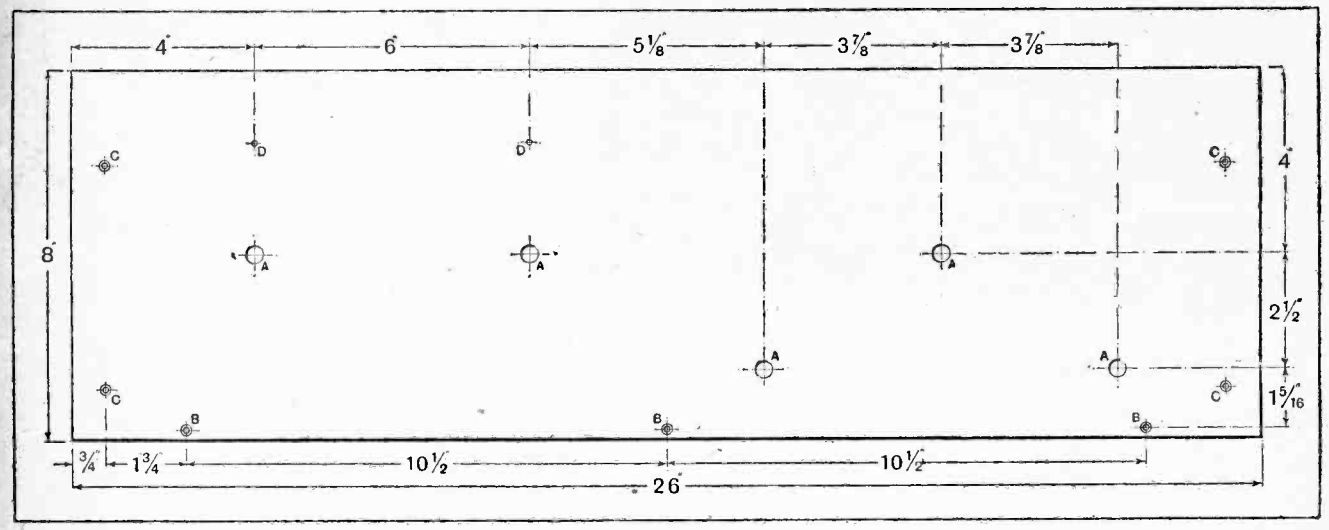

Fig. 6.—Drilling details of front panel. Sizes of holes are as follow:—A, 3/8in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws; C, 1/8in. dia., countersunk for 6B.A. screws; D, 3/32in. dia.

Layout and Wiring.

The baseboard layout and wiring diagram for the circuit arrangement of Fig. 1 (two L.F. valves for gramophone reproduction) are shown in Figs. 7 and 9 respectively.

The wiring will be found fairly simple, and can all be done after all the components have been fitted on the baseboard and the panel and the two latter fixed in position. The fact of using a single plug-in former with all the coils simplifies the H.F. wiring considerably.

Valves of the two-, four-, or six-volt class may be used—the actual type depending on the inclination and purse of the constructor.

The first valve should have an amplification of from 10 upwards, and the A.C. resistance should not exceed about 30,000 ohms.

The second valve may have an amplification factor of 6 to 9, with A.C. resistance up to about 10,000 ohms, while the last valve should be a power valve with an A.C. resistance of about 5,000 ohms or thereabouts.

The following table gives the range of Mullard valves suitable in various positions:—

Position.	2-volt.	4-volt.	6-volt.
V_1	P.M.1 H.F.	P.M.3	P.M.5
V_2	P.M.1 L.F., P.M.2	P.M.4	P.M.6
V_3	P.M.2, P.M.252	P.M.254, P.M.4	P.M.256, P.M.6

Similar valves by other makers are, of course, equally suitable.

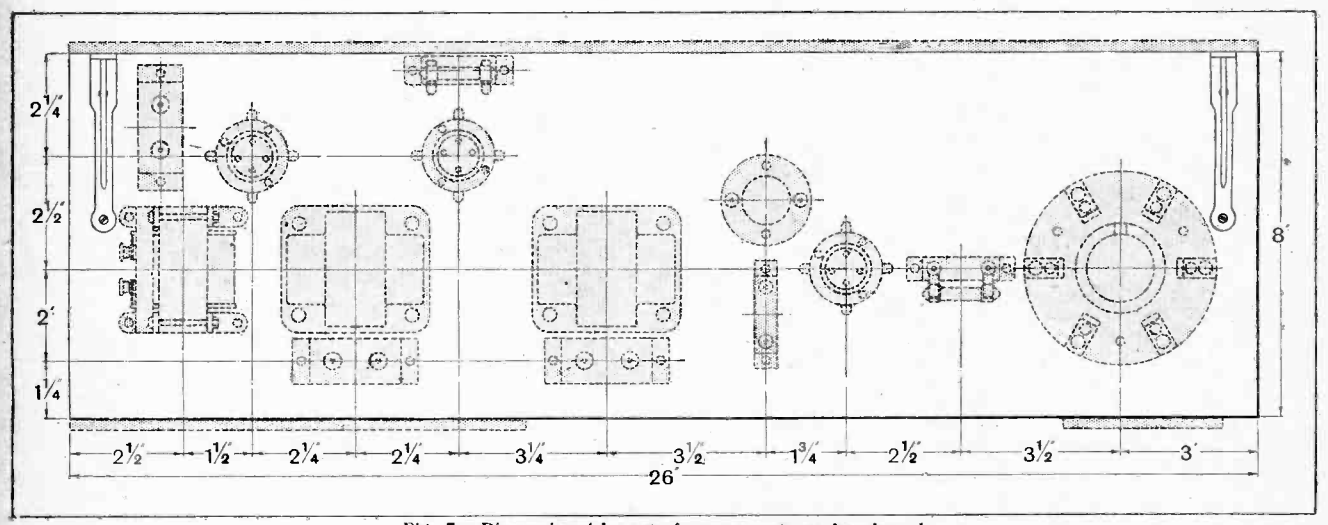

Fig. 7.—Dimensional layout of components on baseboard.

Three-valve Radio-gramophone Receiver.—

If an H.T. eliminator is to be used with the set, and large H.T. values up to 180 volts will be available, the Cosmos A.C. valves will be found excellent in this set, the "Green Spot" for V_1, a "Green Spot" or preferably a "Red Spot" for V_2, and a "Red Spot" for V_3.

Other Accessories.

The choice of the pick-up must be left to the reader—it can only be said that an electromagnetic type will be found more suitable with this set than the electrostatic type.

The H.T. supply should be ample—not less than 140 volts is advised for the amplifiers with about 80-100 volts on the first valve.

If dry batteries must be used, the large capacity type are essential for good quality reproduction for any reasonable length of time. Such batteries as the Siemens' "Super-Radio" will be found to give about nine months' use with this set with an average service of three hours per day.

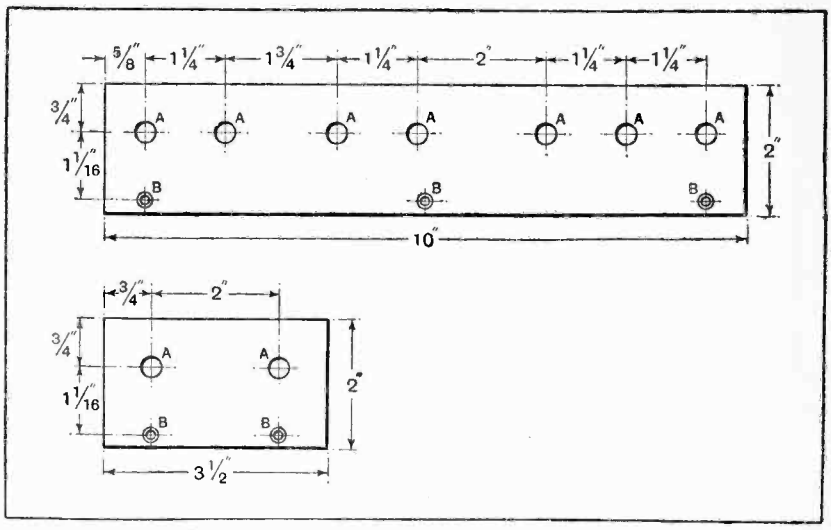

Fig. 8.—Drilling details of terminal strip; A, 5/16in. dia.; B, 1/8in. dia., countersunk for No. 4 wood screws.

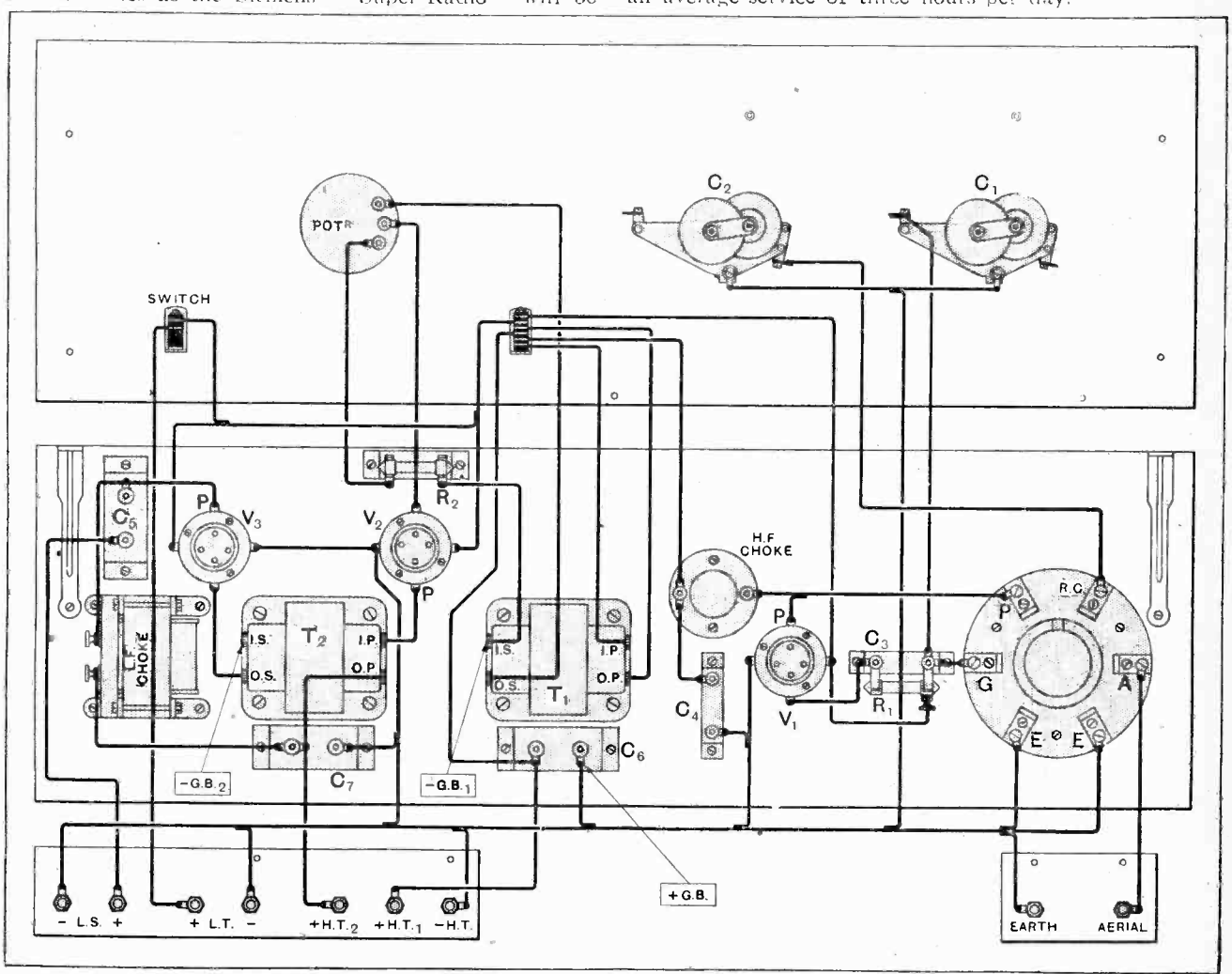

Fig. 9.—Complete wiring diagram; the lettering of the coil holder corresponds with the circuit of Fig. 1.

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The Incompatibles.

Isn't it possible that the two Daventry's are incompatible? The fact that they are both using high power within a few yards of each other is not the obstacle, for there are many stations

B 31

"Drama and the Extraordinary Listener," a tragedy in two lifts by an Undertaker.

Glasgow.

JAN. 18TH.—Italian Instrumental and Vocal Programme.

Belfast.

JAN. 16TH.—An Elgar Programme.

is courting failure?

One person who has formed opinions on the 24-metre wavelength is Dr. A. N. Goldsmith, of the American National Broadcasting Co., who states unequivocally that this wavelength has not shown results which would be necessary to carry on a Transatlantic broadcasting service.

Three-valve Radio-gramophone Receiver.—

H.T. accumulators form another very convenient and efficient source of H.T., but here again it is a great mistake to buy those of very small capacity—cells such as the Exide type W.J. are about the smallest suitable for a 3-valve high-quality set.

switched off on both sides, or H.T. and L.T. may be switched. The current consumption of the relay is under 2 milliamperes, and although the relay winding and the loud-speaker are in parallel with the last valve, the A.C. resistance of the valve is so much lower than the impedance of the relay winding that there is no effect at

Favoured Wavelengths.

It is significant that best short-wave broadcasting of recent times has been carried on with wavelengths of the order of 30 metres and upwards.

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A Promising Debate.

"Need We Envy Our Grandchildren?" is the title of a debate between Mr. Douglas Woodruff and Mr. E. V. Knox ("Evoe" of *Punch*) to be broadcast from 5GB on January 13th. Mrs. Oliver Strachey will be in the chair.

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For the "King's Navee."

There is now included in the Plymouth station programme a weekly broadcast of naval information of particular interest to listeners in a naval seaport. At 9.30 p.m., after the local announcements, every Saturday, information obtained from the Commander-in-Chief, Naval Forces, Plymouth, as to movements of His Majesty's ships is broadcast.

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A Sensible Badge.

The fashioning of a suitable emblem to represent broadcasting is not so easy as one might think. There is the recent example of the B.B.C. coat-of-arms, which may be splendid heraldry but is certainly not a triumph of descriptive art.

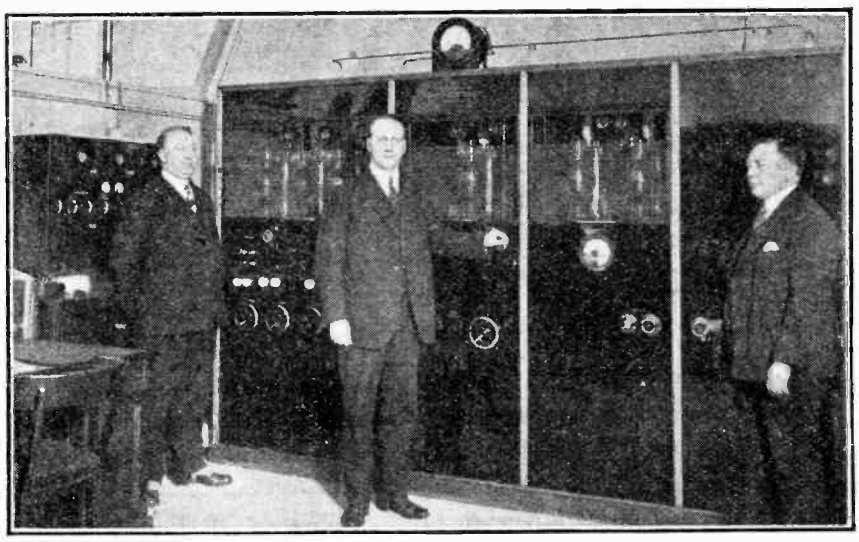
Congratulations are due to the Indian Broadcasting Company, first for producing a new design which omits the inevitable thunderbolt, and, second, for achieving simplicity with something original. The elephant is a familiar figure the representation of which should offend none of the many shades of opinion abounding in India.

INDIA CALLING! A striking emblem adopted by the Indian Broadcasting Company. The elephant's trunk has a logarithmic tendency!

Time by the Dollar.

A rate card for broadcast advertising—by the hour, half-hour, and fifteen minutes—has been issued by the National Broadcasting Company of America. It is interesting to note the different charges for different districts, estimated on the buying capacity of each neighbourhood. For example, if you "sponsor" a programme in New York it will cost you 600 dollars an hour, but if you choose humble Portland, Me., you can occupy the same amount of time for 120 dollars.

In addition to these charges, you have, of course, to supply programme material to fill up the time, and unless this material is good and costly you will waste the whole outlay. That broadcast advertising pays is shown by the fact that the demand for "time in the air" is widespread.



A DANISH TRANSMITTER. Engineers of the Copenhagen Broadcasting Station with the new Pedersen transmitter now undergoing nightly tests between midnight and 1 a.m. It will shortly replace the old transmitting plant, retaining the wavelength of 337 metres.

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The Most Expensive Yet?

What is regarded as the most costly broadcast programme ever transmitted was given from the "Red" and "Pacific Coast" networks of the National Broadcasting Company on January 4th, when an "all-star" programme constituting the Dodge Brothers' "Victory" Hour consumed over 1,000 dollars a minute. Forty-three stations were linked together for this grand "S.B.," and the cost was not diminished by the fact that the Master of the Ceremonies was the celebrated Will Rogers.

Over 12,000 miles of telephone wire were employed.

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A Radio Drama Rumour.

From time to time one hears of a proposal for a special theatre for the production of radio plays. Despite a rumour that the B.B.C. intends to proceed with the idea, I understand that nothing of the sort is likely to be attempted in the near future.

The technique of the radio play is so different from that of the ordinary stage play that it is difficult to see what advantage could be derived from attempting to reproduce ordinary theatre conditions for the broadcast drama. In musical productions a special concert hall might be desirable—but that is another matter.

Arsenal v. West Bromwich.

A running commentary on the second half of the Arsenal *v.* West Bromwich Albion Association football match will be relayed from the Arsenal Football Ground at Highbury on January 14th.

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A Song-writer and His Songs.

Fred E. Weatherly, the veteran song-writer, will take part in a programme to be relayed to 5GB from Birmingham on January 18th. It is entitled "Love and Humour," and old favourite love songs and humorous ballads will be sung by Helen Alston, the lyrics being by Fred E. Weatherly, with appropriate remarks in each case by the writer.

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Mozart's Violin Sonatas.

The "Foundations of Music" series for the week January 9th to January 14th will consist of Mozart's violin sonatas played by Samuel Kutcher (violin) and Reginald Paul (pianoforte).

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News From Copenhagen.

The tendency in favour of placing broadcasting stations outside large towns is not being followed by the Danish broadcasting authorities, who have erected the new Copenhagen station in the centre of the city. The photograph on this page shows the transmitter—an entirely Danish product—which should soon be heard regularly by listeners in this country. The Copenhagen programmes from the older station have recently become familiar to British listeners through the high power station at Kalundborg, working on 1,153 metres.

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Listening to Parliament.

By the way, I hear that Danish listeners will soon be able to enjoy (or endure) the speeches of their leading politicians, as microphones are now being installed for broadcasting purposes in the Danish parliament house.

A BATTERY ELIMINATOR WARNING.

Some Further Notes Arising Out of Recent Correspondence.

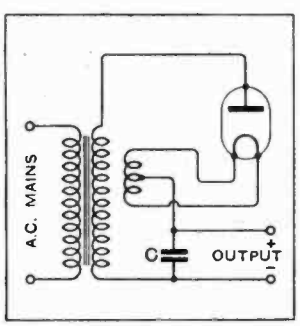
A CERTAIN amount of correspondence has arisen out of a recent note,[1] bearing the title that appears above, and the present article is intended to clear up the points raised by correspondents, and to extend a little the scope of the original note.

One correspondent appears to have gathered that the "warning" was intended to convey that the writer is not in favour of the use of battery eliminators on alternating current mains. The suggestion that this was meant is perhaps best met by stating that the writer's regular receiver for local broadcast is supplied throughout with anode current derived from A.C. mains, and that the installation has given unfailing satisfaction ever since it was first taken into use. Provided that the various components employed in the eliminator are adequate for their work, and that care is taken that they are never subjected to unfair treatment, or, as an alternative to this, that they are able to withstand a heavy temporary overload without sustaining damage, the mains are, in the writer's opinion, by far the most convenient, and certainly the cheapest source of anode current.

Cumulative Condenser Charges.

Another correspondent suggests that the warning given is unnecessary, and that the condensers, in practice, do not break down as a result of running an eliminator without load. The writer was inspired to give publicity to his original note entirely as a result of discovering, by expensive experience, that condensers can and do break down under these conditions, even though they be rated to withstand four times the working voltage. Worse disaster was only averted through the presence of a very light fuse in the primary circuit of the transformer, which, however, did not blow before the plates of the rectifying valves had attained a very bright red heat, representing, at a guess, the dissipation of fifteen to twenty watts in each. This is not very good for the valves.

If reference is made to the diagram, which represents, for simplicity, a half-wave rectifier with no smoothing device other than a condenser, it will be seen how the dangerous voltages can originate.



The unidirectional conductivity of the rectifying valve in a battery eliminator causes successive charges to be trapped in condenser C.

In the first place, it must be realised that when no connection is made to the output terminals the valve-condenser combination forms a veritable "volt-trap," owing to the fact that the valve will pass current in one direction only. When the eliminator is first switched on under these conditions, a current flows into the condenser during the whole of the first voltage half-wave, so charging up the condenser to some fraction of the maximum voltage attained. During the next half-wave the voltage is in the opposite direction, the valve does not conduct, and nothing happens. The third half-wave, in the same direction as the first, causes a current to flow through the valve as soon as the voltage delivered by the transformer rises above the voltage in the condenser. This process continues until finally the condenser is charged up to the highest voltage that the transformer can deliver, even momentarily. This is the "peak" voltage, and is nearly one-and-a-half times the nominal R.M.S. voltage rating of the transformer, which is in turn decidedly higher than the normal working voltage of the eliminator.

If the current through the primary is now broken suddenly at a moment when the current flowing is at or near its maximum, a very high voltage indeed will be momentarily developed across the secondary. If this voltage should happen to be in the right direction to drive a current through the valve (which will always be the case with a full-wave rectifier) the condenser will be charged to a voltage even higher than the peak voltage. The voltage actually attained will depend on several factors, of which the volume of the transformer core and the capacity of the condenser are the most important.

This additional voltage will, barring leakage, be retained indefinitely in the condenser. Although, as one correspondent remarked, no further voltage is likely to be passed into the condenser at the moment of switching the eliminator on again, owing to the slowness with which the rectifying valves light up, yet every time it is switched off the voltage "kick" will recur, and the condenser will receive a further charge. If it is switched on and off half a dozen times, as may easily happen in endeavouring to locate some fault, it is only too possible to attain in this way a voltage very far indeed above that for which the condenser was designed.

Voltage Due to Back E.M.F.

Some rough idea of the possible magnitude of the voltage "kick" may be gathered from the fact that if a neon lamp be connected to the secondary of an ordinary L.F. transformer, and a 6-volt accumulator be connected to the primary, then, when the primary circuit is broken, the lamp will light brightly, despite the high resistance of the circuit in which it is connected. The minimum voltage required to light a neon lamp is about 170 volts, so that it will be seen that the same effect derived, not from a 6-volt accumulator, but from the mains, may give momentary voltages running into thousands of volts.

If a high resistance is connected across the output terminals of the eliminator, a small current will always be drawn as long as there remains any charge in the condenser, so that the maximum voltage that can be attained is reduced to a figure that will probably be less than the peak voltage of the transformer secondary. Thus this

[1] *The Wireless World*, November 16th, 1927, page 672.

A Battery Eliminator Warning.—

simple device acts as a complete safeguard against the development of these excess voltages. In addition, it ensures that the condensers shall not hold their charge after the eliminator is switched off, so that no possibility of obtaining shocks from charged condensers can remain. Ten microfarads even, charged up only to two hundred volts, can deliver a decidedly unpleasant shock, and it is well worth while to add the resistance if only to ensure that the eliminator speedily becomes "dead" after switching it off.

In order that the extra current drawn by this resistance shall not pass through the smoothing chokes, and so lessen their inductance, it will be advisable, if convenient, to connect it next to the rectifying valves, where it will, of course, be equally effective.

It was recommended in the writer's original note that, if the resistance is not present, the eliminator should be switched off while the valves of the receiver are still alight. A correspondent suggests that this would only transfer the danger, in another form, to the set itself, causing transformer primaries and chokes to "burn out" through the sudden voltages developed through the sudden cessation of plate current. While the cutting of a high-tension circuit when H.T. batteries or accumulators are in use is certainly likely to be dangerous, in the case of an eliminator it will be fairly harmless, for the condensers in the eliminator have capacity enough to ensure that the plate current shall die away gradually as the condensers discharge. However, any slight risk there may be can be removed entirely by fitting the safety resistance to the eliminator, when it will be quite in order to switch off the set first.

The value of the resistance may conveniently be such that it takes about one-tenth of the load current. For the average eliminator, delivering perhaps 30 milliamps. at 180 volts, a 50,000-ohm resistance will be convenient, and a wire-wound anode resistance of first-class make may be employed. For a larger instrument, delivering up to 100 milliamps., at 350 to 400 volts for supplying power valves such as L.S.5A's, 15,000 ohms will be more suitable, and a special type of resistance will have to be obtained. But the value of the resistance is not in the least critical.

A. L. M. S.

COIL CALCULATIONS.

Useful Curves for Calculating Optimum Dimensions of 200 and 325 Microhenry Coils.

IN two issues of *The Wireless World*[1] in Vol. XIX very valuable and complete theoretical and experimental data were given for designing inductance coils or for calculating the high-frequency resistance of an existing coil, together with typical examples of the method of using the information. Even so it is to be feared that the matter available would appeal more to the mathematician than the average constructor, and it is thought that in certain definite cases a portion of the information might be so presented in graphical form as to show at a glance the particulars of a series of "best possible" solid wire coils.

Optimum Winding Length.

Investigation shows that if definite values are assumed for the inductance and overall diameter of a coil, there is a corresponding set of particulars which gives a coil whose calculated H.F. resistance is a minimum. The two values of inductance considered were 200 μH and 325 μH, which when used in conjunction with condensers of 0.0005 mfd. and 0.0003 mfd. respectively in parallel, tune over the normal broadcast band of wavelengths. It was found that, for every diameter considered, the optimum winding length was 8-15 of the diameter of coil, this relation holding until a point is reached when there is only just sufficient room to accommodate the necessary number of turns. The frequency used as a basis of calculation was 10^6 cycles, corresponding to a wavelength of 300 metres, and for each case worked out the high-frequency resistance and magnification factor $\left(\frac{2\pi fL}{R}\right)$ were calculated at this frequency.

[1] December 8th, and 15th, 1926.

The results obtained have been plotted in graphical form on the page opposite and show, for coils of the two inductances chosen, the correct number of turns and diameter of wire for any size of coil between 3in. and 6in. diameter. The appropriate standard gauges are marked on the curve of optimum diameter of wire. For diameters of coil which give intermediate sizes of wire the nearest standard gauge may be chosen without increasing unduly the high-frequency resistance of the coil. In most cases it will be found that the optimum winding length provides more than ample space for D.C.C. wire of the appropriate gauge, but it is important that the stated winding length should be adhered to, otherwise both the inductance and high-frequency resistance will be increased. Example :—

Inductance 200μH ; overall diameter 5in.

Winding length $= \frac{8}{15} \times 5 = 2.67$in.

No. of turns = 39.

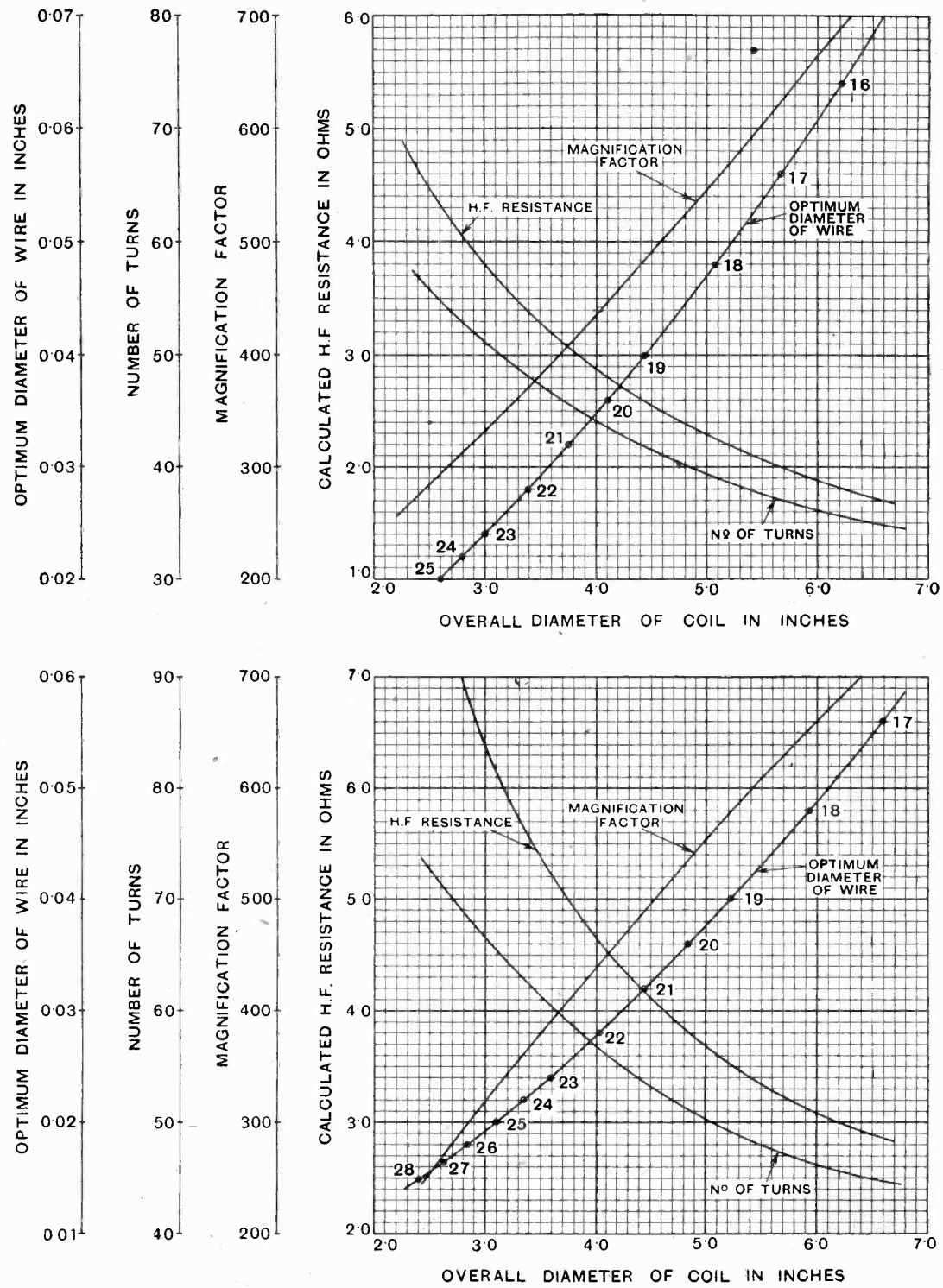
Gauge of wire = 18.

H.F. resistance = 2.3 ohms.

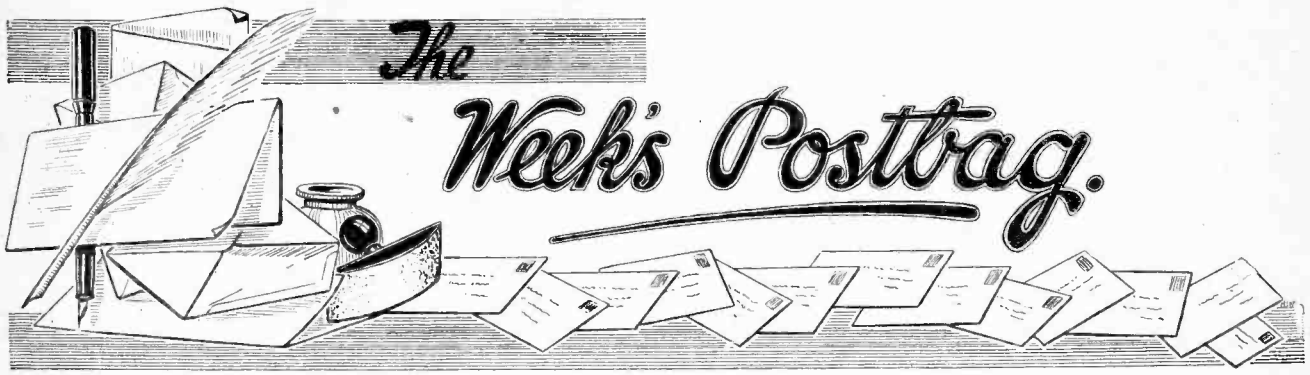
Magnification factor = 545.

It is of interest to note that a 3in. coil closely wound with 55 turns of 27/42 Litz, and having an inductance of 200μH, has a calculated magnification factor of almost 500, and that this figure can be attained by using a 4½in. solid wire coil of proper design. The increase in size is not sufficient to involve much difficulty in accommodation, and the saving in cost is so considerable that it is felt that the information given in this article will be of much value to those who do not care to indulge in the luxury of stranded wire.

F. J. A. P.



Design data for 200-microhenry coils (upper set of curves) and 325-microhenry coils (lower set of curves). The winding length for both sets of curves is $\frac{8}{15}$ × diameter.



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

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

EMPIRE SHORT-WAVE TRANSMITTER.

Sir,—So far as one can judge from the various and contradictory statements appearing in the home technical Press—I am a subscriber to three of your contemporaries in addition to the "W.W."—this transmitter seems likely to begin to function about the Greek Kalendes, unless it is working at such hours as make reception here at normal times impossible. This seems hardly likely unless it is being used for transmission to India and Oceania only.

If this is the case, it would be interesting to know why.

The unfortunate impression created by the rubbish given to the Press by the B.B.C. authorities, technical and otherwise, is still too fresh in our minds to give us any confidence in even the good faith of the B.B.C. on the subject.

The only activities we hear of all seem to refer to the reception of overseas programmes for broadcasting in the U.K. This has nothing to do with a B.B.C. short-wave transmitter and it is devoutly to be hoped that it will never be used for such a purpose if and when it does work.

It ought to be fairly easy for the B.B.C. to understand that the Dominions do not want to swop programmes *via* England, and that the Crown Colonies do not want to listen to Dominion programmes *via* England in any case. Both the Dominions and Crown Colonies, or rather their inhabitants, can and do get these programmes direct, in spite of the statements of the Chief Engineer to the B.B.C. to the contrary. He apparently made the mistake of thinking his own inability to capture these transmissions was shared by countless amateurs at home and in the Empire generally.

What we want are the 5GB programmes with those from 2LO and 5XX when giving opera, symphony concerts, and those Sunday evenings from Eastbourne. You see, I spend six months in England and France and six months out here every year, so know what I am talking about in the matter of programmes.

Another grievance we have is as to the secrecy about this transmitter. If genuine efforts are being made to get it going why not say so. It takes just 23 days for any news from home to reach this spot, and there must be many others in the Empire where the quickest time for news to reach them from home—except by wireless from short-wave transmitters—is nearer 45 days. It is not easy to understand why we should not be allowed to have the chance of picking up transmissions from the start, which will certainly be improbable unless the B.B.C. will get WGY to announce the fact a week before transmissions start. We should all know all about it in that case, but what a humiliating position for all concerned!

I get 2XAF here at the same strength as with the same set I get 2LO in Sussex, and last week I picked up what appeared to be experimental transmissions on two consecutive afternoons—in daylight—from the "Kurt Wellen Sender" at Nanen. Speech was as clear and as strong as the news from Stuttgart in Sussex or the Somme. PCJJ was also excellent before we shut down, and it is to be hoped that the move to Hilversum will not have upset either the strength or quality of the transmissions, with the delightful prospect of getting the Hilversum afternoon and evening programmes added.

When will it be possible to tell the native village that congregates round my bungalow to listen to the "singing wireless" something other than "The reason why you cannot hear anything from England is that the bosses who control wireless in England either do not wish you to hear or don't know how to send the music to you"? G. LLH. II.

11° N.

December 6th, 1927.

EXPONENTIAL HORN.

Sir,—I have made an exponential horn according to the directions in the November 11th and 23rd numbers of *The Wireless World*. It may be useful to some of your readers to know that cardboard sheets as large as 72in. by 36in. can be obtained, so that the horn can be made in one piece per side. I obtained flexible sheets of this size, of Presspahn, with a polished surface about 0.024in. in thickness, from Messrs. Spicer Bros., New Bridge Street, E.C.4. By making a flange at each corner of an inch wide stiffening ribs are formed the length of the horn, and it requires no other supports. READER SINCE No. 1 "MARCONIGRAPH."

Flax Bourton.

January 1, 1928.

GRAMOPHONE TRANSMISSION.

Sir,—I am interested in your criticism of gramophone transmission in "Broadcast Brevities" in your issue of November 16th. I am not going to dispute your contention, but it reminded me of a transmission I heard recently which impressed me very much.

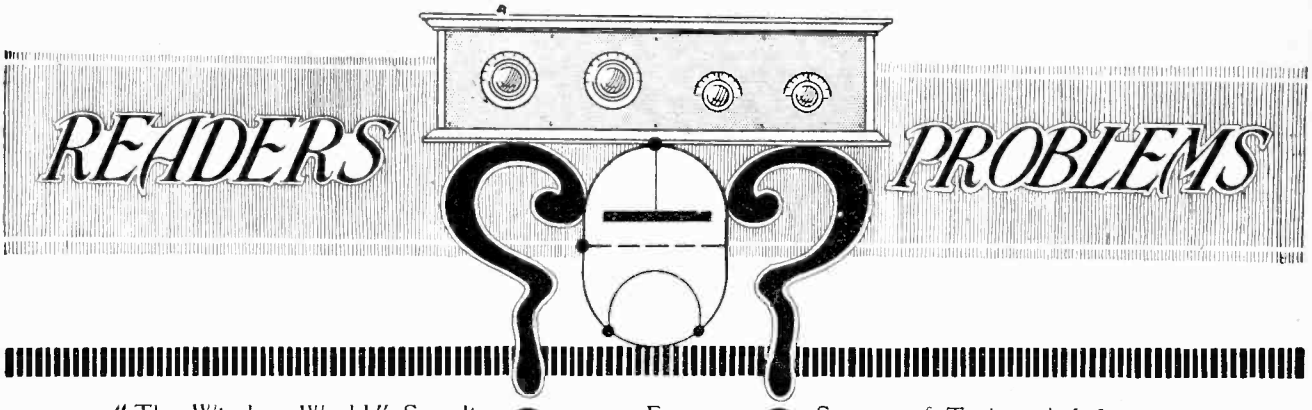
I refer to a test transmission sent out by 2XAD on 22 metres for the benefit of PCJJ on November 18th. It was the most perfect short-wave telephony transmission to which I have listened. After noticing the considerable "background" during the announcements in contrast to the musical items I tumbled to the fact that a gramophone was being used.

I am not suggesting that the gramophone alone was responsible for this extraordinary transmission. I would plead, however, that a good gramophone is by no means the weakest link in "music by wireless."

I should also be interested to hear what any of your readers in other parts of the world thought of that particular transmission. As you have probably gathered, I am still lost in wonderment. G. A. MOUNTAIN.

N. Nigeria.

December 12th, 1927.



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

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

Choosing Transformers.

I am constructing the "Two H.F. Everyman" receiver, described in your issues of October 26th and November 2nd, 1927. Can you tell me whether it is absolutely essential to adhere rigidly to the types of L.F. and output transformers used, as I have others in my possession which I do not wish to waste. I do not wish to depart from the author's specifications in this matter if it will affect the working of the set. T. R. A.

With regard to the L.F. transformer, you can, of course, substitute in place of this any good make of L.F. transformer, but you would be advised to shunt the primary with a 0.0003 mfd. condenser. This is not necessary in the case of the original instrument used, as such a condenser is already built into the transformer. If you have the choice of several transformers of different ratios by the same maker, we should advise you to choose the lowest ratio as in the case of most reputable manufacturers the low ratio indicates a primary of high inductance, which, as you know, makes for better reproduction of the lower musical tones. With regard to the output transformer, you may, of course, substitute any other properly designed output instrument.

o o o o

Using a Pick-up.

I constructed the special power amplifier described by you in your issue of March 31st, 1926, and I use this with great success after a long-range wireless receiver. I now desire to use it in conjunction with a gramophone pick-up and shall be glad if you will tell me the necessary modifications I must make to it in order to do this. R. D. G. R.

No modifications whatever are required in order to enable this amplifier to be used with a gramophone pick-up. All you need do is to connect the gramophone pick-up direct to the input terminals of the gramophone. This will have the effect of shunting the pick-up device across the tapped anode resistance. You will then be able to use the tapped anode resistance as a volume control just as you do when using the amplifier after a wireless receiver. You need not be afraid that the fact of the resistance being in shunt with the pick-up will cause any trouble.

o o o o

A Question of Temperature.

Can you tell me the resistance of a 240-volt 60-watt lamp? T. H. B.

To find the resistance of a conductor such for instance, as the filament of a lamp, we must by Ohm's law first know the voltage across the conductor, and the current flowing through it. The data we have is the voltage and the wattage. Now wattage equals voltage multiplied by current; therefore, we get the simple equation of $60 = 240 \times I$. From this, it is obvious that the value of I is $\frac{1}{4}$ ampere, since all our measurements are made in watts, volts, ohms and amperes. Ohm's law for finding the resistance is $R = \frac{E}{I}$ where R = the resistance in ohms, E = the voltage, and I = the current in amperes. By substitution we find that $R = \frac{240}{\frac{1}{4}}$ which gives us the value of 960 ohms as the resistance of our lamp.

It should be carefully noted, however, that this value of filament resistance only holds good when the lamp is burning at normal brilliancy, and if burned so that it only just glows red the resistance of the filament will be greatly altered, as the actual resistance of a conductor depends upon its temperature. Thus, if we reduce our voltage to 120 we should not necessarily halve the current, and, therefore, the wattage, because the value of the resistance in the circuit will have changed. This does not alter Ohm's law, since that law, of course, assumes that the value of resistance is definitely known, and if we measured the resistance of the filament when it was only glowing dull red, Ohm's law would again apply. This is a very important point to bear in mind when choosing lamps for use in such devices as battery eliminators.

o o o o

Charging H.T. Accumulators.

I have an H.T. accumulator consisting of a number of 20-volt units. Can I charge them from the "arc valve" charger described in your issue of October 5th. I should, of course, connect them in parallel. W. B. R. T.

It is quite impossible to charge your 20-volt units from this charger. In the case of many of these 20-volt units, however, they can be divided into 10-volt units, and if a number of 10-volt units are paralleled, it is possible to charge them in this manner.

RULES.

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

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

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

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

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

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

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

A "South Kensington" Set.

I have been reading with great interest the article on combining the gramophone with the wireless receiver which was published in your November 2nd issue. However, I wish to build something more elaborate, expense being no object. Can you tell me where I can obtain these details? T. L.

We would refer you to our issue of January 26th, 1927, where you will find full constructional details of a combined gramophone and wireless outfit, which is based on the design of the well-known instrument installed at the South Kensington Science Museum.

o o o o

A Cheap Battery Eliminator.

I have constructed the inexpensive H.T. battery Trickle Charger for A.C. mains which was described in your August 3rd issue. Would it be possible for me to add a simple and cheap filter circuit and use it as a battery eliminator? If so, will you indicate to me the necessary procedure? R. F. D.

It is quite possible to add a simple filter circuit to this charger and use it as an eliminator as you propose, but since the A.C. mains will be used directly connected to the set without the interposing of any transformer, certain precautions will have to be taken. You will have either to completely abandon the earth connection on your receiver, and use the mains earth for your earthing system, or alternatively, you will have to use a loose-coupled aerial circuit with an ordinary earth. This latter procedure should be quite simple enough in the case of most modern receivers, such, for instance, as the "Everyman-Four." Thus, in the case of this latter receiver, you would merely have to remove the wire which runs from the earth terminal of the set to the screen, and in the case of most sets of this type, it would merely mean removing the wire connecting the earth terminal to the L.T.– busbar.

We give in Fig. 1 two circuits of a suitable filter unit which you could make up and attach to the charger without in any way altering the charger or impairing its functions as a charger when so required. Fig. 1 (a) is the simplest system, and all you would have to do is to connect the + and – input terminals to the + and – terminals of the charger which are marked "set." This would give you only one H.T. tapping, and in the case of 240-volt mains would mean that you were using an excessive H.T. voltage, although it would be adequate in the case of 110-volt mains. This smoothing unit could be made up for about 30s. In Fig. 1 (b) two H.T. tappings are given, and obviously, you can tap off any value of voltage you require, provided that you purchase a suitable potential divider. A reliable instrument of this type can be obtained for as low as 5s. If any extra smoothing is required, an additional choke may be connected between the points A and B in both units.

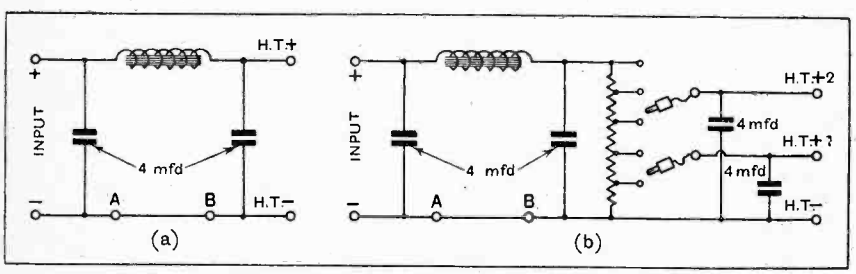


Fig. 1.—Smoothing circuit and potential divider for use with the "A.C. Trickle Charger."

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A Charger Question.

Can the H.T. Trickle Charger, described in your August 3rd issue, be modified so that it will "trickle charge" a small 2-volt L.T. accumulator, and if so will you give me the necessary information how to modify it? D. E.

It is quite impossible to modify this charger for the purpose you name. The normal charging rate of the instrument was only 20 milliamperes, and this could not be greatly increased, and naturally such a low rate is of little use for an L.T. accumulator even if there were no other difficulties. We advise you to construct the L.T. battery charger described in our issue dated October 5th, 1927.

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A Question of Quality.

I have a three-valve receiver consisting of a leaky-grid detector with reaction, and two transformer-coupled L.F. stages, and use a super-power valve in the last stage. Quality on all stations at moderate distance is very good, but not so on the local station, although a milliammeter in the plate circuit of the last valve does not indicate very serious overload of this valve. Can you tell me how to remedy this fault? I might state that I use a 5-megohm grid leak and find this gives considerably greater sensitivity. R. L.

We are of opinion that your trouble lies in the use of this large value of grid leak, which does much to mar quality on your local station, and we should advise you to substitute for it one of considerably lower value when receiving on the local station, as on this station you can afford to sacrifice a great deal of sensitivity and gain extra quality. We think it would be better if you provided yourself with a separate low value leak for use on the local station rather than to attempt to make use of a variable grid leak.

o o o o

Hand Capacity Effects.

I have a three-valve receiver, 0-v-2, incorporating capacity control of reaction, and find that when the reaction is adjusted to the most sensitive point the receiver goes into oscillation as soon as I take my hand off the dial. Can you suggest any means of overcoming this effect? A. W.

The alteration in the state of your receiver when the hand is removed from the dial would indicate that the reaction condenser is at high potential with reference to the earth. This is brought about, no doubt, by connecting one side

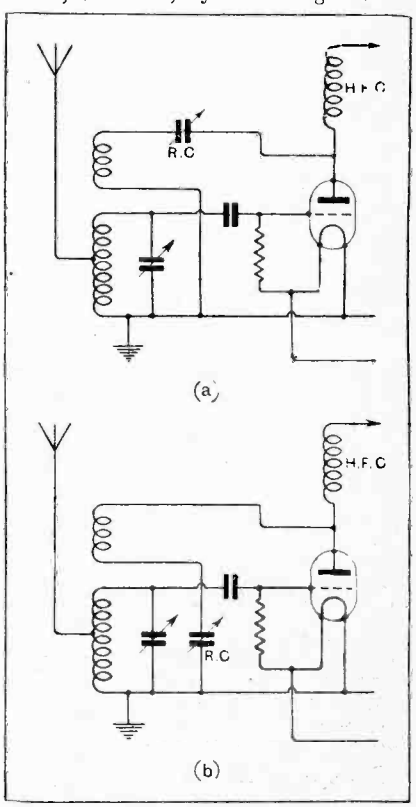

Fig. 2.—Reaction condenser connections; the arrangement in circuit (b) avoids hand capacity effects.

of the condenser to the anode of the detector valve, whereas we usually recommend that this should be so arranged that the moving vanes are connected to negative filament. By referring to Fig. 2 (*a*) the incorrect position for this control will be seen, and in Fig. 2 (*b*) the same circuit has been redrawn with the condenser in the correct position. To overcome hand capacity effects the moving vanes of the variable condensers should be connected to a point of low potential, and in certain cases an earthed screening plate behind the panel, to which the condensers are attached, will be found advisable. However, in the majority of cases the circuit Fig. 2 (*b*) will be practically free from this undesirable effect.

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CHEAPER VALVES?

WE hope that our readers will not permit themselves to jump to the conclusion that cheaper valves are in sight, as the result of having read certain Press reports of what is announced as a new discovery which will lead to a much cheaper process for exhausting the air in the manufacture of valves than that at present employed.

In pumping valves to obtain the high degree of vacuum which is necessary to ensure stable working and long life it is essential to keep the mercury vapour from the pumps employed from getting to the valves. This is normally done in modern valve manufacture by means of a liquid air trap.

Origin of the Report.

The recent announcement of the prospect of cheaper valves made in the daily Press owes its origin to a demonstration by Dr. G. I. Finch, at the recent Exhibition of the Physical Society and the Optical Society in London, when, according to the report, his apparatus was described by Dr. Finch as an improved mercury vapour trap, the liquid used being an alloy of potassium and sodium.

Some time ago an article was published by Dr. Ll. Hughes in *The Philosophical Magazine* (August, 1925) announcing the discovery that a trap of sodium and potassium alloy would act just as well as a liquid air trap for collecting mercury vapour. This result has, therefore, been known for two years to workers interested in vacuum technique.

Too Optimistic.

It is possible that Dr. Finch has improved this device, but the fundamental discovery is undoubtedly due to Dr. Ll. Hughes. In any case, now that liquid air, which appears to serve the purpose adequately, can be manufactured so cheaply, often by the valve manufacturers in their own works, it is difficult to see how there is any possibility that even an improvement in the method where sodium and potassium alloy is employed, can cheapen the production of wireless valves and electric lamps as suggested.

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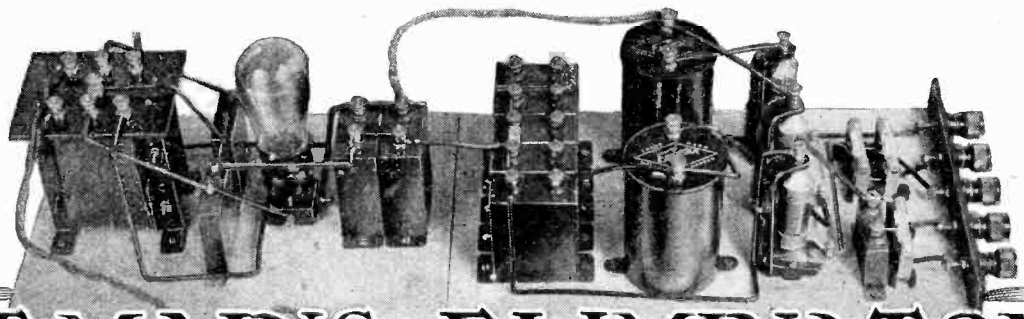
GROUSES FOR 1928.

A READER who writes to us in the Correspondence Columns of this issue asks "Why not start the year well with something other than a grouse?" and he details a list of some of the good things which have come our way in the past year, and is kind enough to suggest that we have to thank the columns of *The Wireless World* for some, if not all, of these.

We like the spirit of thanksgiving which has prompted the writing of the letter, but we do not recommend to our readers the hint conveyed that we should give up grousing in 1928. There always have been, and probably always will be, things in the world of wireless which require to be put right. Some are just common grievances of the individual, but many of them are important enough to affect the interests of our readers collectively, whilst there are yet others which may not appear at first to be of real importance to any section of the community, but which may nevertheless rank as matters of principle which call for remedy. As an example, one may take the establishment of a station for Empire broadcasting. Here one may say that no great hardship was suffered by any section of the community through the neglect of any attempt to establish such a service, but nevertheless it was a matter of national importance, and we believe that our efforts contributed in no small way towards bringing about the establishment of the experimental station at Chelmsford, which we hope is to be the forerunner of an Empire system.

We trust that our readers will not hesitate to bring to our notice grouses for 1928 as they did so effectively in 1927; we will do our part in assisting to eliminate the causes as far as it is in our power to do so.



H.T. MAINS ELIMINATORS

Specially Designed for "Everyman Four" Receivers

By W. JAMES.

THE "Everyman Four" receiver was designed for valves having certain definite electrical characteristics. These were specified in the original article, and a good deal of trouble was taken to explain why valves of particular types had to be used for the best results. A user's failure to employ valves of the correct types has the effect of impairing the set's selectivity, reducing volume, and modifying the quality or fidelity, as compared with the original receiver.

It was emphasised that a high-tension voltage of 150 or 160 should preferably be used for all valves except, of course, the detector, which has to be supplied with approximately 90 volts. The first three valves of the receiver take a relatively small amount of high-tension current; it is the last valve that takes an anode current of several milliamperes. This was one of the reasons why a valve of the D.E.5 class was recommended for the output stage, for then the total current taken from a high-tension battery of 160 volts is 10 milliamperes. This current is well within the economical discharge rate of a large type dry battery.

But many listeners have found dry batteries not to be a too economical source of high-tension current, even when the discharge is normally only 10 milliamperes. Further, with the more general adoption of better class loudspeakers and the desire for considerable volume, a number of users have fitted a valve of the low impedance type in the output stage. Such a valve with appropriate grid bias and a high-tension voltage of 160, takes an anode current of 14 milliamperes, making the total anode current 18 milliamperes for the set. Dry batteries of the ordinary type

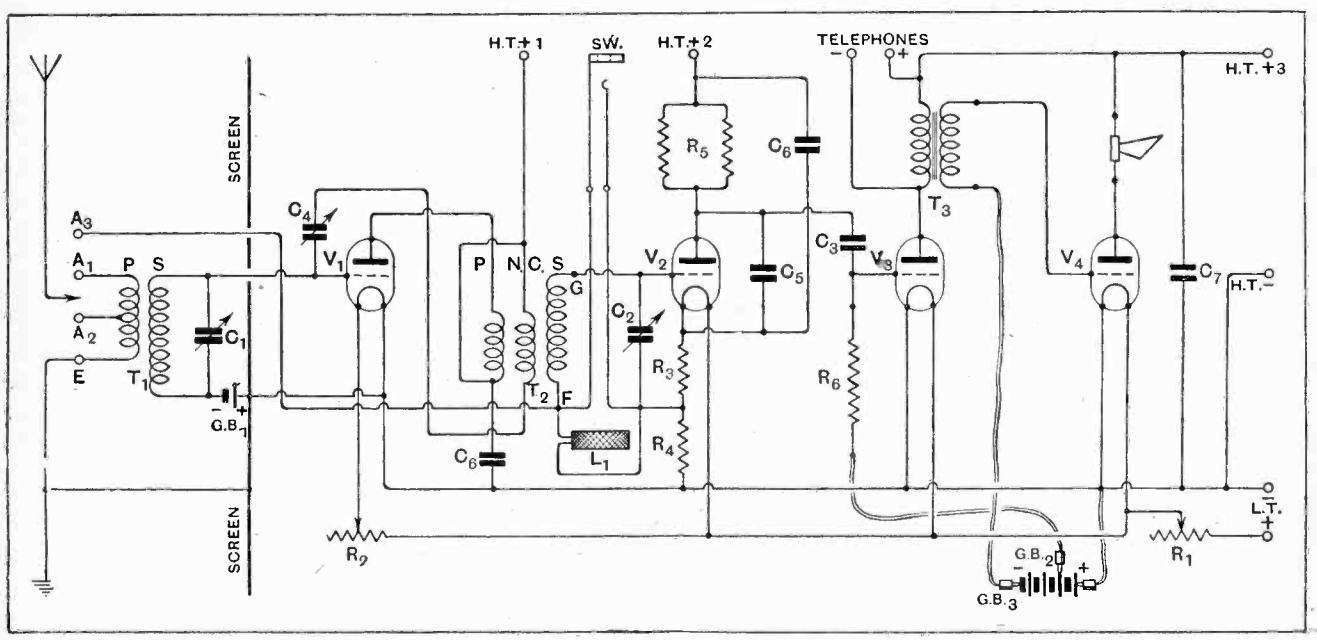


Fig. 1.—The "Everyman Four" receiver.

H.T. Mains Eliminators.—

will not supply so heavy a current as this for very long, and even a large capacity battery will last only for six or seven months. A number of users are therefore inquiring as to whether the high-tension current can be derived from direct or alternating current house mains in a manner which is both inexpensive as to first cost and to run. A number of experiments have been made with different supplies of electricity, and it has been found possible to construct eliminators that give complete satisfaction for use with direct or alternating current mains at low cost. The experiments brought out quite a number of interesting points, and an account of them will be helpful to the reader who proposes to build an eliminator of the most economical type for himself.

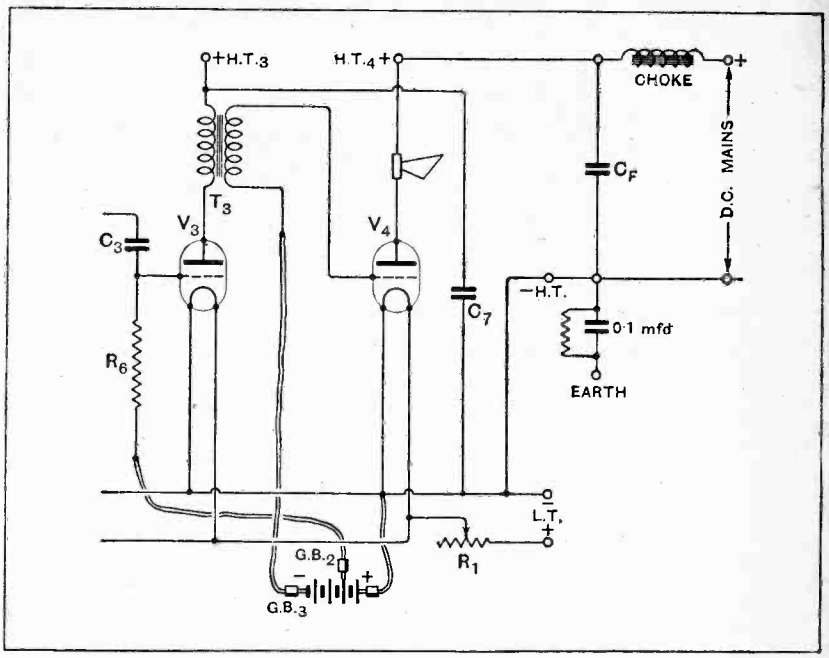


Fig. 2.—The last two valves of the "Everyman Four" with a filter showing how current may be supplied to the last valve from D.C. mains.

Eliminators and "Motor Boating."

It was soon found that the low-frequency circuits of an "Everyman Four" tended to oscillate when supplied from a high impedance source, a popping sound being emitted by the loud-speaker, while of course the quality was bad. Reversing the primary or the secondary winding of the intervalve transformer (but not both) reduces the tendency of the receiver to "motor boat" (the popular name given to the popping noise just referred to). The effect of reducing the value of the coupling condenser between the anode of the detector and the grid of the first valve was also to reduce the tendency of the set to "motor boat." The reader is advised not to interfere with the coupling condenser, however; he may reverse the leads to the primary or secondary of the intervalve transformer if he so desires, without changing the amplification frequency characteristics of the stage by more than a very slight amount.

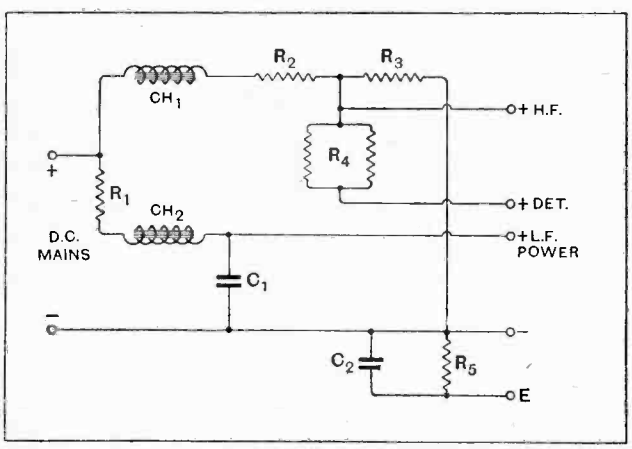


Fig. 3.—An eliminator for attachment to direct current mains for the "Everyman Four" receiver. Resistance R_1 may be of 5000 ohms when the mains voltage is 240 and the full amount is not required across the L.F. and power valves. Values for resistances R_2 and R_3 are given in the text. R_4 comprises two 0.5 megohm resistances in parallel, and R_5 is of 0.25 megohm.

Realising that it is the coupling of the various circuits through the common impedance of a high-tension battery or eliminator that causes the trouble, experimenters may care to try the simple arrangement of Fig. 2. This is satisfactory when direct current mains of a suitable voltage are available. With this arrangement it is intended that a dry battery be used to supply high tension for the first three valves of the set, and that the power valve, which is the one taking the most current and requiring a really high anode voltage, be connected to the mains.

The connections of an "Everyman Four" receiver are given in Fig. 1. Fig. 2 shows the last two valves of the set, and it should be noticed that the third valve only is connected to the terminal +H.T.3. The last valve is connected through the loud-speaker (or loud-speaker transformer, or filter circuit) to the positive terminal of a filter connected to the D.C. mains.

The positive and negative terminals of the filter have to be connected to the mains and a choke inserted as indicated with a by-pass condenser C_F. An additional condenser of 0.1 mfd. is also connected to a terminal marked "earth," and the earth on the wireless set must be connected to this terminal. The capacity of the condensers used at C_F should be at least 6 mfd., and the choking coil can be one having an inductance of 10 or 20 henries, with a low D.C. resistance such as three or four hundred ohms, or even 500 ohms. This simple filter will eliminate mains hum in most districts. The reader is therefore advised to connect the choke as indicated, and to connect three 2-mfd. condensers together, making a total of 6 mfd. for the filter condenser. Additional smoothing may have to be provided when the mains current is very rough. First of all, try the effect of connecting the choke in the negative lead, and secondly, connect a further 2-mfd. condenser. When the mains are very bad indeed it may be necessary to use two choke coils and 10 mfd. of capacity, one choke coil being

H.T. Mains Eliminators.—

connected in each wire from the mains. In the majority of instances one choking coil and 6 mfd. will suffice. But as mains vary so greatly in their characteristics, the reader will have to experiment a little for himself. This seems to the writer to be the best procedure. It would be easy for him to give values for a filter that would suit all mains, but this would be unnecessarily expensive in the majority of instances, and the reader who conducts the experiments just described cannot fail to find a satisfactory arrangement for his own particular circuit.

D.C. Eliminator with an A.C. Attachment.

The arrangement described is, of course, for direct current mains only, and preferably for mains having a

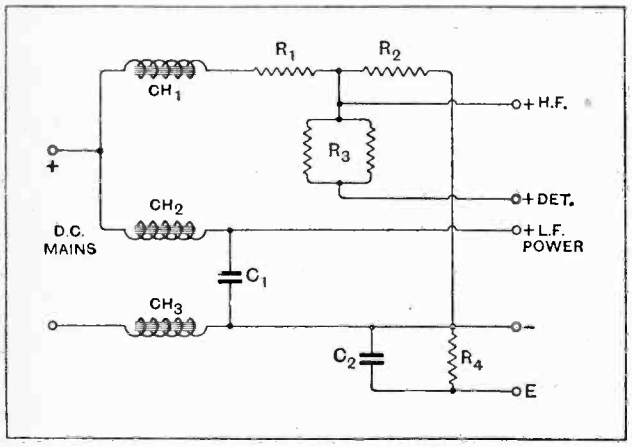


Fig. 4.—When the mains are very rough an additional choking coil may have to be connected as shown at CH_3.

voltage of 200 or more. The reader must, of course, not fail to remember that practically the full voltage is applied to the receiver, and the last valve must be biassed accordingly.

It is very easy to connect a rectifier to the input of the filter in Fig. 2, in order that an alternating current supply may be used. Such a rectifier is shown in Fig. 5. It comprises a transformer having three windings, a full-wave rectifying valve, and filter condensers. The transformer has a primary winding P suited to the voltage and periodicity of the mains. Winding S_2 is for heating the filament of the rectifying valve, and winding S_1 for supplying high-tension current to the two anodes. Across the two halves of the high-tension winding condensers C_1 of 0.1 mfd. each are connected, and the centre

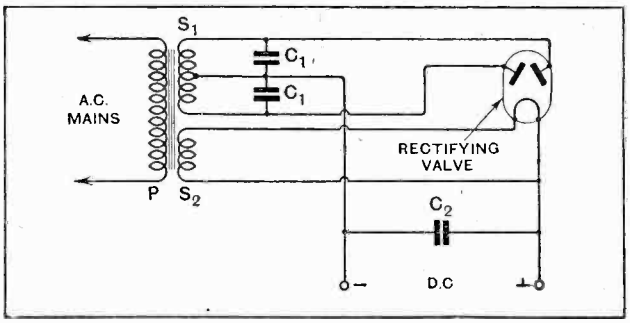


Fig. 5.—A rectifying unit. Condensers C_1 are of 0.1 mfd. each, and C_2 of 4 mfd.

point is joined to the negative direct current terminal. The positive terminal is connected to the filament. Across the direct current terminals is a condenser C_2 of 4 mfd. These terminals are joined to those marked D.C. mains in Fig. 2, but the shunted 0.1 mfd. condenser and the "earth" terminal of Fig. 2 are not required. When a rectifier is connected to the filter of Fig. 2, the capacity of C_F may be 6 mfd. and the choke of 10 or more henries, having a resistance of about 500 ohms. Further details of the rectifier are given below.

A complete high-tension eliminator is, of course, more expensive to make than the eliminator for the power valve just described. We will deal with apparatus for use with direct current mains first. The "Everyman Four" receiver has three positive high-tension terminals, for the H.F., detector, and the L.F. stages. A voltage of 120 to 160 is required for the high-frequency stage, a voltage of about 90 for the detector, and the highest possible voltage for the last two stages. Our eliminator must, therefore, be so arranged that it will give these outputs and eliminate all hum and noise.

Additional circuits were therefore added to the filter of Fig. 2, as shown in Fig. 3. From the positive terminal on the mains side a resistance R_1 in series with choke CH_2 is connected to the output positive terminal, and condenser C_1 is connected across the positive and negative terminal. Except for the resistance R_1, this part of

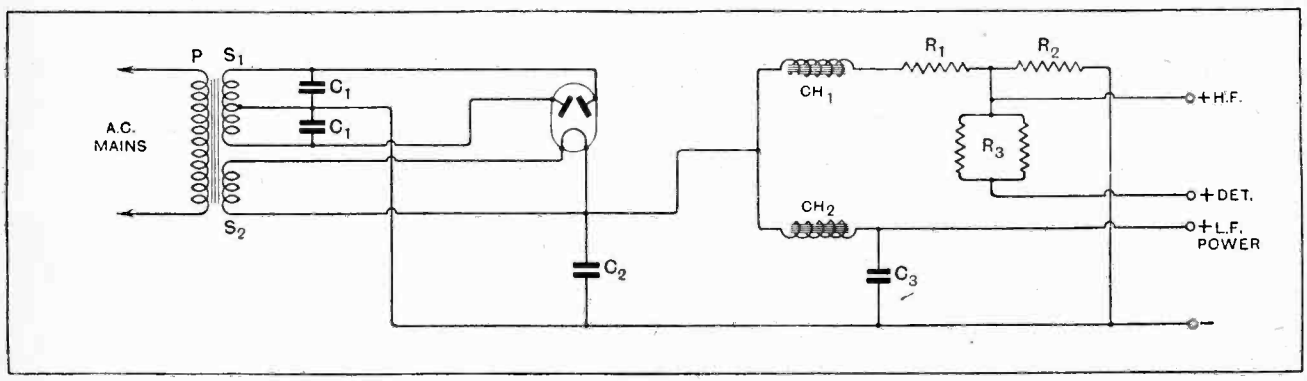


Fig. 6.—Connections of the complete eliminator for working off A.C. mains.

H.T. Mains Eliminators.—

Fig. 3 is the same as the circuit of Fig. 2. Resistance R_1 is included in this diagram to show how the voltage of the mains may be reduced to a convenient value if desired. Thus, supposing the mains voltage is 240, and the last two valves of the receiver take a current under normal conditions of 15 mA. at 160 volts. This leaves 80 volts to be dropped across the resistance whose value should therefore be 80,000 divided by 15, or 5,300 ohms. A resistance of 5,000 ohms, which is a stock value, is satisfactory. This resistance is usually not required when a valve of the L.S.5 or L.S.5a type is used in the last stage; even when the last valve is an ordinary D.E.5a, this resistance need not be used unless the user feels that his loud-speaker will not stand the relatively heavy anode current that would flow were the 240 volts practically all applied to the set.

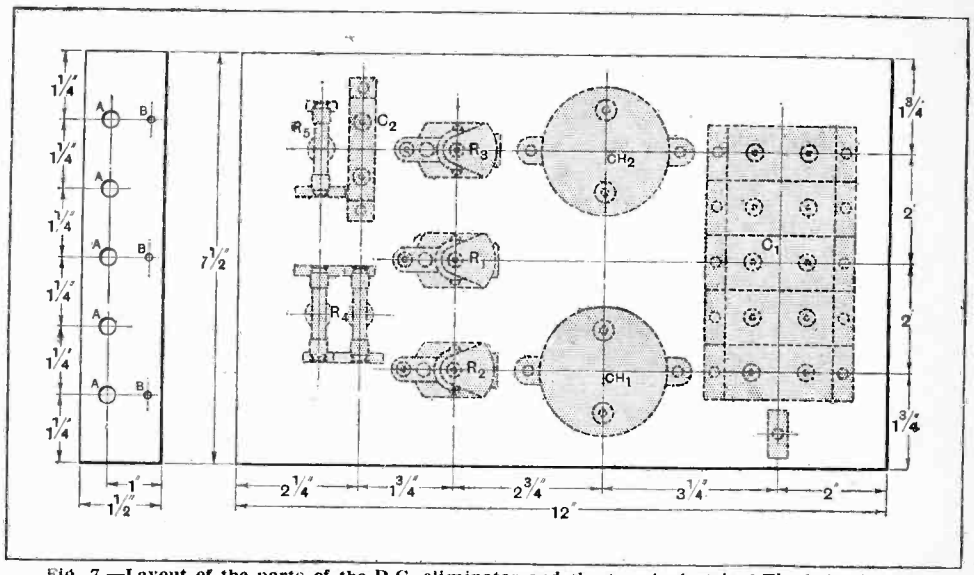


Fig. 7.—Layout of the parts of the D.C. eliminator and the terminal strip. The holes have the following diameters: A 5/16in. B. 1/8in.

The circuit just described supplies the current for the last two valves, and we have therefore to arrange for the power supply of the high-frequency stage and the detector. An additional circuit is used, but because of the fact that by-pass condensers are included in the "Everyman Four" none are included in this part of the filter.

It must be remembered that we have to avoid a coupling between the detector and low-frequency circuits, and that the full voltage of the direct current mains, when these are of 200 volts or more, is not required for the H.F. or detector. A potentiometer comprising resistances R_2 and R_3 with a choking coil CH_1 is therefore connected across the mains as indicated in Fig. 3, and a wire is taken from the junction of the two resistances to a terminal marked +H.F.

This terminal has, of course, to be connected to the one marked H.T.+1 on the receiver. Now the voltage of the +H.F. terminal for a given mains supply depends on the relative value of the two resistances R_2 and R_3. If these are of 5,000 and 15,000 ohms respectively, the current passing through them will be 10 milliamperes for a 200-volt supply and a little more for higher voltage mains, while the voltage of the +H.F. terminal will be 150 less a few volts because the anode current of the high-frequency valve passes through resistance R_2, but not R_3.

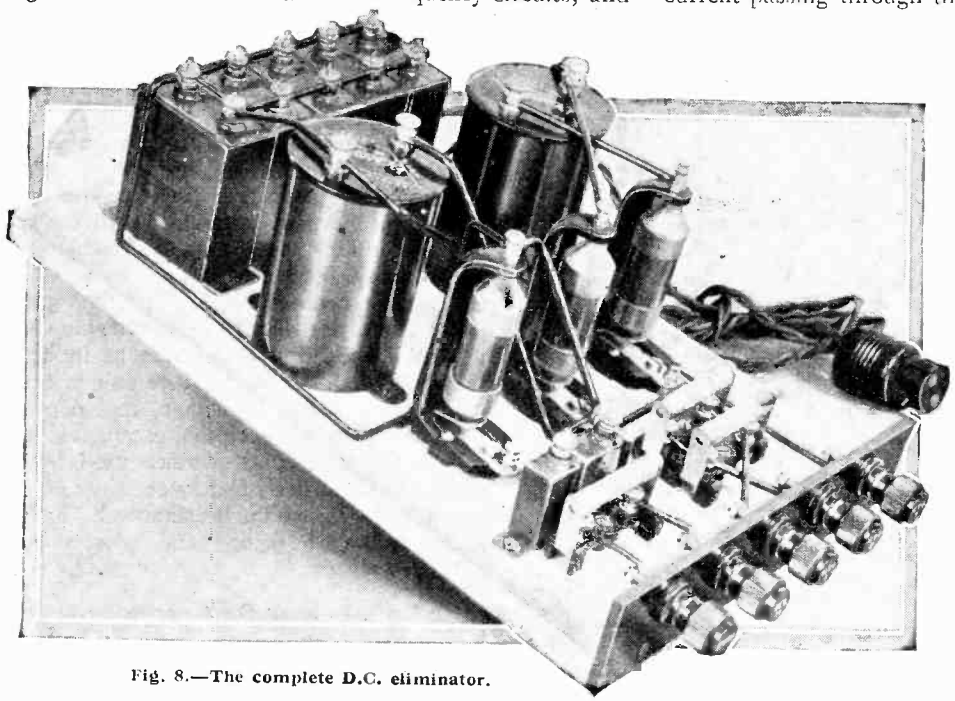


Fig. 8.—The complete D.C. eliminator.

When the mains are of 240 volts the voltage at +H.F. will be about 170. If this is considered too much resistance R_2 can be of 10,000 ohms and R_3 of 15,000 ohms. The current flowing through the resistances will then be 8 milliamperes for 200-volt mains and nearly 10 milliamperes for a 240-volt supply, to which must be added the high-tension current taken by the H.F. valve (about 2 milliamperes) that flows through resistance R_2. Terminal +H.F. has now a voltage of about 115 for

H.T. Mains Eliminators.—

200-volt and 135 for 240-volt mains. For the detector circuit 2 grid leaks in parallel, R_4, Fig. 3, are connected between the +H.F. terminal and the + detector terminal. These may be of half a megohm each, regardless of whether the mains voltage is 200 or 240, as the supply to the detector is to a large extent self-regulating.

The complete eliminator, therefore, comprises two main circuits. One of these is for the low-frequency and power valves, while the other is for the high-frequency with a branch circuit for the detector. Switching off the high-frequency valve has no effect on the detector, and the only point that it is necessary to consider is whether this arrangement will eliminate all hum and allow the receiver to operate with complete stability. The high-frequency and detector circuits are satisfactory, the by-pass condensers in the receiver being of adequate value. It is the supply to the L.F. and power valves that has to be considered.

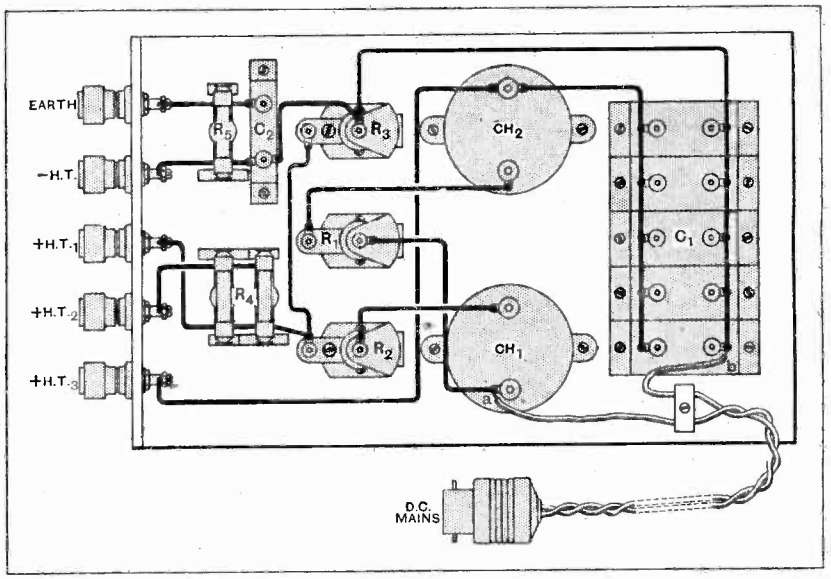


Fig. 9.—Wiring diagram of the D.C. eliminator.

Components for Modified Receiver.

We have already explained that if the mains are very noisy a choke may have to be connected in the negative lead. This is shown in Fig. 4. Further condensers, too, may have to be connected at C_1, and if the receiver is fitted with a Ferranti A.F.5 transformer, instead of an A.F.3, additional condensers must be used. When a Ferranti output transformer is connected, still more capacity must be connected at C_1.

For the standard "Everyman Four" receiver 10 mfd. of capacity at C_1 give satisfactory smoothing on the usual mains, and when they are very noisy an additional choke CH_3, Fig. 4, has been found to give complete freedom from hum and stability of working. This eliminator was tested on an "Everyman Four" receiver having a Ferranti A.F.5 coupling transformer, and for the best results an additional 4 mfd., making 14 in all, had to be used at C_1. An output transformer, also of Ferranti manufacture, was connected, and in order to remove the last trace of noise as tested by head telephones, a further 2 mfd. had to be used. These points are mentioned in order that the reader who has modified his receiver may know exactly what to do in order to obtain satisfactory results.

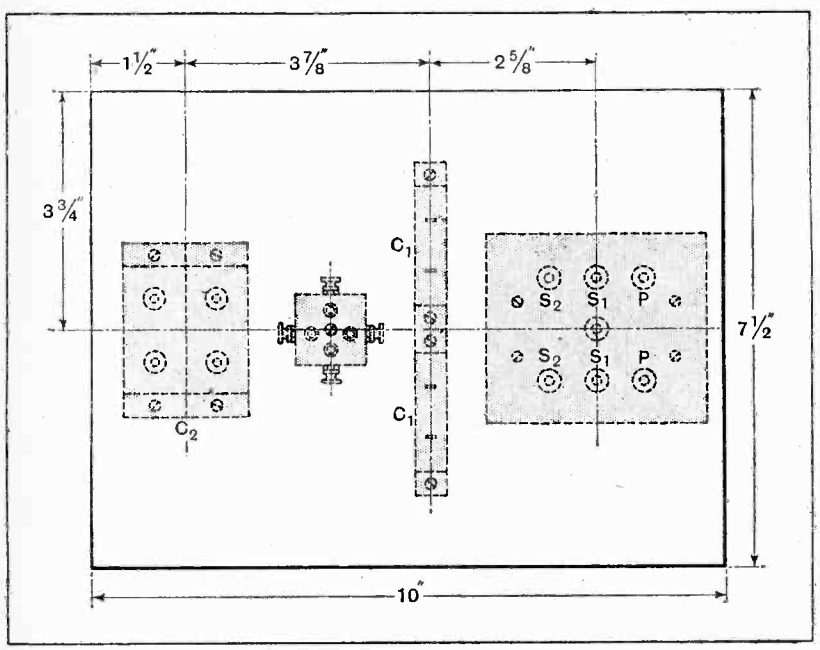


Fig. 10.—Layout of the parts for the rectifier.

The eliminator of Fig. 3 may be used as the filter of an alternating current unit for supplying the receiver with power from the alternating current supply mains. A suitable rectifier has already been described.

The connections are in Fig. 5. A transformer supplies the rectifying valve, and smoothing condensers as indicated are fitted. The complete unit is therefore as shown in Fig. 6, and does not need further description except this, that as the particular rectifier used by the writer and described below gives an output of 180 volts, resistances R_1 and R_2 may be of 10,000 and 30,000 ohms respectively.

Easy Construction.

Two eliminators have been constructed. One is for D.C. and the other for A.C. mains. They were not boxed

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because it was thought the reader would have his own ideas as to the best method of covering them. Naturally a metal case is best. The direct current instrument is constructed along the lines of Fig. 3.

It should be understood that in some instances resistance R_1 may not be required, but if the mains voltage is 240 a resistance of 5,000 ohms may be used at R_1 as described above. Resistances R_2 and R_3 may be of 5,000 and 10,000 ohms when the mains are of 200 volts, and 10,000 and 15,000 ohms when the mains are of 240 volts.

The parts are assembled as in Fig. 7, and wired according to Fig. 9. Fig. 8 is a photograph of the completed D.C. eliminator. Wiring is done with No. 18 tinned copper covered with sistoflex. The construction is so easy that nothing else need be said. The reader should remember, however, that additional condensers may have to be connected in parallel with the 10 mfd. if his receiver has been modified by fitting an output transformer or a different coupling transformer. The values given are quite satisfactory for a receiver whose low frequency side is connected according to Fig. 1. It is hardly necessary to reverse the primary or secondary of the intervalve transformer, but this should be done as a precaution. An adaptor and a length of flex are connected to the input of the eliminator, the wires being firmly held by a stout cleat.

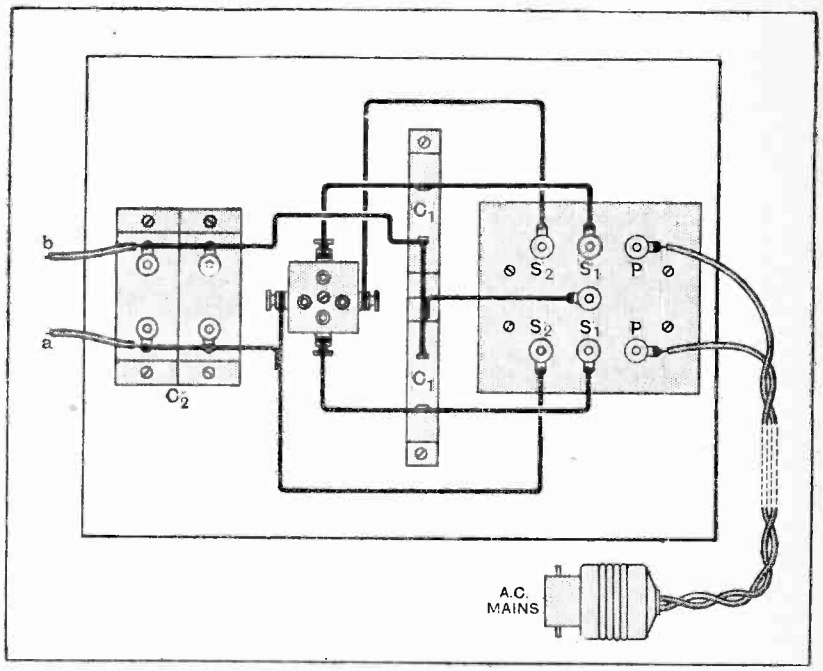


Fig. 11.—Wiring diagram. Wires a and b have to be connected to the input terminals a and b (fig. 9) of the D.C. eliminator.

It will be noticed that ordinary condensers are used. These are satisfactory when the voltage actually across them does not exceed about 180. When a higher voltage is available, condensers of the 4 mfd. 400-volt D.C. test type should be fitted. The two $\frac{1}{2}$-megohm resistances are connected in parallel at R_4, Fig. 3, and the one $\frac{1}{4}$-megohm resistance is connected across the 0.1 condenser C_2 at R_5.

For the eliminator to work from alternating current mains a rectifying unit must be connected to the filter just described. The rectifier is illustrated in Fig. 12. The parts are arranged as in Fig. 10, and wired according to Fig. 11. The output from condenser C_2 is taken through two wires lettered *a* and *b* to the terminals that have the flex on them) marked *a* and *b* in Fig. 9. The output of the rectifier is approximately 180 volts under load, and therefore resistance R_1, Fig. 9 need not be used. Resistances R_2 and R_3 should be of 10,000 and 30,000 ohms respectively.

A reader who desires a larger high-tension voltage can easily obtain a transformer to suit his purpose. If he had a transformer

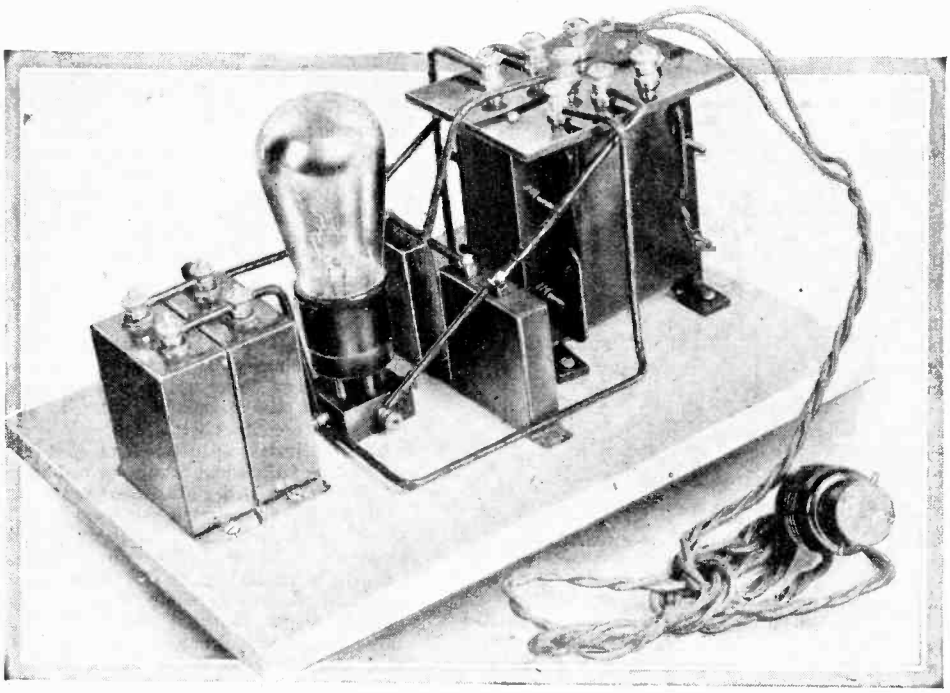


Fig. 12.—The completed rectifying unit with flex and adaptor.

PARTS REQUIRED.

D.C. ELIMINATOR.

2 Choke coils (model A, Eureka, Portable Utilities Ltd.).
5 2-mfd. condensers (T.C.C.).
1 0.1-mfd. condenser (T.C.C.).
3 Power resistances and holders (R.I. & Varley).
2 0.5 megohm grid leaks (Ediswan).
1 0·25 megohm grid leak (Ediswan).
3 Grid leak holders (Aermonic).
1 Baseboard, approximately 12×7½in.
1 Terminal strip.
5 Engraved terminals (Belling & Lee).

(Approximate cost £4 : 0 : 0).

A.C. RECTIFIER.

1 Power transformer to suit the voltage and frequency of the mains (Eureka, Portable Utilities).
2 2-mfd. condensers (T.C.C).
2 0.1 mfd. condensers (T.C.C.).
1 Valve holder.
1 Full-wave rectifying valve (Cossor).
1 Baseboard, approximately 10×7½in.

(Approximate cost £3 : 0 : 0 excluding valve).

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

capable of giving 260 volts on each half of the secondary, the output would be approximately 230, so that the filter portion of the eliminator could be exactly as described for 240 volt D.C. mains.

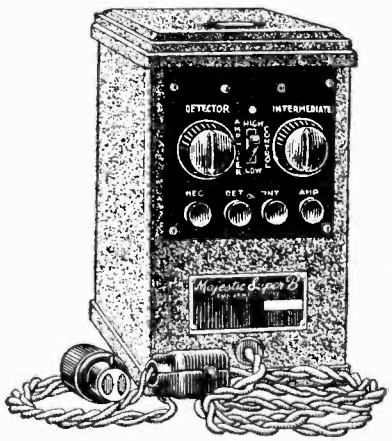
These eliminators have been very carefully tested on several different supply mains and give excellent results. If all mains were of the same type and voltage it would be easier to describe an eliminator and to give exact figures for the output, but when there are such great differences in the mains, exact figures cannot be given for every case, and some mains (direct current) require more smoothing than others. The reader will, however, have no difficulty in building an eliminator to suit his own supply. An eliminator is not recommended when the mains are direct current at 100 to 120 volts, the maximum potential available being inadequate.

ELIMINATOR EMPLOYING GLOW-DISCHARGE VALVE.

MENTION has already been made in these pages of the Majestic eliminator, obtainable from the Benjamin Electric, Ltd., Brantwood Works, Tottenham, London, N.17, when describing the moving coil loud-speaker.

Its particular merit is the high anode voltage which can be obtained on moderately heavy load and the absence of parasitic oscillation in the receiver with which it is used. Instead of the usual thermionic rectifier a valve of the glow discharge type is employed. This form of rectifier has not become popular owing to the non-linear relationship between the current and applied potential in the anode circuit, necessitating the use of a more liberal smoothing equipment than in the case where the thermionic rectifier is employed. Every endeavour has been made in America, however, to improve the rectifying properties of this form of valve by modifying the shape and dimensions of the electrodes, and the new type American Majestic valve used in the eliminator gives such perfect results in conjunction with the smoothing apparatus that even on heavy load ripple is entirely absent.

The manufacturers are fully aware of the circuit conditions which tend to bring about parasitic oscillation, either in the form of merely producing distortion or in the more apparent form known as "motor boating." Back coupling between alternate amplifying stages is avoided by the provision of separate terminals for feeding the several valves of the receiving set, in circuit with which are the voltage controlling high resistances. Three output voltages are obtainable as follows: (1) the maximum potential at the terminals of the smoothing circuit; (2) an intermediate



Benjamin Majestic rectifier suitable for the operation of a multi-valve set employing a liberal output stage.

potential obtained through a variable high resistance, and (3) a detector potential which is produced by a variable resistance in series with the fixed resistance so that the arrangement is actually that of a potentiometer. This latter high resistance potentiometer circuit being in shunt across the output improves the regulation and at the same time protects the condensers of the smoothing circuit against breakdown. In addition to the voltage control provided in this way a two-way key switch is fitted which varies the turns of wire composing the transformer primary so that a two-range output is obtained. On a voltmeter load of 2.5 mA. a maximum output potential of 240 was obtained, and on a 30 mA. load the voltage was 190, while it was found that when connected to a four-valve receiving set so that a total current of some 7 milliamperes is passed by the first three valves, a potential of 180 volts was maintained on the output valve with a load of 28 milliamperes.

The eliminator is compact and well finished, easy to operate, and protected to prevent the possibility of the user coming into contact with high voltages.

The enthusiast so often feels that it is preferable to construct his own battery eliminator in order to incorporate the many suggestions which are from time to time put forward in respect of battery eliminator design. He can, however, accept with confidence this latest Benjamin product as being capable of giving liberal output without involving difficulties and being practically similar in its performance to a low resistance high tension battery. With full wave rectifying valve the complete eliminator sells for £7 15s.

LOW-FREQUENCY TRANSFORMERS.

A Simple Exposition of the Fundamental Principles Underlying their Design.

By "EMPIRICIST."

THE following notes are concerned with the various audio-frequency transformers encountered in broadcast and kindred instruments, and are intended to give a brief outline of the most important factors which govern their design and use. Naturally it is a very difficult matter to deal shortly with so large a subject, but it is thought that an article such as the present one might serve as an introduction which would enable those interested to pursue their investigations further.

Transformers of the type under consideration are characterised by one principal requirement, which is that all frequencies should be treated alike; this desideratum must be more closely defined when we come to consider the exact function which any particular transformer has to fulfil, and as a rule the correct performance of any transformer is conditioned by the characteristics of the circuit in which it is to operate. At the same time, broadly speaking, we are confronted with the problem of designing an instrument to work correctly at frequencies varying from 50 to 6,000 cycles per second, and the problem is therefore by no means an easy one.

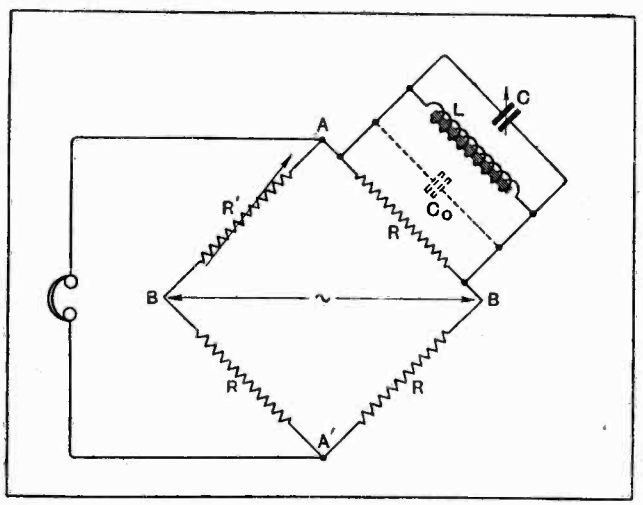


Fig. 1.—Bridge circuit for investigating the properties of iron-cored inductance windings.

There are one or two general properties of transformers about which a few preliminary remarks may advantageously be made. If we assemble any compact winding on an iron core and measure its electrical properties at a number of different frequencies, we will find that it has an inductance and a self-capacity with quite definite and constant values, subject to certain conditions. In order to establish these constants of the winding we may employ a bridge arrangement such as is shown in Fig. 1.

Here A B, A′ B′, is a Wheatstone bridge in which three of the arms have equal resistance values R (usually of the order of 1,000 ohms) and the fourth is variable and has a resistance R′. A source of audio-frequency current of varying frequency is connected to the diagonals BB′, and a pair of telephones across AA′. If the resistances alone are in circuit the bridge will balance at all frequencies when R′ = R. If, however, an inductance L, shunted by a variable condenser C, be connected across one of the equal arms, the balance will in general be upset. By adjusting C to the value which tunes L to the frequency of the supply we shall closely approximate to a balance for a value of R′ equal to R if the coil L is of good quality and free from short circuits. The balance may then be made exact by adjusting R′ to a value somewhat less than R, and this drop will represent the effective shunt resistance value of the tuned circuit LC. The resistance variation yields a useful indication of the quality of the coil L, a point which will be considered later, but the main purpose of the measurement is to find the value of C, which will yield a balance and therefore tune L to the supply frequency.

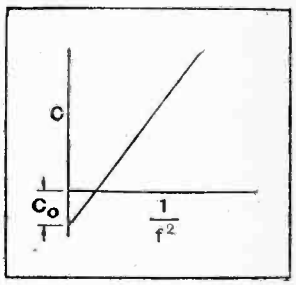


Fig. 2.—Graphical method of determining self-capacity.

At this point we have a value for C given by the formula

$$4\pi^2 LCf^2 = 1$$

where f is the supply frequency. Hence if the coil has a constant inductance and no self-capacity, that inductance will be given by

$$L = \frac{1}{39.4Cf^2} \quad \text{..... (i)}$$

In order to test the constancy of L a graph may be drawn giving the value of C against $\frac{1}{f^2}$. This should plot as a straight line, as shown in Fig. 2, but if there is self-capacity this straight line will not pass through the origin; also as the frequency is increased to values for which C has to be very small there may be a departure from the straight-line law. If, however, we draw the straight line corresponding to the points having larger values of C, and produce it back so as to meet the vertical axis, the intercept will give the value of the effective self-capacity corresponding to these points, and the inductance will be given by

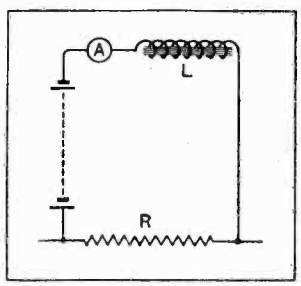


Fig. 3.—Modification of the inductance arm of the bridge for measuring the effect of a steady D.C. "polarising" current.

$$L = \frac{1}{39.4(C + Co)f^2} \quad \text{... (ii)}$$

Low-frequency Transformers.—

C and f being the capacity and frequency corresponding to any observation.

If a battery and milliammeter be included in series with the inductance, as in Fig. 3, then, provided that the milliammeter is of good quality and negligible impedance, we can note the effect of "polarising" the core. This will in general give a reduced value for L, and it may be found to be so serious in the case of transformers and chokes used in power valve circuits as to necessitate a special construction of the iron circuit. However, the value of inductance obtained is in general just as constant and definite as before, and it would appear that for reasonably small voltages there is not very much distortion occasioned by this flow of current.

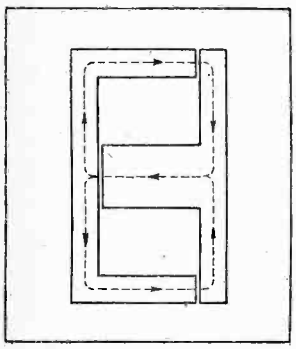


Fig. 4.—Iron core laminations of typical shape showing mean length of magnetic circuit.

If we repeat the measurements without the use of the iron core at all, we shall, of course, obtain a very much lower value of inductance and be able to form an estimate of the effect of the iron in increasing the latter. The property of the iron by virtue of which this increase is obtained is termed its permeability, and we may predict the inductance of a coil with fair confidence from a knowledge of the permeability and the length and area of the iron circuit. For the present purposes it is best to define the permeability from the formula used for this calculation, but in the first place it is necessary to be clear as to what is meant by the length of the iron circuit.

In Fig. 4 a common form of lamination is shown for the purpose of building up transformer cores. This consists, as is clearly indicated, of a T-shaped piece and a U-shaped piece assembled as shown, and these pieces are threaded through the transformer windings so that the latter have their common axis along the central leg of the T. Each successive pair of stampings is reversed in relation to the preceding pair, so that the gaps between them do not register over each other; in this way the magnetic effect is very close, as if the core consisted entirely of iron.

With the arrangement of stampings shown in the above figure, the magnetic flux set up by any current flowing through the windings divides itself into two paths, as shown by the dotted lines, and the length of either of these paths is said to be the length of the iron circuit, the assumption being that the cross-section throughout the paths is uniform. The path across the inner edge of the iron is, of course, less than that across the outer, but the mean length will be that corresponding to the mean path, as indicated by the dotted line. The cross section of the central part must, of course, be equal to that of the two outer parts added together.

The inductance of the coil is then given by the formula

$$L = \frac{4\pi}{10^9} \cdot \frac{N^2 A}{l} \times \mu \quad \ldots\ldots\ldots\ldots \text{(iii)}$$

where N is the total number of turns.
A is the area of the core in square cms.,
l is the length of the iron circuit in cms.,
and μ is the permeability of the iron.

We may take equation (iii) as defining μ, and the experimental fact on which this definition is based is that if we make up iron-cored coils for which N, A, and l have any desired value, the inductance will vary as $\frac{N^2A}{l}$ so long as the material of the core and its magnetic condition remain unchanged. There is a further limitation which is concerned with the amplitude of the alternating currents with which we have to deal, but in most cases where transformers of the present type have to be used, the currents are very small and the permeability of the iron is found to have a definite and constant value, termed the *differential* or *initial* permeability. This value is very much lower than that corresponding to the larger currents used in power engineering practice, being about 200 for Stalloy iron, whereas for larger amplitudes this material may have a permeability as great as 5,000.

Short-circuited Turns.

So far we have considered only a single coil on an iron core; it is now necessary to outline some general properties of transformers, which consist in their simplest and most common form of two coils on the same core. As is well known, the passage of fluctuating currents through one such coil will result in electromotive forces being induced in the other; when such currents are of regular

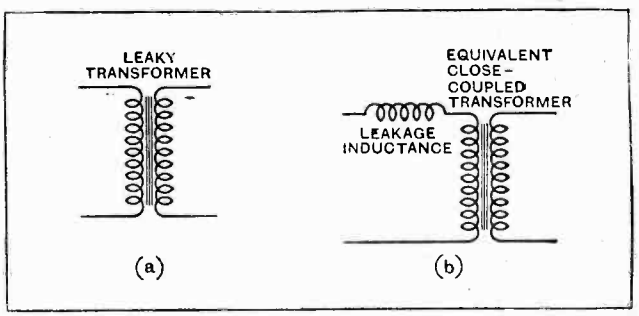


Fig. 5.— Transformer (a) with magnetic leakage, and (b), the equivalent circuit with leakage inductance referred to one winding.

sine-wave form, so also are the E.M.F.s under all but extreme conditions of working, and when the load on the secondary winding is negligibly small, as also the primary resistance, the ratio of the voltage across the secondary to that across the primary is a constant quantity, and is termed the ratio of transformation. If the primary and secondary windings are not too widely separated on the core, this ratio is very nearly equal to the ratio of the number of turns in each winding.

If one of the windings is short-circuited, the passage of current through the other will result in a current being set up in the short-circuited coil, which throws back a voltage into the open-circuited coil. This voltage will have the effect of nearly cancelling the inductance of the open-circuited coil, but in all practical transformers a residual inductance will be left. This is commonly termed "leakage inductance," as it is due to magnetic leakage, or, in other words, the fact that all the lines of

Low-frequency Transformers.—

magnetic force due to current passing through the one coil do not thread all the turns of the other. Owing to the presence of the iron circuit a very large proportion of the lines will do so, however, and it is seldom found in any good construction of transformer that the inductance of either winding remains greater than 5 per cent. of its original value when the other winding is short-circuited.

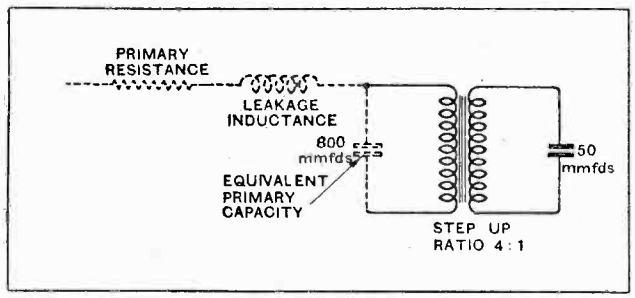


Fig. 6.—The equivalent primary capacity transferred from the secondary is increased as the square of the step-up ratio.

The leakage inductance may be referred to either winding, *i.e.*, we may measure the inductance of either of the windings with the other short-circuited, and the values will be different in the two cases, the ratio being that of the main inductances. Speaking precisely, the leakage inductance should be considered as distributed between the windings, but actually it is most convenient for practical purposes, with transformers of low leakage, to consider it as concentrated in one winding or the other. According to simple theory it can then be shown that a transformer having magnetic leakage can be represented by a combination of a leakage-free transformer and an external inductance in series with one winding. If we short-circuit the other winding of the transformer the only inductance left in the first winding will be that of the external coil, since the transformer has been assumed to have no leakage. We are therefore able to specify the value of the external coil in the equivalent transformer arrangement as being the leakage inductance of the actual transformer. Figs. 5 (a) and (b) show the actual and equivalent circuits.

Primary and Secondary Capacity.

A transformer will also have an effective self-capacity, that is to say, either winding will behave as if it had a condenser connected across it, although this value may be totally different from that of a single coil on the same core having the same dimensions as either of the windings. The effective self-capacity is made up of the self-capacity of each winding taken by itself and the mutual capacity between the two windings. In the case of transformers having a step-up ratio, the self-capacity of the windings having the larger number of turns will carry more weight than that of the other winding, and the mutual capacity may carry either more or less weight according to the manner of connection of the transformer. A most important point in making measurements is that the windings should be connected to each other at one point if, as is nearly always the case, they are to be so connected (*e.g.*, through a H.T. battery) when used in a practical circuit.

The impedance of the primary winding of a transformer is very frequently of great importance, since upon this value depends the performance of the instrument when connected in a valve circuit. In order to appreciate the factors which govern the value of this it is necessary to understand the principles regarding the transference of load from one circuit into the other. To fix ideas let us imagine a transformer having a 4 : 1 step-up ratio and its magnetic leakage. Then if, as in Fig. 6, we connect a condenser of 50 micro-microfarads across the secondary winding and measure the increase in the effective capacity of the primary due to this external load, we will find that it is as if a condenser of sixteen times the value had been connected across the primary winding, *i.e.*, one of 800 micro-microfarads capacity. The load is thus transferred inversely as the square of the ratio of the turns of the corresponding windings.

Ratio and Resistance Load.

If a resistance or inductance be connected across the secondary winding, the equivalent primary load will be $\frac{1}{16}$ of the inductance or resistance value; in other words, the load will be thrown across from one winding into the other directly as the square of this ratio. If the transformer has magnetic leakage the above rules apply except that we must split up the primary of the transformer into two parts, a closely coupled part across which the loads are thrown from the secondary winding, and the external inductance equivalent to the leakage inductance.

Putting this matter now in a more general form we may tabulate the following figures for a transformer having a step-up ratio σ :—

Load across secondary winding.	Load across primary winding.
Capacity, C.	Capacity, σ^2C.
Inductance, L.	Inductance, $\frac{1}{\sigma^2}$L.
Resistance, R.	Resistance, $\frac{1}{\sigma^2}$R.

It does not matter in what kind of network the condensers, inductances, and resistances are arranged across the secondary winding; the effect will be as if an equivalent network were connected across the primary winding with the values changing the ratio given in the above table. If a transformer has magnetic leakage we may

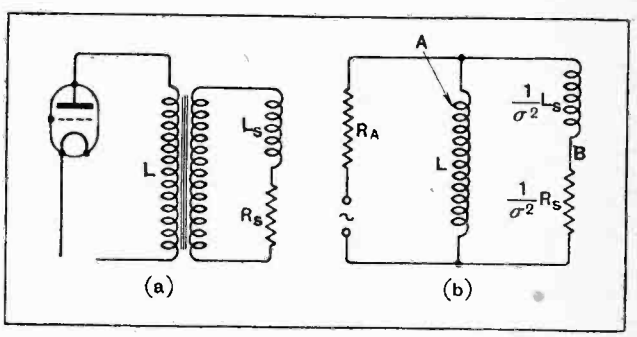


Fig. 7.—Output transformer feeding into a loud-speaker represented in (a) by L_S and R_S. The equivalent primary circuit is indicated in diagram (b).

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regard it as in Figs. 5 and 6 as having a leakage inductance which is altogether external to the above, the transference of load taking place, according to the above rules, in relation to the leakage-free transformer which is assumed to be a part of the equivalent arrangement.

It should be noted that the transference of load takes place across the inductive part of the primary winding only, the resistance as well as the leakage inductance being external to the loaded part of the winding; this is illustrated in Fig. 6, the external resistance R, shown in dotted form, representing the D.C. resistance of the primary winding, if of appreciable value. In general the D.C. resistances of both windings can be neglected and will not be taken into account except when this is specially necessary.

We are now in a position to consider the different types of transformer in practical use, and as perhaps the simplest example we may take the case of a transformer designed to operate between the last valve of an amplifier and a loud-speaker. The impedance of a loud-speaker is, in general, a very complicated quantity, owing to the effect of the movement of the diaphragm on the electrical properties of the actuating coil. It is impossible to make an assumption that will cover all cases, but perhaps the most satisfactory working hypothesis is that a loud-speaker winding consists of a resistance and an inductance in series. The inductance represents mainly that of the windings of the loud-speaker, and the resistance corresponds both to the resistance of these windings and also to the power consumed in various parts of the mechanism, a very small fraction of which is, of course, converted into useful work. On the input side we have, connected across the primary winding of the transformer, the resistance of the valve, the circuit arrangements of the whole system being as shown in Fig. 7 (a). In order to obtain uniform operation at all frequencies it is necessary that, as far as possible, a constant voltage should be maintained across that part of the secondary circuit which is represented by the resistance in response to a constant voltage on the grid of the valve at various frequencies.

If we redraw Fig. 7 (a) as shown in Fig. 7 (b) by transferring the load according to the rules previously given, we shall obtain a circuit as shown consisting of two branches, one branch representing the primary inductance of the transformer and the other branch representing the transferred load, which consists of an inductance in series with the resistance. For the moment we will assume that the transformer is leakage free, but it will appear that in this case the question of leakage requires no special consideration. The branch representing the inductance of the primary winding has been deliberately drawn as if free from resistance, since the transfer of load takes place across the inductive part of the primary winding only, and the resistance may be counted as a part of the resistance of the valve.

Considering the effect of this arrangement at various frequencies, it is evident that the impedance of branch A is negligibly small in comparison with that of branch B at the lowest frequencies. In consequence all the current will flow down this branch and practically none through branch B. As the frequency increases the impedance of branch A will rise, and a value of frequency will soon be attained where all the current may be considered as flowing in branch B and none in branch A. Considering branch B alone, it will be seen that as it consists of an inductance and a resistance in series there will be a voltage drop across the inductance which will tend to oppose the flow of current and reduce the voltage drop across the resistance. When this voltage drop becomes comparable with that across the combined resistances of the valve and loud-speaker the current will begin to diminish and the reproduction of the high frequencies will be affected.

Let L be the primary inductance of the transformer, R_a the resistance of the valve, and L_s R_s the inductance and resistance of the loud-speaker. Then, according to previous calculations, the inductance in branch B is equal to $\frac{1}{\sigma^2}L_s$ and the resistance is $\frac{1}{\sigma^2}R_s$. Now, in order that a note of frequency f should be adequately reproduced, the impedance of $\frac{1}{\sigma^2}L_s$, which is equal to $\frac{2\pi f}{\sigma^2}L_s$, must not be materially less than $R_a + \frac{1}{\sigma^2}R_s$; if these two quantities are equal there will be a loss of about 30 per cent. of the intensity of reproduction. Supposing that we fix on a frequency where this loss is permissible, we are then in a position to work out a lower limit to the value of σ.

To fix ideas let us take a concrete case in which the loud-speaker has an inductance value of 0.5 henry and a resistance of 4,000 ohms, the valve resistance being 2,000 ohms. If we select a frequency of 4,000 cycles as that at which a 30 per cent. drop in performance is permissible, we have then

$$6.28 \times 4{,}000 \times 0.5 = 2{,}000\ \sigma^2 + 4{,}000,$$
$$i.e.,\ \sigma^2 = 2.1 \text{ about.}$$

This value of σ will not give the maximum volume of reproduction, however, as something must be sacrificed in order to preserve the upper frequencies. The conditions for maximum volume at the intermediate frequencies is that the transferred resistance $\frac{R_s}{\sigma^2}$ should be equal to that of the valve R_a. Under these conditions, in the present case we have $\sigma^2 = 2$, *i.e.*, $\sigma = 1.41$, but σ cannot have as low a value as this, for the reasons above given.

Having settled the ratio, we must determine the primary inductance in order that the design may be completed. The value of the resistance in branch B is 935 ohms, and the inductance of branch A must have an impedance not materially lower than this at the lowest frequency which it is desired to reproduce. If we can tolerate a 30 per cent. drop at a frequency f we must then have

$$2\pi f L = \frac{R_s}{\sigma^2}.$$

Selecting 50 cycles as the limiting frequency we get immediately

$$6.28 \times 50 \times L = 935, \text{ or } L = 3 \text{ henries (approx.)}$$

In considering this value of inductance it is of course necessary to take into account the steady currents flowing through the windings, which may be very great, but in any case the leakage inductance should not be greater than 5 per cent. of this value without special precautions being taken, and consequently we may neglect it in comparison with that of the loud-speaker.

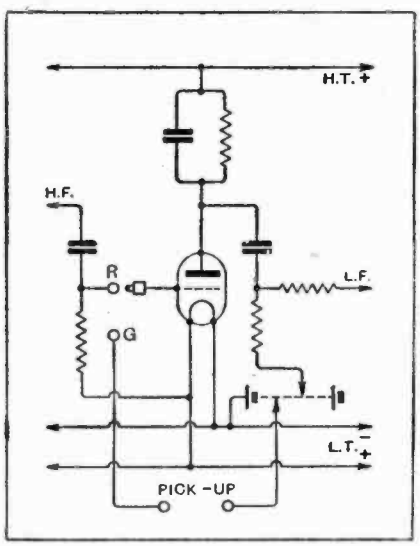
READERS' NOVELTIES

A Section Devoted to New Ideas and Practical Devices.

PICK-UP CONNECTIONS.

The circuit diagram shows a method of altering a tuned anode receiver for use with a gramophone pick-up.

The lead from the grid of the detector valve takes the form of a flexible wire provided with a wander plug, which may be inserted alternatively into two sockets R and G ("Radio" and "Gramophone").



Detector circuit connections for using gramophone pick-up in tuned anode receiver.

Socket R is connected to the grid condenser and leak from the H.F. stage, while socket G is joined through the pick-up terminal to a suitable point on the grid bias battery. By changing over from R to G the detector valve is converted into a L.F. amplifier with appropriate grid bias.—G. H. B.

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DRILLING EBONITE.

When drilling ebonite it often happens that after carefully marking out and dotting the hole, the drill wanders to such an extent that it may mean the scrapping of the piece and starting afresh, *e.g.*, the base piece for a six-pin coil former. The following is a method of ensuring that the drill will run true to the dot mark within a few thousandths: Mark out and dot as usual. Then, instead of a drill, use a rose bit or countersink, and drill with that until the diameter of the countersink formed in the ebonite is a little larger than the hole to be drilled. Now drill as usual, and it will be found that provided that the drill is ground reasonably true, the hole will be central with the original dot mark.

The reason for the running-out with a twist drill is that when dotting, especially if the punch mark is big, the ebonite displaced by the point of the punch rises in the form of a ridge around the dot mark. The twist drill, having only two cutting edges, almost invariably bites more into one side of the ridge than the other, and throws the hole out of centre. A rose bit, having about a dozen cutting edges, has to run very much truer, and gives a better start to the drill.—S. W.

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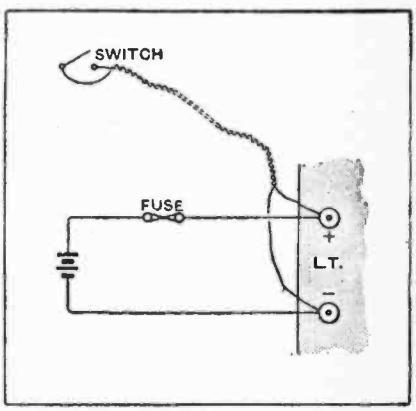
REMOTE CONTROL.

A simple and inexpensive method of switching *off* L.T. current is shown in the diagram. In series with the L.T. battery is connected a fuse just capable of carrying the normal L.T. current to the valves and across the L.T. terminals are joined a pair of heavy flex leads, to the other end of which is connected a push switch. On depressing the switch the fuse is connected directly across the L.T. battery and will blow immediately, thus opening the circuit. To switch on again it is only necessary to insert a fresh piece of fuse wire.



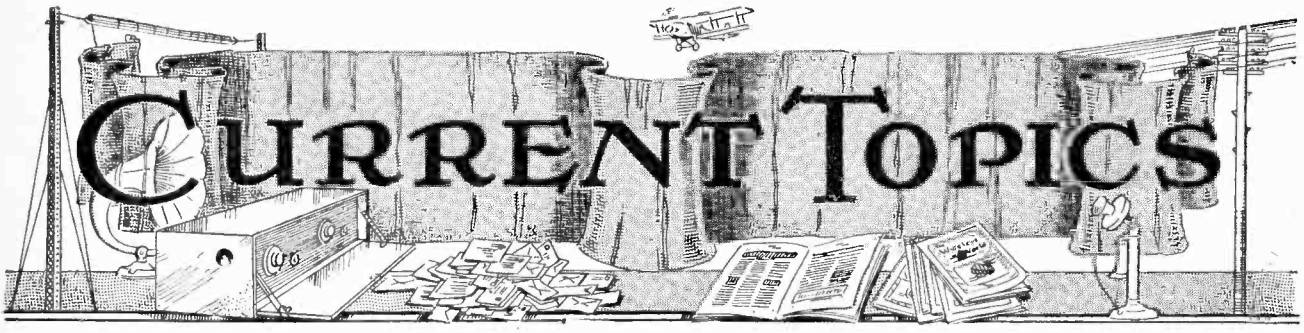
Switching off L.T. by means of a fuse.

No harm can result from leaving the switch in contact for any length of time, and the device is perfectly sound provided that the lightest possible fuse is employed.—B. R. A. B.

VALVES FOR IDEAS.

Readers are invited to submit brief details, with rough sketches, where necessary, of devices of experimental interest for inclusion in this section. A dull emitter receiving valve will be despatched to every reader whose idea is accepted for publication.

Letters should be addressed to the Editor, "Wireless World and Radio Review," Dorset House, Tudor St., London, E.C.4, and marked "Ideas."



Events of the Week in Brief Review.

WIRELESS-CONTROLLED TARGET SHIP.

The old British battleship "Centurion" has been fitted with directional and remotely controlled wireless for use as a target ship. The vessel can be manœuvred for several hours without a crew.

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NEMESIS.

Ramsbottom, near Bury, Lancs, has just achieved notoriety as the home of an oscillator "caught in the act." The Post Office van, using a special direction-finder, tracked the offender after a prolonged search. He had been spoiling broadcast reception over a wide area.

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WAVELENGTH THAT WAS TOO LOW.

Early every morning except Monday, KDKA, Pittsburg, is sending out its programme on two short wavelengths, viz., 27 and 62.5 metres. Occasionally a wavelength of 42.95 metres is also used. These transmissions are made between 1 and 3 a.m. (G.M.T.), and, judging from reports, are eagerly listened to in all parts of the world. The owners of the station, the Westinghouse Electric and Manufacturing Company, state that the transmissions on 2.5 metres have been abandoned, this wavelength being too low to be of any practical value. All the Pittsburgh transmitters are crystal-controlled.

THE BEST PRESENT.

Pursuing a very popular fashion, the staff of the Bradford City Tramways chose a three-valve wireless set and loud-speaker for presentation to the retiring Assistant Electrical Engineer, Mr. J. W. Dawson. The day of the presentation gold watch, generally too good for use, seems to have passed.

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PCJJ RETURNS.

The famous short-wave broadcasting station PCJJ has now been rebuilt and has started a regular schedule of transmissions on Tuesdays and Thursdays from 6 to 9 p.m. (G. M. T.). The wavelength is 30.2 metres, as before.

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A WIRELESS MEDAL.

A medal in honour of the science and art of wireless has been struck by the French Government, and is about to be placed on sale. It is a product of the French mint, says a Paris message. On the obverse of the medal appear the signs of the Zodiac, with Iris, as messenger of the gods, walking through the clouds. The reverse bears a tribute to wireless in the form of a globe surrounded by stars, and encircled by a frame aerial. The inevitable zigzags, portraying wireless waves, complete the picture.

TRANSMISSIONS FROM ZEESEN.

Germany's new high power broadcasting station at Zeesen, near Koenigswusterhausen, is at present functioning only in the evenings from 7 o'clock onwards. The temporary wavelength is 1,250 metres.

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WHAT OF FL ?

Rumour and counter-rumour have been busy during the past week concerning the fate of the Eiffel Tower. The latest advices seem to indicate that no immediate decision has been made to raze it to the ground. The extinction of the Tower would not necessarily imply the eclipse of the famous wireless station FL, though it is doubtful whether a better aerial "mast" could be found anywhere in the neighbourhood. The Eiffel Tower was built in 1889, and was guaranteed to stand 20 years.

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BEAM BREAKS RECORDS.

All existing telegraph records seem to have been broken by beam wireless during the Christmas season, when speeds up to 400 words per minute were attained without a single repetition being necessary. No fewer than 31,694 Christmas greetings were exchanged by beam wireless between this country and the Dominions.

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WORLD BROADCASTING SURVEY.

The world is now blessed with 1,116 active broadcasting stations, according to Mr. L. D. Batson, of the U.S. Department of Commerce, who has made a sweeping survey of the subject. Of the total number, 685 operate in the United States and its non-contiguous territories, while Europe has 196. North America outside the U.S. has 128; South America, 52; Asia, 18; Oceania, 28; and Africa, 9.

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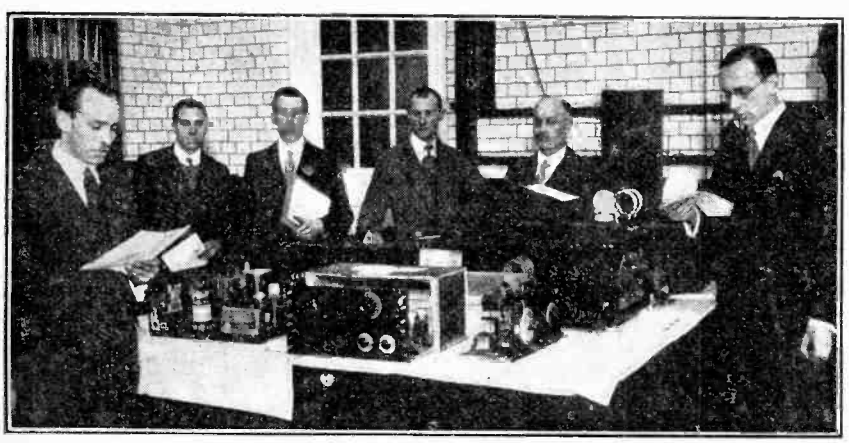
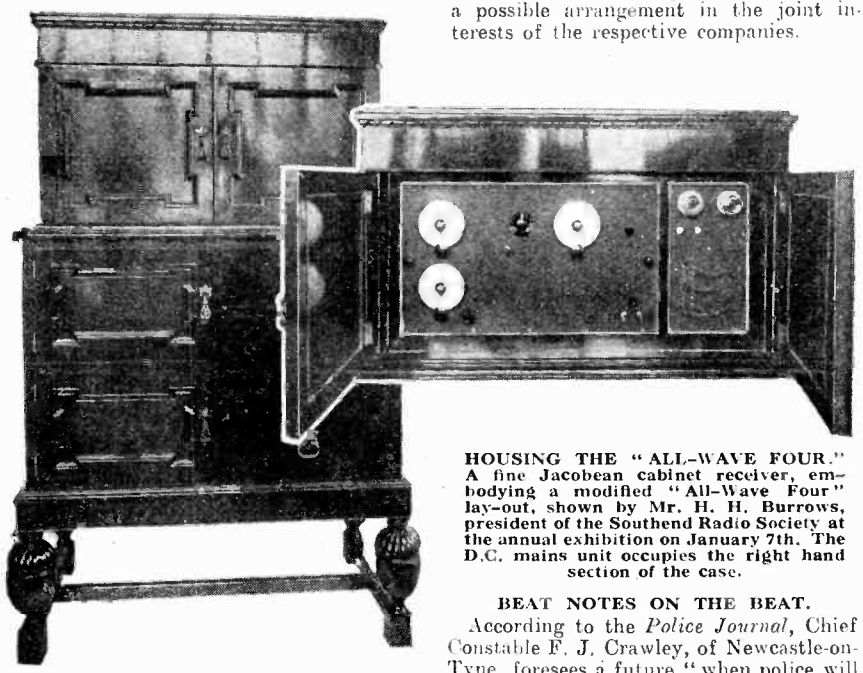
COMPETITION FOR WIRELESS CABINET DESIGNERS.

Among the interesting array of tests open to the public in connection with the Fifth Annual Competition of Industrial Designs, to be held in June under the auspices of the Royal Society of Arts, is one which should appeal to the wireless carpenter. A prize of £5 5s. is offered by *The Cabinet Maker* for a cabinet for a wireless receiving set, the design remaining the property of the competitor.



SOUTHEND WIRELESS COMPETITION. There was a large entry of home-constructed sets at the Southend and District Radio Society's competition in connection with the Annual Wireless Exhibition on Saturday, January 7th. The photograph shows the judging in progress. On the extreme right is Mr. Hugh S. Pocock, Editor of "The Wireless World," who acted as a judge. A report of the competition appears on page 74.

The competition is open to all British subjects, and application for entry forms should be made to the Secretary, Royal Society of Arts, John Street, Adelphi, London, W.C.2, between May 1st and 12th.



HOUSING THE "ALL-WAVE FOUR." A fine Jacobean cabinet receiver, embodying a modified "All-Wave Four" lay-out, shown by Mr. H. H. Burrows, president of the Southend Radio Society at the annual exhibition on January 7th. The D.C. mains unit occupies the right hand section of the case.

I.E.E. ANNUAL DINNER.

The Institution of Electrical Engineers will hold its Annual Dinner and Reunion at the Hotel Cecil, Strand, W.C.2, on February 9th.

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PRIVATE WIRELESS FOR BUSINESS.

A licence for a private short-wave station, purely for business purposes, has been granted by the U.S. Federal Radio Commission to a well-known rubber magnate, Mr. Harvey. The station is to be erected in Liberia, and will be used for business communications between that place and the head office at Akron. The call sign is XAS.

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ITALIAN STATE BROADCASTING.

The State control of broadcasting in Italy is reflected in Royal Decree Law No. 2,539/2,207, recently issued, which contains new regulations for improving and developing the broadcasting services. Special subscription rates are being arranged for communes, organisations and private individuals, while a stricter watch on wireless activities is provided for by the institution of a new committee of control.

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ARMISTICE.

An interesting truce in the so-called "war" between wireless and the cables is suggested by a joint announcement issued last week by Marconi's Wireless Telegraph Co., Ltd., and the Associated Cable Companies. The statement says that Sir William Plender, on behalf of the Eastern and Associated Telegraph Companies, and Sir Gilbert Garnsey, on behalf of Marconi's Wireless Telegraph Co., Ltd., have been asked to co-operate with a view to making a joint report for submission to their respective boards as to a possible arrangement in the joint interests of the respective companies.

BEAT NOTES ON THE BEAT.

According to the *Police Journal*, Chief Constable F. J. Crawley, of Newcastle-on-Tyne, foresees a future "when police will be moving about with wireless apparatus in helmets." It is pointed out that messages sent to a policeman with a wireless-equipped helmet would have to be made by code "or a form of attunement which would prevent the general public from receiving the message."

Writing in the same journal, Mr. G. A. H. Wootton, an assistant engineer at New Scotland Yard, states that many police wireless difficulties have been overcome, and that the results of experiments carried out by the Metropolitan Police have been made available for the Paris and other police forces, as well as for the Army and the R.A.F.

Telephony was used in earlier experiments, but has since been abandoned in favour of telegraphy, which has been found to be more reliable and speedy.

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TWENTY-FOLD POWER JUMP IN SWEDEN.

There are 53.6 wireless receivers for every thousand of the population in Sweden, according to the official report on broadcasting just issued by the Swedish Royal Telegraph Administration, which also states that revenue from licences has increased by 50 per cent. during the past year.

At present it is not intended to build new broadcasting stations owing to the scarcity of available wavelengths, but plans are afoot to increase the power of the Gothenburg and Malmö stations from 0.5 to 10 kilowatts.

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LISTENING POPULATIONS COMPARED.

With 53.6 per thousand of the Swedish population owning wireless sets the State Telegraph Administration estimates that Sweden leads the way among European countries in the popularity of broadcast reception. Great Britain is said to come next with 53 per thousand, followed by Denmark, 44.8; Austria, 43; Germany, 28.1; Norway, 22.1; Switzerland, 15.9; Czecho-Slovakia, 15.2; Hungary, 9; Finland, 8.8; and Belgium, 4.6.

FORTHCOMING EVENTS.

WEDNESDAY, JANUARY 18th.

Golders Green and Hendon Radio Society.—At 8 p.m. At the Club House, Willifield Way, N.W.11. Lecture: "Methods of Faithful Reproduction, with Special Reference to 5GB," by Mr. H. L. Kirke, of the B.B.C.

THURSDAY, JANUARY 19th.

Stretford and District Radio Society.—At 8 p.m. At 6a, Derbyshire Lane. Lecture: "L.F. Transformers," by Messrs. Ferranti, Ltd.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Haydon House, Fairlop Road, E.11. "Junk Sale."

Institute of Wireless Technology.—At 7 p.m. At the Engineers' Club, Coventry Street, London, W. Lecture: "Experiments with Multi-Feed Aerials," by Mr. W. H. B. de M. Leathes, A.M.I.R.E.

FRIDAY, JANUARY 20th.

Leeds Radio Society.—At the University. Demonstration and Talk on High Frequency Instruments, as used in Radio Work, by Mr. S. Matthews, F.P.S. (of the Cambridge Instrument Co.).

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Demonstration of members own moving coil loud-speakers.

Radio Experimental Society of Manchester.—Special Elementary Class.

Bristol and District Radio Society.—Lecture by Mr. Clark, of the Edison-Swan Electric Co., Ltd.

MONDAY, JANUARY 23rd.

Hackney and District Radio Society.—At 8 p.m. At the Electricity Show Rooms, Lower Clapton Road. E.5. Demonstration of 8-valve receiver, by Mr. G. V. Colle.

TUESDAY, JANUARY 24th.

Bradford Radio Society.—Lecture by representative of Messrs. Ferranti, Ltd.

BOOKS RECEIVED.

Les Filtres Electriques, L'Alimentation des Postes Récepteurs, by M. Veaux, Engineer-in-chief of the Wireless Service of P.T. and T. Pp. 242, with 227 illustrations and diagrams. Published by Léon Eyrolles, Librairie de l'Enseignement Technique. Paris, price, 35 francs.

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The Cable and Wireless Communications of the World. A survey of present-day means of international communication by cable and wireless. Pp. 148, with map and 20 illustrations and diagrams. Published by Sir Isaac Pitman and Sons, Ltd., London, price 7s. 6d. net.

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Pitman's Radio Year-book, 1928. A book of reference for all interested in broadcast receiving, with contributions by Prof. J. A. Fleming, Capt. P. P. Eckersley and other well-known writers. Pp. 118, with many illustrations. Published by Sir Isaac Pitman and Sons, Ltd., London, price 1s. 6d. net.

A SUPER-RECEIVING STATION.

Some Details of the New Transoceanic Relay Station at Belfast, Maine, U.S.A.

By A. DINSDALE.

HISTORY repeats itself in radio communication as in everything else. About 25 years ago, while Senatore Marconi was endeavouring to prove the feasibility of wireless communication across the Atlantic, he chose the Newfoundland coast as the nearest and best site for the reception of signals emanating from his transmitting station at Poldhu, Cornwall.

Later, Marconi established a station at Glace Bay, in Nova Scotia, and still later at South Wellfleet, Mass., near the northern end of the narrow arm of Cape Cod. More recently, transoceanic radio communication has been handled, on the American side from the north shore of Long Island, far to the south, where several powerful transmitters are employed to hurl dots and dashes to Europe and South America, side by side with supersensitive receivers for intercepting the signals originating overseas to the east and to the south.

Yet to-day, as the result of actual test and careful survey, American radio engineers have determined on the coast of Maine as the most suitable locality for long-distance reception. Hence the establishment by the Radio Corporation of America of the Belfast, Maine, receiving station marks the return of transoceanic wireless reception to the north-eastern coast of America, which is virtually steeped in transoceanic wireless history.

Commercial radio engineers are ceaselessly striving for a better, faster, and still more economical long-distance wireless service, and as part of these efforts the Belfast station has been constructed to intercept European radiotelegrams under the most favourable conditions, and to relay them automatically, by land line, to the main traffic office of the company, which is situated in the heart of the financial district of New York City.

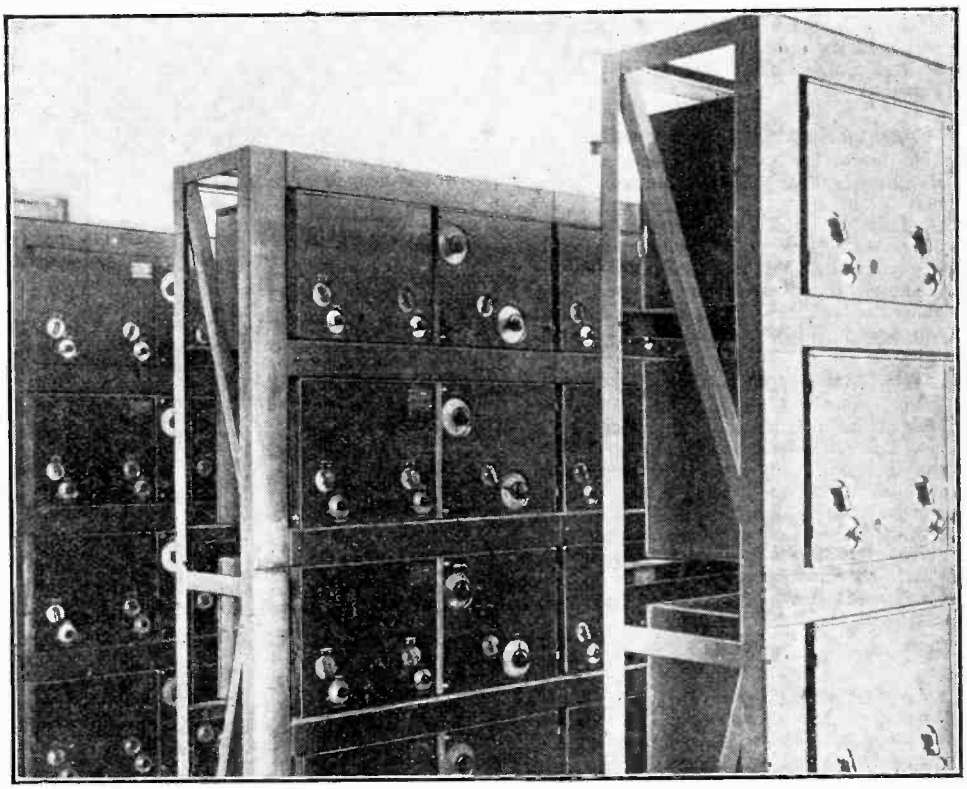
Why the little town of Belfast should have been chosen as the virtual centre of international affairs is neither a great nor a deep mystery. It appears that extensive tests have demonstrated that European signals can be received very much better at Belfast than at Riverhead, Long Island, where the main receiving station is situated, but where local conditions are not so good.

A survey of thunderstorms during the last decade, made by the U.S. Weather Bureau, indicates that there are twice as many thunderstorms at Riverhead as there are at Belfast. There is also a bad thunderstorm centre in the New England States which affects Riverhead more than Belfast. Furthermore, while Belfast is nearly north of Riverhead, it lies almost directly on the Great Circle route from Riverhead to Europe, and is 300 miles nearer the distant transmitters than is Riverhead. For this latter reason, European signals are at least 30 per cent. stronger at Belfast.

Receiving Equipment.

Apart from its work as a commercial wireless telegraph receiving station, Belfast has also played its part in the realm of broadcasting, for it is at this point that signals from Daventry have been intercepted, retransmitted on short wave to New York, and finally rebroadcast from station WJZ, this time on the usual broadcast wavelengths.

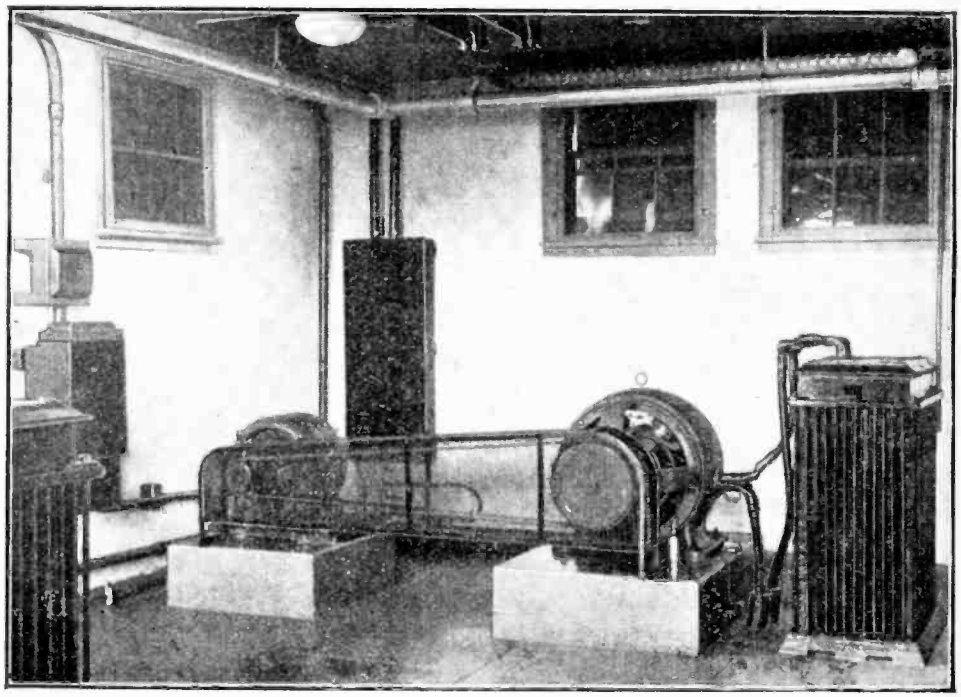
Encouraged by the excellent results obtained at Belfast,



Part of the receiving equipment at Belfast, Maine. Note the neat appearance and absence of external wiring.

A Super-receiving Station.—the R.C.A. have built there a new super-receiving station which is the last word in receiving station design. It has a capacity of sixteen radiotelegraph channels.

The building, which is of brick and concrete construction, entirely fireproof, at present houses twelve complete long-wave receivers, operating on wavelengths from 8,000 to 23,000 metres, and, in addition, contains a complete power plant, consisting of battery and motor-generator equipment for supplying filament lighting current, H.T., and grid bias voltages for the receiver valves. It is also equipped with an oil-heating system (a recent American development) and has its own water supply.



The generating plant; the transformer steps down the public supply current to a suitable voltage to run the driving motor.

Aerials Nine Miles Long!

In comparison with the average listener's broadcast receiving aerial, the aerials in use at Belfast are decidedly unique. There are three of them, each nine miles long, and spaced six miles apart throughout their parallel spans in order to obtain the maximum possible efficiency in long-wave reception. These three aerials are highly uni-directional, covering only a small angle, and are arranged to receive signals from European countries, beginning with Norway to the north, and sweeping down to Italy in the south.

Of interest to those accustomed to the idea of "one aerial, one receiver" is the fact that a multiplicity of receivers is worked on each of three Beverage aerials, each receiver being provided with wave-trap and filters so that signals from the desired transmitter are taken off the aerial without interference from any of the other nearby receivers. Several stages of high-frequency amplification precede the detector in each case, followed by several stages of L.F. amplification, note filters to eliminate jamming, and limiting devices, which latter are for the purpose of reducing the effects of static and ensuring that the signal level shall at all times be above the static or other noise level.

The incoming signals, after having been intercepted at Belfast, amplified and filtered clear of jamming and static, are then automatically relayed over leased telegraph lines to the central office in New York. At the latter point, the signals, after amplification to make up for line attenuation, are automatically recorded on high-speed recorders, the inked paper tape from which passes before an operator seated at a typewriter, who transscribes the wavy lines representing the dots and dashes of the Morse code into letters, words, sentences, and finally into complete radiotelegrams.

To handle the volume of traffic going through the Belfast station alone, including radiotelegrams from Norway, Sweden, Great Britain, Germany, France, Holland, Poland, and Italy, requires a permanent staff of ten men to look after and operate the station equipment.

THE DANGERS OF DETUNING.

WITH a sensitive receiver, it is often necessary to have some simple means of cutting down the volume of sound received from the local station, or even from some of the more powerful distant stations, and the obvious method that suggests itself is that the volume should be reduced to a sufficient extent to prevent overloading by detuning one of the circuits of the receiver.

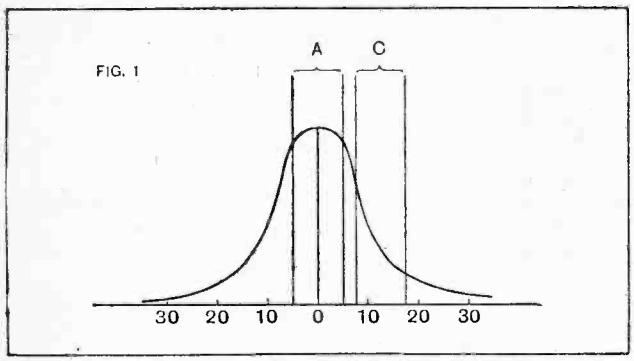
Applied wisely, detuning can be a very satisfactory solution of the problem, but if care is not taken a considerable amount of distortion can quite easily be introduced, more especially if the circuit that is detuned is of low resistance, and if the decrease in volume required is not large.

Effect of Side Bands.

The origin of the distortion can be seen from an examination of Figs. 1 and 2, which represent the selectivity curve of a tuned circuit. Distances outward from the centre line represent distances in kilocycles from the resonant point, while the vertical height of the curve represents the voltage supplied by the tuned circuit to the valve following it, which we may regard as signal strength.

The Dangers of Detuning.—

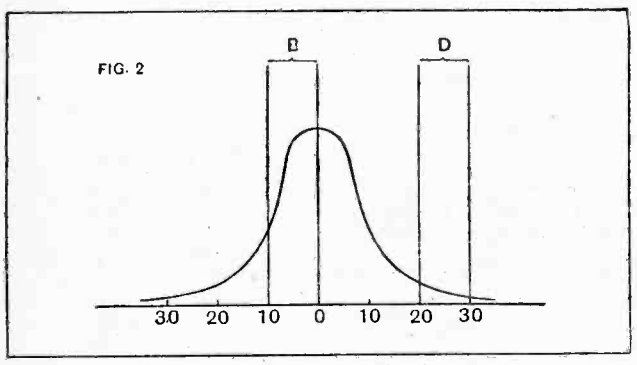
The wave sent out by a transmitter is not a simple wave of one frequency only, but covers a small band of frequencies extending about five kilocycles on either side of the nominal frequency of the station. In this band of frequencies the centre portion carries the low notes of



music or speech, while high notes and overtones are carried by the two outer fringes. If the tuned circuit of our diagrams is adjusted so that it is accurately in tune, then the ten-kilocycle band from the transmitter will fall as shown at A, in Fig. 1, and substantially the whole of the band falls on the peak of the resonance curve of the tuned circuit. Thus there is no discrimination in the tuning between the centre and fringes of the band, so that high and low notes receive the same treatment.

Slightest Detuning May Cause Distortion.

On slight detuning, the peak of the curve is moved with reference to the transmitter, so that the frequency band falls on the curve in some such way as suggested at B, in Fig. 2. Here it will be seen that one-half of the band is received at full strength, while the other half is cut down very considerably by being situated on the steeply falling side of the peak, so that while half of the high notes, and practically all of the low notes, are heard well, the remaining half of the high notes is cut out more or less completely.



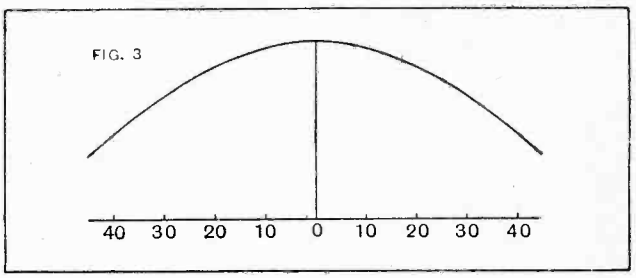
On further detuning, the centre of the band falls at the beginning of the lower part, or " skirt " of the curve, as shown at C, in Fig. 1. In this case one half of the high notes is accentuated, while the low notes and the remainder of the high notes are badly heard.

In either of these two cases, in which the tuned circuit picks out part of the total wave at the expense of the rest, there is discrimination between low and high notes, which inevitably results in distortion.

On still further detuning the circuit, so that the peak of the curve is so completely removed from the frequency-band of the transmitter that the whole of the band falls on the skirt of the curve, as at D in Fig. 2, the distortion disappears again, for once again all parts of the band receive equal treatment from the tuned circuit.

Damped Circuits.

It follows, then, that if it is desired to detune a receiver, and at the same time to avoid distortion, each tuned circuit must be adjusted either exactly in resonance with the station being received, or well away from the resonant point. The only exception that may safely be made is where one of the circuits, owing to damping either by the aerial, or by a grid detector, tunes flatly, so that it has a resonance curve of the type shown in Fig. 3. It will at once be seen from the figure that in such circum-



stances, no matter what position the frequency band may have with respect to the curve, no appreciable distortion can be introduced.

It must not be imagined that the distortion described here is purely theoretical and academic; it can be heard only too plainly in the loud-speaker whenever a really low-resistance circuit is tuned slowly through the wave-length of the local station, the distortion corresponding to B being particularly well marked. This type of distortion is heard at its worst when receiving on a frame aerial with a nearly oscillating detector, when the most minutely accurate tuning is necessary to centre the transmission on the very sharp peak of the resonance curve.

Use of H.F. Valve Rheostat.

Complete detuning is particularly useful as a volume control when receiving the local station on a modern neutralised receiver, in which the chief volume control is by the filament rheostat of the high-frequency valve. It often happens with such a set that the local station continues steadily to overload the output valve until the filament is turned right out, when dead silence supervenes. If the aerial circuit is now detuned at least far enough to ensure freedom from distortion, and the filament of the H.F. valve relighted, a position of the rheostat will be found at which the local station is received at convenient volume.

Detuning, then, cannot be used for fine control of volume, except when one circuit of the receiver is of high resistance, but when there is already a volume control of insufficient range, it can be made to provide a very valuable auxiliary control. A. L. M. S.

BROADCAST RECEIVERS

Brandeset IIIA

A General Purpose Receiver of Moderate Price.

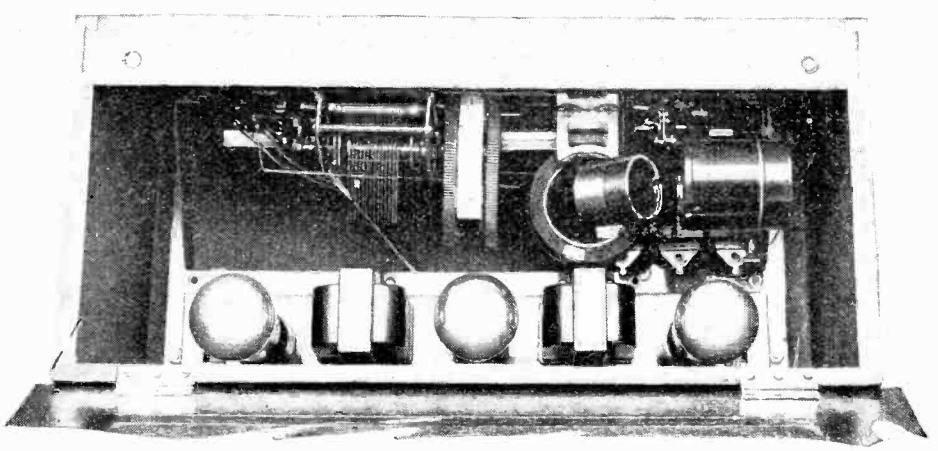
THE Brandeset IIIA belongs to that widely distributed species of receiver in which a reacting detector is followed by two low-frequency amplifying valves. In the struggle for existence this species is holding its own against the competition of various types of H.F. amplification chiefly on account of its robust simplicity and the ease with which a change-over from short to long waves can be arranged. The high-frequency amplification resulting from the use of reaction, if not equal to that obtainable with the latest H.F. methods, is considerable; but against this must be set the danger of causing interference with near-by receivers due to accidental oscillation Further, the selectivity of this type of receiver is, speaking generally, hardly adequate for modern conditions unless one is situated 10 or 15 miles from the nearest main station.

In the particular example under consideration, however, the selectivity is above the average, and at $3\frac{3}{4}$ miles from 2LO the alternative programme from 5GB can be enjoyed without the slightest background from London—this with a full-sized aerial. Similarly, foreign stations in the wavelength vicinity of 5GB can be well received while 2LO is transmitting, but lower down the scale distant reception is possible only during the intervals in the local transmissions. The selectivity on long waves is good also, and no difficulty is experienced in receiving Radio Paris clear of 5XX when using aerial terminal 3.

Quality of reproduction is satisfactory, and best results are obtained when receiving from the local station with only two valves in circuit. When using three valves the general tone seems high-pitched, but this may be due to the fact that we have been accustomed lately to hearing over-emphasis of the bass—a common fault in modern cone loud-speakers.

So much for general performance; now let us consider one or two salient points of the design. In the first place we would congratulate the manufacturers on the general production of the set. It is evident that a good deal of time and thought have been given to each individual component and, where necessary, pressed parts have been used for which special tools must have been necessary. As a result, the finished product possesses individuality, a quality absent from sets merely assembled from standard components.

The cabinet is of fumed oak, wax polished, and the panel fittings are finished in oxidised silver. All components are built into an aluminium "chassis," the front panel of which lies behind the oak front panel of the cabinet and forms a screen for hand capacity.



Plan view of interior from back of set; the tuning and reaction coils are assembled in the top right-hand corner.

Broadcast Receivers—Brandeset IIIA.—

The tuning arrangements are neatly assembled at the left-hand end of the cabinet (right-hand top corner in plan view) and consist of a single-layer coil for short waves and a duolateral long-wave coil with their axes at right angles. The reaction coil which couples with either coil is controlled by the left-hand knob on the front panel and a neat wave-change switch is incorporated in the plate below this knob. The Brandes tuning condenser is mounted with its spindle parallel to the panel so that drum control may be used. There are two drums, one for coarse and the other for fine tuning, and the knurled edges are framed in an oxidised plate. The scale is visible through a small "window" between the knurled drums. The makers have espoused the kilocycle system of identifying stations, and the dial readings are the reverse of the usual convention; this is at first confusing to those accustomed to associate increasing dial readings with increasing wavelengths.

The low-frequency valves are transformer-coupled, and the first stage can be switched off if desired by the "Volume" control on the right-hand side of the panel; the loud-speaker is, therefore, always supplied from the last valve with its higher H.T. and grid bias.

Aerial, earth, and loud-speaker leads are connected at the back of the cabinet, and L.T., H.T., and grid bias are supplied through a multiple cable permanently connected in the set. The terminal connections are made to "Refty" spring terminals, which save time in connecting, and do not work loose; the knack of using these terminals is to push the top well down before attempting to insert the wire, otherwise, if thin, it may work down the side and jam.

With regard to the battery leads a criticism is necessary; in both of two sets we have tried, the H.T. leads to the detector and first L.F. amplifier were reversed. Thus 80 volts would be applied to the detector and 40 volts to the first L.F., instead of *vice versa*. Those readers who already have one of these sets in use would do well to test their H.T. connections to ensure that this fault does not exist. To do this, turn the "Volume" control to position 2 and tune-in a station. The middle valve under these conditions will be extinguished, and if the H.T. lead to this valve (yellow, 80+) is disconnected from the battery, no change in the reception should take place; on the other hand, the removal of the detector lead (green, 40+) should completely stop reception. If it does not, reverse the positions of the green and yellow leads on the H.T. battery.

Finally, a word of praise for the operating instructions which are admirably written from the point of view of the ordinary listener.

At £6 15s. the Brandeset represents good value; another type incorporating a battery compartment in the base is available at £8 5s. To these prices must be added Marconi royalty and the cost of accessories.

The address of the makers is Messrs. Brandes, Ltd., 2 and 3, Norfolk Street, London, W.C.2.

TRANSMITTERS' NOTES AND QUERIES

General Notes.

Mr. W. A. Allwright (2ABR), 80, High Street, Lewes, Sussex, is willing to stand by on 23 and 45 metres on Sundays from 11 a.m. to 12.30 p.m., 2 to 3.30 p.m., and 6 to 7 p.m. for transmitters desiring reports.

Ing. Armando Marzoli (1MA), Via Bramante 3, Rome-147, is transmitting every Sunday between 17.30 and 19.30 G.M.T. the programme from Depolavoro Remuria Theatre on a wavelength of 43.5 metres and with an input of 14 watts.

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An American Amateur.

Mr. J. S. Roelf, Bartonville, Illinois, is anxious to receive reports from British amateurs of signals from his two stations, 9ARN and 9CPH. The first of these stations transmits with an input of 100 watts, using a Kenotra rectifier and a four-wire cage aerial and counterpoise.

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Correction.

We regret an error in our note on page 846 of our issue of December 28th, 1927. The correct address of Mr. F. C. Mason's station, 2BXH, is 80, Forburg Road, N.16, and the concluding words of the paragraph should, of course, read "on wavelengths *between* 5 and 200 metres."

Calibration Signals.

With reference to the note on page 786 of our issue of December 14th, 1927, the Hon. Sec. of the QRP Transmitters' Society informs us that it has been decided to continue this service according to the following schedule:—

2nd Sunday in month (commencing Feb. 12th, 1928).

10·00 G.M.T., approx. 46 metres (exact wavelength announced at the time).
10·05 G.M.T., approx. 45.5 metres (exact wavelength announced at the time).
10·10 G.M.T., approx. 45 metres (exact wavelength announced at the time).
10·15 G.M.T., approx. 44.5 metres (exact wavelength announced at the time).
10·20 G.M.T., approx. 44 metres (exact wavelength announced at the time).

4th Sunday in month (commencing Feb 26th, 1928).

14·00 G.M.T., approx. 46 metres (exact wavelength announced at the time).
14·05 G.M.T., approx. 45.5 metres (exact wavelength announced at the time).
14·10 G.M.T., approx. 45 metres (exact wavelength announced at the time).
14·15 G.M.T., approx. 44.5 metres (exact wavelength announced at the time).
14·20 G.M.T., approx. 44 metres (exact wavelength announced at the time).

Transmissions will be: "QRP de G 5YK. Here QRP T.S. calibration service QRH—metres," followed by half-minute dash and AR.

The transmitter used comprises a master oscillator with two amplifiers. The main amplifier dissipates 50 watts. Power for the three valves is obtained from a 1,000 volt 150 watt M.L. generator, suitable potential dividers being used to obtain lower voltages for the first stage amplifier and oscillator valves.

Communications should be addressed to the Hon. Sec., Mr. C. D. Abbott, 129, Cavendish Road, S.W.12.

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New Call-signs and Stations Identified.

2ZL	H. W. Haydon, Electra House, Worcester St., Gloucester. Transmits on 200 and 440 metres. (Change of address.)
6 IN	(ex 2AXI), F. Inchley, 127, Holly Lane, Erdington, Birmingham. Transmits on 150-200 metres.
6NT	(ex 2BHY), C. S. Hunt, 53, London Rd., Bromley, Kent.
6VQ	(ex 2AWH), L. S. Crutch, 15, Mundania Rd., East Dulwich, S.E.22.
2ABR	W. A. Allwright, 80, High Street, Lewes, Sussex.
2BGM	J. H. Cant, 295, Hither Green Lane, Lewisham, S.E.13.
2BWB	A. Blake, Ivy Cottage, Cotessey, Norfolk. (Change of address.)
XEP 1MA	Lieut.-Commr. Gabriel Prior, Portuguese Cruiser "Adamastor," now in Chinese waters.

PATENT ABUSES.

The Law in Relation to Licences of Right.

By A BARRISTER-AT-LAW.

WHEN an inventor has succeeded in winning a passage through the Patent Office, he will find his rights and privileges set out in the formal grant of Letters Patent in the following terms:—

> We (King George V) of our especial grace, certain knowledge and mere motion do by these presents . . . give and grant unto the said patentee our especial licence, full power, sole privilege and authority that the said patentee by himself, his agents, or licensees, and no others may . . . make use exercise and vend the said invention . . . in such manner as to him or them may seem meet, and that the said patentee shall have and enjoy the whole profit and advantage from time to time accruing by reason of the said invention during the term of sixteen years. . . .

This undoubtedly appears to give the lucky patentee an absolute monopoly to do just as he likes with his invention. He may keep manufacture entirely in his own hands and charge his own price. He may grant licences to whom he likes, or refuse to grant any licence, at will, or he may refuse either to manufacture himself or to allow anyone else to do so, and so keep the public from enjoying any of the advantages of his invention.

Limitations of Patentees' Rights.

Of course, the average patentee naturally wants to secure the widest possible market consistent with the largest revenue by way of royalties. He will therefore aim at manufacturing on a large scale, and if the demand exceeds his own powers of supply he will grant licences to other manufacturers. Further, he will fix his royalty fee in accordance with the principle that a reasonable selling price and a large output brings in a better revenue in the long run than a luxury price and a restricted market.

This is the straightforward case. Sometimes, however, ulterior motives may come into play. For instance, a foreign manufacturer might seek to secure a British patent simply in order to prevent the article from being manufactured here in competition with his own activities abroad, or a British manufacturer might take out what is called a "blocking" patent with the object of protecting some improvement upon existing apparatus, not because he intends to market the improvement itself, but simply to prevent someone else from doing so. In this way he may aim to safeguard the sale of a possibly inferior article for which expensive plant has already been laid down before the possibility of the later improvement was realised.

Again, there is the possibility of an obstinate patentee deliberately restricting the output of an article for which there is a wide demand, thus depriving the public of benefits to which they are entitled. Such possibilities were formerly part of the privileges appertaining to the possession of Letters Patent. They fell inside the scope of the monopoly grant and there was no available remedy.

Some twenty years ago, however, steps were taken by Parliament to prevent arbitrary abuses of this kind, and a series of enactments were passed which culminated in the Patents Act of 1919.

Here, for the first time, it was made clear that the consideration due from the inventor in return for the grant of Letters Patent was not simply and solely the disclosure of a new invention, in order that the public might enjoy the benefits thereof once the monopoly period of sixteen years had expired.

Granting of Licences.

In addition the inventor is now bound to make a direct contribution to the trade of the country by taking active steps to bring the new invention into commercial use without undue delay. He cannot, for example, prevent the manufacture of the patented article in the United Kingdom from ulterior motives.

Nor can he use his monopoly powers to encourage foreign trade to the prejudice of home industries. Nor, finally, can he hinder trade in this country by unfairly refusing to grant manufacturing licences.

The remedies provided by the Act for such abuses are (a) Revocation of the patent grant where no other relief appears possible, or (b) the issue of "licences of right."

Under existing laws, any interested person may at any time apply to the Comptroller of the Patent Office alleging that there has been an abuse by a patentee of his monopoly rights, and may ask for relief either as at (a) or (b) above, on the following grounds, amongst others:—

(I) That four years have elapsed since the date of the patent grant and that the invention is not worked on a commercial scale, and no satisfactory reason can be given for such non-working.

(II) That the demand for the patented article in the United Kingdom is not being met to an adequate extent and on reasonable terms.

(III) That by reason of the refusal of the patentee to grant a licence or licences upon reasonable terms home industry is being prejudiced.

(IV) That home industry is being unfairly prejudiced by the conditions attached by the patentee to the purchase, hire, licence, or use of the patented article.

If the Comptroller is satisfied that a case of monopoly abuse has been established he may order the patent in question to be endorsed with the words "licences of right," or he may order a special licence to be granted to the applicant by way of relief, and upon such terms as are equitable to all parties; or in an extreme case he may order the patent to be revoked.

When a patent has been endorsed "licences of right"

Patent Abuses.—

any person is entitled *as of right* to become a licensee under the patent. But, of course, he does not acquire such a licence on his own terms. The rights of the patentee, and of any existing licensees, are still adequately safeguarded.

For instance, in the case of any patent where a considerable number of licences have already been issued on reasonable terms, it is unlikely that either the Comptroller of the Patent Office, or the Court, would consider that an abuse of the monopoly grant had been established merely because one or more particular persons could not succeed in obtaining a licence.

Although a patentee is now forbidden by law to hamper home industry by unfairly refusing to issue an adequate number of licences, he is by no means compelled to grant licences indiscriminately. So long as he meets the reasonable demands of the public by ensuring an adequate supply of the patented article he does not abuse his patent rights, and there is no case against him.

Even where "abuse" has been established and licences are issued to applicants "as of right" and by way of a penalty against the patentee, the Act states quite definitely that the Comptroller in issuing such licences must be guided by the following considerations, amongst others:—

(a) He shall on the one hand endeavour to secure the widest possible use of the invention in the United Kingdom consistent with the patentee deriving a reasonable advantage from his patent rights.

(b) He shall on the other hand endeavour to secure to the patentee the *maximum advantage* consistent with the invention being worked at a reasonable profit in the United Kingdom.

In conclusion, it may be added that a patentee may if he so desires voluntarily apply to have his patent endorsed "licences of right." Under certain conditions this may serve to encourage commercial exploitation, particularly where the inventor has no opportunity of coming directly into contact with those having the capital or plant necessary to market the invention. It may be added that once a patent has been so endorsed the official renewal fees necessary to keep it alive are reduced to one-half those normally payable.

NEWS FROM THE CLUBS.

Multi-Feed Aerials.

"Experiments with Multi-Feed Aerials" is the title of a paper to be read to-morrow (Thursday) by Mr. W. H. B. de M. Leathes at 7 p.m. at a meeting of the Institute of Wireless Technology at the Engineers' Club, Coventry Street, W.

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

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X-Rays.

Members of the Bristol and District Radio Society listened to an interesting lecture on "X-rays" given by Mr. Frank Holmes on Friday, January 6th. The lecturer described the evolution of the X-ray tube, and exhibited several different types, each an improvement on its predecessor, and concluded with a summary of the various applications of X-rays, particularly in medical work.

Hon. Secretary: Mr. S. J. Hurley, Arno's Vale, Bristol.

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Neutralised Short-wave Set.

A short-wave receiver employing a perfectly neutralised H.F. valve was described and demonstrated by Mr. H. A. Clark (G6OT) at the last meeting of the Q.R.P. Transmitters Society. Although neither aerial nor earth was used many stations were brought in at great strength during the demonstration.

Hon. Secretary: Mr. C. D. Abbott (G6TA), 120, Cavendish Road, S.W.12.

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A Visit to Daventry.

By the courtesy of the B.B.C. and of Mr. Hotine, Engineer-in-charge of the Daventry stations, members of the Selfridge Radio Society were able to visit 5XX and 5GB on Sunday, January 8th. The party left the store at 10.30 a.m., and proceeded by road to Daventry, where they were welcomed by the Engineer-in-charge and his staff. After spending a most interesting hour at 5XX, the party adjourned to its younger brother 5GB, which proved even more interesting, as the atmosphere of this station appealed to the experimental instincts of the party. In inspecting the long-wave station the party was impressed by the extraordinary cleanliness and order: the station seemed more like a showroom, in contrast to its smaller neighbour.

Hon. Secretary: Mr. J. A. Edley.

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Exhibition at Southend.

The Southend and District Radio Society held their fourth annual radio exhibition in the Boys' High School, Southend-on-Sea, on January 7th, and the exhibits in both the amateur and professional sections proved that a definite advance has been made in the radio art during the past twelve months. An interesting feature of the exhibition was the demonstration by Mr. F. H. Haynes, assistant editor of *The Wireless World*, of a coil-driven loud-speaker operated in conjunction with a receiver and special amplifier which could be used for either wireless or gramophone reproduction. The loud-speaker proved its wonderful capabilities by delivering enormous volume without distortion over practically the whole audible scale of frequencies.

A tour through the trade section showed that the local wireless enthusiasts have no reason to venture beyond the borough boundaries for their radio requirements. Each exhibitor was allotted certain hours for demonstrating his products, and the absence of interference reflects credit on both the organising committee and the exhibitors for the manner in which this was carried out.

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"The Wirelesss World" Challenge Cup.

The silver challenge cup presented by Mr. H. S. Pocock, Editor of *The Wireless World*," for the amateur exhibit of most outstanding interest was won by Mr. L. J. Davis for a Morse recording apparatus constructed from parts which can be found in the average experimenter's workshop.

Among the first prize winners in the various sections were the following:—

High School Boys.—Mr. L. S. Renall.

Elementary School Boys.—Mr. R. Thorn.

Short-wave Sets.—Mr. R. C. Horswell.

Testing Apparatus.—Mr. L. C. Iles.

Three-valve Sets.—Mr. S. A. Balls.

Four (or more) Valve Sets.—Mr. W. L. Savage.

Sets of Coils.—Mr. R. Denham.

Cone Loud-speakers.—Mr. H. Jagged.

Coil-driven Loud-speakers.—Mr. L. J. Davis.

Receiving Set Cabinets.—Mr. E. W. Lockhart.

Remote Control Systems.—Mr. B. Costin.

H.T. Supply Units.—Mr. W. L. Savage.

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Value of Debates.

The enlivening effect of a debate on a controversial subject is often overlooked by club secretaries. Next month a hot debate is promised among members of the Bradford Radio Society who will discuss the question: "Should you earth your aerial when your set is not in use?"

By Our Special Correspondent.

Controversy: What Next?—Daventry.—Anonymous Letters.—The "Wireless School".—Post Office and the Licences.—Burns Nicht.—Chaos at Aberdeen.

Controversy in Broadcasting.

Last week's meeting of the B.B.C. Board of Governors evoked the official statement that the whole question of broadcasting controversial matter had had for some time past, and was still having, the Governors' careful consideration.

This pronouncement offends nobody, but it will be interesting to observe how long the careful consideration lasts before a more or less definite announcement of policy is made.

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Daventry Dolours.

The situation at 5GB can hardly be described as a happy one, and the engineers admit that the 5XX masts are still shielding the new aerial of the experimental station.

At the moment of writing I have no reports from the Birmingham area, but London listeners report "no change." No one expects 5GB to be as powerful as 2LO in the London area, but it does seem strange that 5GB is not now so strong as it was in the early days before the increase in power.

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"Kelmsford" or "Chellumsford"?

Charity should be extended to the 2XAF announcer who was in difficulties last week wondering whether he should call it Kelmsford or Chellumsford. How many Englishmen know whether to say Shenectady or Skenectady?

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Anon.

That unattractive type of human animal—the anonymous letter writer—is fairly often represented in the Savoy Hill mail bag, and his efforts generally receive the attention they deserve. But the animal made his appearance recently in an aggravated form by sending in an anonymous letter—unstamped!

Can you beat that?

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Always Unpleasant.

The unidentified writer always has something unpleasant to communicate. If an anonymous letter said: "Thanks for a delightful programme" there would be a rush for the official smelling salts.

Lessons for 8-year-olds.

In issuing the programme of school broadcasts for the new term, the B.B.C. Education Department announces a special course for younger children, consisting of a number of the best stories from history and mythology. The idea is to accustom the 8- or 9-year-olds to the loud-speaker, so that they, too, may be able a little later on to reap the full benefit from the courses which required more concentration.

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How the "Wireless School" Grows.

School broadcasting has grown so rapidly of late that its magnitude is hardly realised by the majority. Some five thousand schools are known to have receiving sets, and the actual number may be considerably greater. Last term 80,000 school "Aids to Study" pamphlets were applied for—a figure which gives some idea of the magnitude of the "Wireless School." In this way great numbers of children, often deep in the country and very much "out of things," are coming under the influence of great experts and great teachers, and the life of the schools is enriched and freshened.

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The Lost Chord?

Let us hope that the non-appearance last week of Mr. Reginald Foort in an advertised recital on the Plaza organ

AN AWKWARD POINT.

A DILEMMA AT DAVENTRY. The engineers at 5GB have reached a stage in their experiments where they can please Birmingham listeners only at the expense of other parts of the country. The trouble, which might have been foreseen, is due to the shielding effect of the 5XX masts.

means nothing more than a hope deferred. Some misunderstanding seems to have arisen between the Plaza authorities and the B.B.C. concerning Mr. Foort's first recital from that theatre, but I have no doubt that matters will be happily arranged within a week or two. Reginald Foort is too good an organist to be allowed to exit without a murmur.

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Post Office and Licences.

One of the bright ideas of the past week concerns the provision of funds for running the Empire broadcasting service. The idea takes the form of a question: Why not use the surplus licence money now lining the coffers of the Post Office?

How do we know there is a surplus? No direct answer is possible to this question, but we can make some shrewd surmises.

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Is There a Surplus?

According to the agreement between the Post Office and the B.B.C., the former automatically takes 12½ per cent. from each licence payment. Of the remaining sum the B.B.C. is allowed 90 per cent. on the first million licences, 80 per cent on the second million or portion thereof, and 70 per cent. on the third. The Post Office keeps the rest to cover clerical charges, etc.

Now a little calculation will show that the books at St. Martin's-le-Grand *ought* to show a comfortable little balance in hand. The approximate number of licences issued in 1927 was 2,350,000. Calculating on the above scale of deductions we shall find that the Post Office should have acquired at least £300,000 during the past year. This is a big figure even allowing for overhead charges.

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The Finance of Empire Broadcasting.

It is mistakenly supposed that we have an embryonic Empire broadcasting service in the shape of 5SW. This is not the case. The Chelmsford station is purely experimental, and there is no financial arrangement which would permit of special programme material.

A mandate for an Empire service would have to come from the Government, which, it may be presumed, would first negotiate with the Dominion Governments to ascertain to what extent they are prepared to share in the financial burden.

If the Mother Country bears a part of the cost where is the money coming from? Those Post Office coffers are very inviting!

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Wu Li Chang.

One of *the* events of the near future is the resurrection of "Mr. Wu," for broadcasting purposes, on Monday, January 23rd. "Mr. Wu" made its name as a successful play just before the war, running for no fewer than 400 performances at the Aldwych Theatre, with Matheson Lang in the name part. In the broadcast version Matheson Lang will reappear in the same *rôle*, and Mr. Evan Thomas, who originally created the character of Basil Gregory, will also take part.

Not the least interesting feature of the play is the fact that the incidental music was composed by that popular B.B.C. conductor, John Ansell.

FUTURE FEATURES.

London and Daventry (5XX).

JAN. 22ND.—Service from St. Dominic's Priory. Chamber Music.
JAN. 23RD.—Light Orchestral Programme.
JAN. 24TH.—Massenet Programme.
JAN. 25TH.—"Damon and Phillida" (John Gay).
JAN. 26TH.—Hallé Concert (from Manchester).
JAN. 27TH.—National Concert relayed from the Queen's Hall.
JAN. 28TH.—Running commentary on 4th round of F.A. Cup.

Daventry Experimental (5GB).

JAN. 22ND.—Symphony Concert.
JAN. 23RD.—"Sweethearts," a play by Sir W. S. Gilbert.
JAN. 24TH.—Military Band Concert.
JAN. 25TH.—Programme of Music by B.B.C. Composers.
JAN. 26TH.—"Grandmother's Golden Wedding," an entertainment arranged by Mona Pearce.
JAN. 27TH.—"A Museum Episode," a farce by Stuart Ready.
JAN. 28TH.—Operatic Music and Songs.

Cardiff.

JAN. 23RD.—A Tale of Alsatia—a Picaresque by Vincent Thomas.
JAN. 25TH.—Burns Night Celebrations relayed from the City Hall. Guest of Honour, Sir John Reith.

Manchester.

JAN. 22ND.—Organ Recital and 'Cello Solos relayed from Manchester Cathedral.

Newcastle.

JAN. 25TH.—Speech by Sir John Samuel at the Newcastle Burns Club Dinner relayed from the Central Station Hotel.

Glasgow.

JAN. 25TH.—Robert Burns Programme.

Aberdeen.

JAN. 24TH.—"Chaos," a fantastic novelty not to be taken seriously.

Belfast.

JAN. 23RD.—"Sea Silence," a play by Edwin Lewis.
JAN. 28TH.—Running commentary on Rugby International—Ireland v. France—by Capt. R. A. Lloyd.

A Change at the Savoy.

Have your heard the new Savoy war-cry? Here it is "The Savoy Orpheans, Fred Elizalda and his music, and the Savoy Tango Band." Mr. Fred Elizalda is the successor of Mr. de Mornys.

A Broadcasting Murder.

Broadcasting has many sins to answer for, but I doubt whether, until now, it has ever been held responsible for a murder. The other day, however, an ill-starred youth was executed at Columbus, Ohio, for the murder of a woman and her son. He explained in his defence that the music over the wireless made him feel queer and prompted him to commit the crime.

I hope the Savoy Hill programme department will take this to heart.

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The Wanderer's Return.

A welcome return to the 2LO microphone will be that of Ernest Longstaffe on Saturday next, when he will present his "Black Cat Cabaret." Ernest Longstaffe has had a lengthy spell at Blackpool, where he has been responsible for a number of outside broadcasts *via* Manchester.

Saturday's presentation is described as "a London night revue"; the book and music are both by Longstaffe himself.

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New Temple Thurston Play.

Mr. Temple Thurston is the latest adherent to the ranks of those writers who believe in radio drama. His new play is to have its first night in the Savoy Hill studio on February 7, when it will be broadcast.

"The Burden of Women" deals with the hard life of the sailor's wife who awaits the return of her man from the sea.

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Burns Nicht.

Of the thousands of speakers who will propose "The Immortal Memory" at Burns Gatherings up and down the country on January 25, none will have an audience anything like the size of that which will listen to the Rev. James Barr, B.D., M.P., when he concludes the broadcast "Burns Night" in the Glasgow studio—relayed by all Scottish Stations, Daventry and London—with a ten-minute address on "The Immortal Memory." Mr. Barr has just returned from a 37,000 miles' tour in Australia and New Zealand, during which he lectured to hundreds of audiences on many subjects, but particularly on Burns—about whose work he is an authority.

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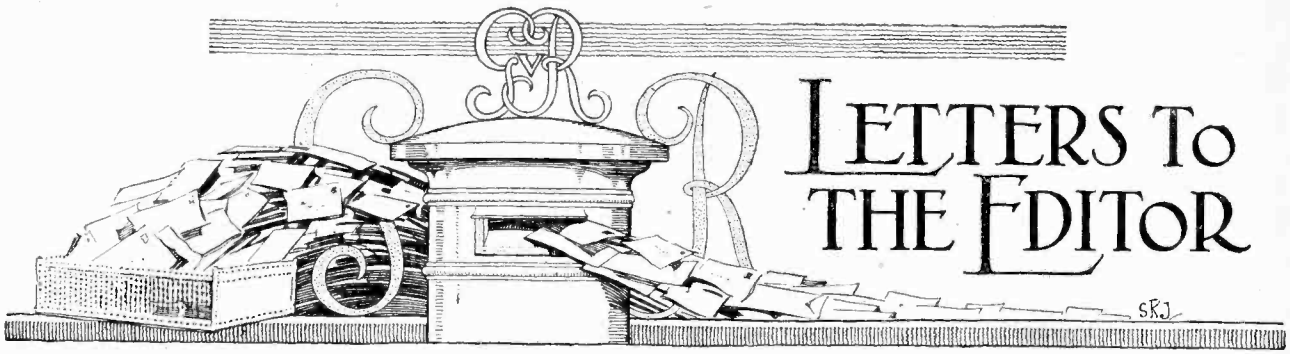
Chaos!

The Aberdeen station seems to have the happy knack of presenting everyday happenings in their most amusing light. In "Chaos," the show which we are promised on January 24, the Aberdeen staff have turned the searchlight on their own activities and imagine the terrible muddle which would occur if a complete novice were suddenly put in charge of the intricate system of control. With relays from various other stations, sudden switches-over from one studio to another, and outside broadcasts from clock-towers, dance-halls, and so on, there is plenty of room for a glorious mix-up.



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.

INTER-STUDIO JAMMING.

Sir,—I notice in your issue of December 14th, page 800, that you mention inter-studio jamming. At that date I had already been in communication with the B.B.C., pointing this out, but that it was not inter-studio, since it occurred when both stations were taking outside broadcasts. The B.B.C. have investigated, and report that they have traced and cured this trouble. Trusting this will interest you. JOHN A. BENJAMIN.

Selly Park, Birmingham.
January 6th, 1928.

OPTIMISTIC PERFORMANCE CLAIMS.

Sir,—I agree with Mr. S. G. Black in his protest which appeared in *The Wireless World*, December 28th, regarding the exaggerated performance claimed for sets. It is very doubtful if 0-v-2 sets will reproduce in this district (within three miles of Glasgow Station) the wonderful results which they are supposed to give; in fact, one of them demonstrated by a dealer in Glasgow could only give the local station.

As local station sets, they are perhaps excellent but they are not "distance getters" up here. "AERIO."

Cathcart, Glasgow.
January 2nd, 1928.

Sir,—I note with great astonishment the letter published in your issue of the 28th inst. from Mr. S. G. Black on the question of the performance of three-valve receivers. Although an ardent believer in H.F., I made up a certain three-valve receiver now being extensively advertised by a firm of valve makers. The results obtained were, to me, astonishing. Thirty stations are obtainable on the speaker—headphones have not been employed—in fact, I should view the use of these with considerable trepidation owing to the great amplification. To state that the whole of Cornwall is outside the L.S. performance of a three-valve set is nonsense, as several of my friends will testify. When the Savoy bands are S.B., Aberdeen is obtainable free from 5GB, also 2LO is free of Leipsic, and 5XX from Radio Paris; so selectivity is not lacking. While I do not wish to state that all these stations are obtainable any night, a choice of programmes is always available, and it is my belief that the designers are modest in their claims of what their circuit can be expected to do. It may interest Mr. Black to know that 5XX can be received at quiet L.S. strength in the morning on two valves—0-v-1. And, if he is interested, I will forward him particulars of circuit and components used. In any case, the imputation is uncalled for; the sets do give the results claimed, are cheap, easy to build and run, and bring the boon of radio to many who might otherwise be deterred by the sight of many controls and valves. W. A. E. ROWETT.

Buckland, Fairbourne Road, St. Austell, Cornwall.
December 29th, 1927.

Sir,—I am pleased your correspondent wrote about the "optimistic" claims made by makers of modern three-valvers and similar receivers. Any enthusiast cannot but feel "sick" when he reads that "*twenty, and thirty, stations can be received on loud-speaker*" on plain 0-*v*-2 *sets*, for he knows that it is more or less impossible on average conditions; and, after all, that's where such sets are required!

This does more harm than good among the novices, who are only misled by such statements!

New Barnet. FRANK APPLETON.
January 3rd, 1928.

DATE OF THE ANNUAL RADIO EXHIBITION.

Sir,—I heartily agree with the remarks of Mr. Toulmin in December 28th issue of your valued paper, and, like that gentleman, suggest that the correct time for the above show is June.

A friend of mine, having received from a well-known manufacturer leaflets dealing with battery eliminators, decided to build up one of the given circuits, and proceeded to procure the necessary material specified. After spending some pounds, he was informed that certain of the specified articles could not be had, and so he is left with three or four pounds' worth of useless chokes, condensers, etc., until such time as the manufacturers make up their minds to get on with the job. When are the manufacturers going to wake up? One could fill all the pages of *The Wireless World* with examples like these, but space is too precious for any more. W. H.

Glasgow.

WHY GROUSE?

Sir,—Why not start the year well with something other than a grouse? We have now:—

(a) First-class valves at 10s. 6d.
(b) A power valve at 12s. 6d. that will work on 50v.
(c) A large capacity British H.T. battery at 15s.
(d) A high-frequency valve that does much more than stimulate the owner's imagination.

It is now possible to get reasonable reproduction for the home of many stations at a cost for H.T. and L.T. of about 1s. a week.

For at least two, if not all of above, we have your columns to thank.

With all good wishes for 1928. WILLIAM B. WEST.

Deal, Kent.
January 10th, 1928.

IDENTIFYING STATIONS.

Sir,—Mr. D. Kingsbury's letter in your current issue certainly calls for comment, and I might certainly be led to believe that there must be three sides to a question, the third being the *outside*, from which angle he appears to have been writing.

All wireless stations should be compelled to reveal their identity frequently, just as all amateur transmitters must.

Ships have distinctive colours and markings, aerodromes, too.

Our streets have names and our houses names and numbers.

These signs are not for those who are familiar with them, but for those who are not. J. C. LANE.

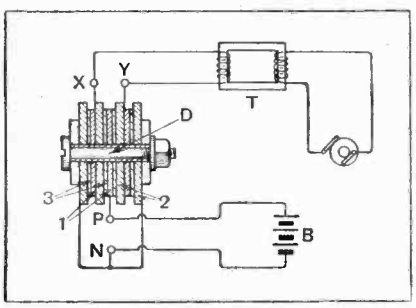
Rayleigh, Essex.

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

Dry Contact Rectifiers. (Nos. 277,103 and 277,405.)

Application date: June 9th, 1926.

Relates to asymmetric contact rectifiers adapted for dealing with high voltages. The electro-positive element consists of a metal of the chromium group, whilst the electro-negative element is an oxide of lead, manganese, or vanadium. The figure illustrates a full-wave rectifier charging a battery B fed through a transformer T. Oxide-coated electrodes 2 are pressed by a bolt D into firm contact with the positive electrodes 3, intermediate conducting plates 1 being provided as shown. With a pressure of one ton between the plates an output current density of half an ampere per square inch has been obtained. The A.C.

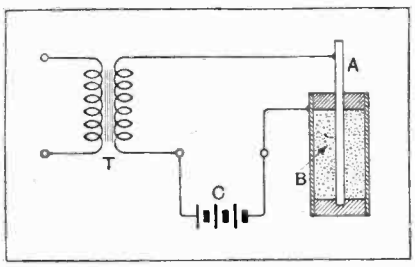


Section of dry contact rectifier and associated circuit. (No. 277,103.)

input terminals are indicated at X Y and the rectified output terminals at P N.

o o o o

A positive electrode, A, consisting of an oxide-coated tantalum strip, is held in surface contact with a film-forming electro-negative powder B, preferably of lead peroxide. Current from the transformer T will pass freely through the rectifier to charge the battery C when the direction of the pulse is from A to B, but pulses in the reverse direction are blocked owing to the high-resistance (or contact drop of potential) across the film formed between the two electrodes. The secondary winding is connected directly across the strip A and the metal walls of the vessel containing the lead peroxide. The container must be sufficiently rigid to withstand the



Dry contact rectifier. (No. 277,405.)

dynamic effects of electrostatic repulsion generated at the contact surfaces. Patents issued to S. Ruben.

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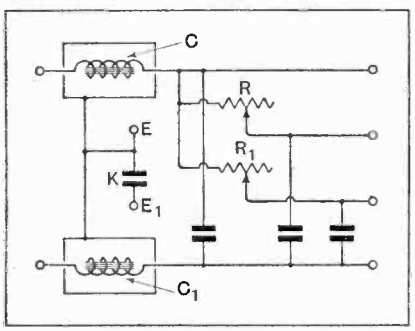
H.T. Mains-supply Unit. (No. 277,478.)

Application date: August 28th, 1926.

To improve the smoothing action, the choke-coils C, C_1 inserted in the positive and negative mains are shrouded in metal cases, which are connected together and earthed at two points E, E_1. The terminal E is connected to the earth terminal on the set, whilst the terminal E_1 in series with a 2-microfarad condenser K is



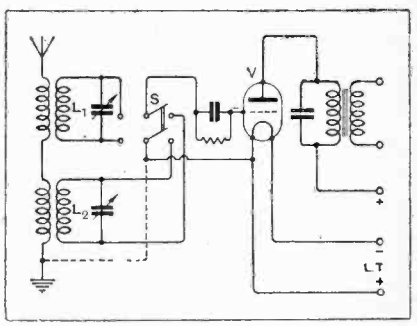
Smoothing circuit for H.T. supply from mains. (No. 277,478.)

connected to an earthed plate or to the aerial counterpoise. Different voltages are tapped off either from resistances R, R_1 arranged in parallel as shown, or from a single potentiometer resistance shunted directly across the mains. Patent issued to A. Hartley.

Selective Receivers. (No. 277,799.)

Application dates: September 14th, 1926, *and February 2nd*, 1927.

In order to receive alternately signals from two or more different stations free from mutual interference, the input circuit comprises a number of differently tuned units, together with suitable switching means whereby when one tuned unit is in circuit with the detector, the other tuned unit operates as a wave-trap or absorber to cut out interference, and *vice versa*. Various arrangements of acceptor, rejector, and absorber units, arranged to ensure selective reception along



Receiving circuit for reducing interference. (No. 277,799.)

these lines, are described in the specification.

In the typical example shown, two units L_1, L_2 are associated with two separate aerial inductances, the first unit L_1 being tuned, say, to station A and the second L_2 to station B. When the switch S is in the left-hand position, unit L_1 is inserted across the grid and filament of the detector V, and station A will be received. In this position, unit L_2 is open-circuited and acts as a wave-trap or absorber to cut out signals from station B. When the switch S is changed over to the right-hand position, the signals from station B are received, whilst those from station A are cut out by the trap unit L_1. Patent issued to British Thomson-Houston Co. and T. H. Kinman.

READERS' PROBLEMS

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

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

Mutual Interference.

Recently a neighbour erected an aerial parallel to my own, and now I experience great difficulty in receiving the local station at sufficient strength to operate the loud-speaker. This is not a question of oscillation but partial rejection when the neighbouring receiver is tuned to the same wavelength. Can you suggest any means of overcoming this difficulty, please? C. M.

When two aerials are erected in close juxtaposition to each other, it is inevitable that mutual interference will take place if either or both receivers are fitted with reactive detector circuits tightly coupled to the aerial. In the majority of cases mutual interference can be reduced to a minimum by the employment of loose coupling, and preferably with a stage of neutralised H.F. amplification before the detector. However, this will hold good only when both receivers embody these features.

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A.C. Supply for Moving Coil Speakers.

I have a moving-coil loud-speaker fitted with a 6-volt field winding, and wish to utilise the supply mains for the purpose of energising the field. Can you advise me how to achieve this when the supply is 220 volts 50 cycles? C. R.

A direct current is required for energising the pot magnet, so that it will be necessary first to rectify and partially smooth the mains supply. The most economical method of obtaining the required current would be to step down the voltage, by means of a transformer, from 220 to about 20, rectify and feed this to the winding of the electro-magnet. For the purpose of stabilising the output voltage an accumulator should be floated across the output of the charger, and this will function also as a smoothing device. The circuit of the arrangement suggested is given in Fig. 1, the charger shown being the "Home A.C. Charger" recently described in this journal. The maximum charging current should not be allowed to exceed 1.3 amps., and as it is possible that the field winding will take a greater current than this the accumulator will be slowly discharged. To compensate for this, the charging should be continued for a short period after the receiver has been switched off so as to bring the battery up to full charge.

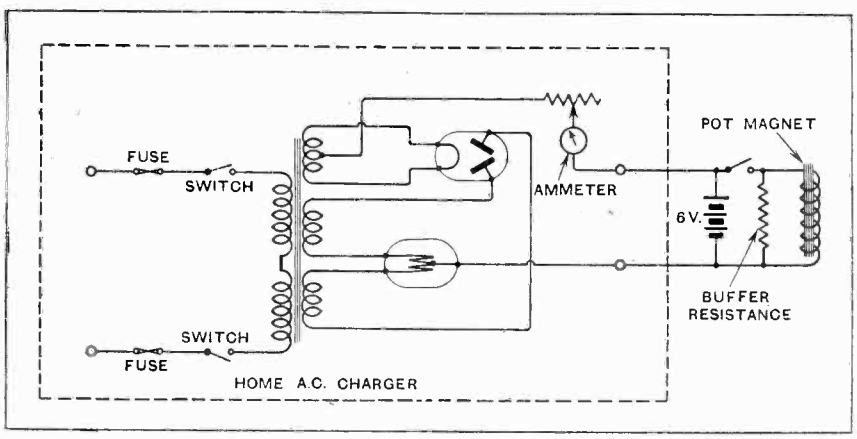

Fig. 1.—Method of energising 6-volt field winding of moving-coil loud-speaker from A.C. mains.

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Low-frequency Amplifiers.

I intend to build a receiver employing one H.F. stage and three L.F. stages, two of the latter being resistance-coupled, and one transformer-coupled. In which stage should I put the transformer? G. R. D. G.

In the case of a "mixed" L.F. amplifier the transformer stage should be used as the last stage, but we do not on any account advise the use of three L.F. stages, and should advise you to eliminate one of the R.C. stages. With three stages you will probably get trouble due to valve overload, and due to battery coupling. In all probability, unless extreme care is taken, the L.F. amplifier will howl at an audible frequency.

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Everyman Four Improvements.

I have studied the additional article on the "Everyman Four" receiver, which was published in your December 28th, 1927, issue, but find no mention made of how to add reaction if necessary on the long wavelengths. I believe this has already appeared in your columns, and should be glad if you would give me the necessary references. C. R.

You will find full details of how to add reaction to the long wave loading coil on page 289 of our August 31st, 1927, issue, and on page 316 of our September 7th, 1927, issue. Wiring diagrams are given, showing the necessary modifications.

RULES.

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

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

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

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

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

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

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

A Doubtful Point.

I am constructing the "Everyman-Four," and have noticed an apparent discrepancy in the instructions given. On page 31 of the book the author gives instructions for using fixed filament resistances when using 2-volt valves, although on page 29 it states that they may be dispensed with altogether. I shall be glad if you will clear up this difficulty. H. T. R.

On page 29 the author is discussing the question of using a 2-volt valve as detector in conjunction with 6-volt valves used elsewhere in the set. Since, of course, it will be necessary to use a 6-volt accumulator to provide for the 6-volt valves, it is obvious that a resistance must be connected in the filament circuit of the 2-volt detector in order to drop the superfluous 4 volts, or otherwise the valve would be burnt out. On page 31 of the book, the author is discussing the question of using 2-volt valves throughout in the set, with, of course, a 2-volt accumulator, and obviously in these circumstances no resistance will be necessary in the filament circuit of the detector valve or any other valve.

This matter was more fully dealt with in reply to "A. W. F." on page 315 of our September 7th issue.

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Is a Choke Filter Output Circuit Necessary?

I am building a two-valve receiver for loud-speaker work on the local station only. I presume that, using only two valves, it will not be necessary to use a choke-filter output circuit, and I should be glad if you will confirm this. N. H. R.

The desirability of using a choke-filter output circuit does not depend at all on the number of valves used, and it is just as important for you to use a choke-filter output circuit with your two-valve set as in the case of, say, an eight-valve superheterodyne.

When using a loud-speaker, the last valve in any receiver, that is, the output valve, should always be of the power type, no matter whether it is preceded by only one valve or even by a crystal detector, or by several stages of H.F. amplification, such, for instance, as in the case of a superheterodyne receiver. A power valve, of course, has a comparatively heavy plate current, which, if allowed to pass through the windings of an ordinary loud-speaker, is liable to cause saturation of the iron core of the loud-speaker, because, obviously for physical reasons, it is impossible to make this core of very generous dimensions. In the case of a choke or output transformer, however, the core can be made of generous dimensions, so that a really large plate current can be passed through its windings without risk of saturation, and consequent distortion. In addition, of course, the fact of passing no heavy D.C. plate current through the loud-speaker windings does away with the risk of an actual breakdown in the windings of the loud-speaker due to this cause, and transfers this risk to the choke. The choke is more robustly made, and is less liable to experience a breakdown in its windings, and even if it does break down, a choke is cheaper to replace than a loud-speaker.

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Crystal Potential.

I desire to connect a dry battery and potentiometer to a carborundum crystal detector, but I am not quite sure of the correct method to adopt. Will you indicate in your reply which of the two elements comprising the detector should be connected to the battery? R. E. T.

The usual method of applying a potential to a carborundum detector is shown in Fig. 2, where it will be seen that two

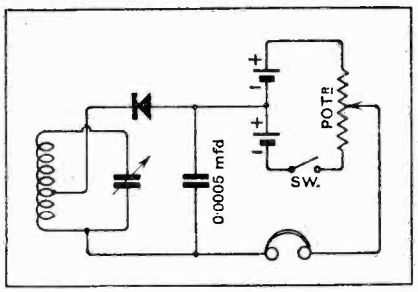

Fig. 2. Potentiometer connections giving positive or negative bias.

1½ volt dry cells are connected in series and shunted by a potentiometer. This should have a resistance of about 400 ohms, and it would be advisable to include a switch in the circuit so that the batteries can be disconnected when the receiver is not being used. It is immaterial which element of the detector is connected to the centre point of the battery, for the reason that the potentiometer enables a voltage of plus or minus 0 to 1½ to be selected.

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A.C. Mains Unit.

I wish to make up a battery eliminator to to work off 220 volt A.C. 50 cycle mains, and should be obliged if you would provide me with the necessary constructional details. W. T.

An adequate treatment of this subject would be beyond the scope of these columns, but we think the desired information could be obtained by reference to the issues of *The Wireless World* for June 29th and July 6th last. This matter was discussed in the "Hints and Tips" column under "Dissected Diagrams" and a theoretical circuit diagram was given.

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H.F. Transformer Connections.

I have modified my receiver and incorporated an H.F. transformer of the "Everyman" type. The results are very much below expectation, and I think that I may have wrongly connected the secondary of the transformer. Can you inform me, please, which end should be connected to the grid of the valve? C. H. N.

If the secondary winding is incorrectly connected, the efficiency of the transformer will be adversely affected, and, in addition, the neutralisation of the H.F. circuit will not remain constant over the full tuning range. The end of the secondary, over which the primary and neutralising turns are wound, should be connected to the filament of the valve (*via* a grid battery, if one is used), and the other end of the secondary to the grid of the detector valve. This matter was fully discussed in the "Hints and Tips" column in *The Wireless World* for May 18th last, and we think you could not do better than refer to this back number for more detailed information.

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A Question of Capacity.

I have a two-stage transformer-coupled amplifier, which I have used successfully following a single-valve receiver. Is it permissible to use this amplifier following a crystal set without any alterations? P. G.

Your amplifier can be used following a crystal receiver, but it will probably be necessary for you to increase the capacity of the fixed condenser shunting the primary. Since the input transformer of your amplifier usually follows a detector valve, you will probably have a condenser of 0.0003 mfd. capacity shunting its primary, and it may be necessary to increase this capacity to 0.001 mfd. when using it after a crystal set.

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Choke Resonance.

I have constructed a three-valve receiver, using the "Schnell" circuit. The receiver functions excellently on the normal broadcasting lengths, but oscillates continually on the Daventry wavelength. Curiously enough, oscillation seems to increase when the reaction control is turned towards the minimum position, although the receiver behaves normally on the ordinary broadcast wavelengths and gives great satisfaction. V. N. E.

We presume, in the first place, that you have not used too large a value for the fixed feed back condenser. This should have a capacity of 0.00005 mfd. (not 0.0005 mfd.), and this capacity may be obtained by connecting two 0.0001 mfd. condensers in series, although it is possible to obtain fixed condensers having the requisite capacity of 50 micro-microfarads, and of course the purchase of a single condenser of this capacity is a cheaper proposition.

From the symptoms you mention, we think that the trouble lies in the fact that the H.F. choke resonates approximately to the Daventry wavelength. The result would be that the tuned plate method of reaction would come into operation, and in these circumstances, owing to the peculiarities of the "Schnell" circuit, you would find that reaction was strongest with the normal "Schnell" reaction control at its minimum position. The trouble can be cured by connecting two chokes in series, or using a home-made choke constructed in the manner described from time to time in the "Hints and Tips" section of this journal.

The Wireless World AND RADIO REVIEW

(15th Year of Publication)

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STATION IDENTIFICATION.

OUR readers will now have had the opportunity of considering the views expressed by Capt. Eckersley, the chief engineer of the B.B.C., on the subject of station identification as expressed in his article on this subject in our issue of January 11th. As, however, we feel that many of our readers will find it difficult to agree with Capt. Eckersley on all points, we think it may be of interest to pick out one or two arguments which might be put forward in opposition to his views.

He prefaces his remarks by saying, very wisely, that there are two points for consideration, viz., whether any system of station identification such as has been suggested is necessary, and secondly, the form which the identification signal should take, and since the one is dependent on the other, that it is only necessary at this stage to consider and decide whether an identification signal is necessary or not. He proceeds to say that in his view no such signal is necessary, and gives various reasons for holding that opinion. The great majority of people, we are told, listen most of the time to the local station. With that view we agree, but even minorities, especially intelligent minorities, should be given some consideration, and there can be no doubt that the interest in listening to stations other than the local one is growing. As evidence of this one cannot, perhaps, do better than observe the trend of development of broadcast receivers, for latterly important advances have been made, all with the aim of increasing range and selectivity, and further, we have the interest of the B.B.C. itself in a publication devoted to giving the programmes of the foreign stations.

Artistic Value of Programmes.

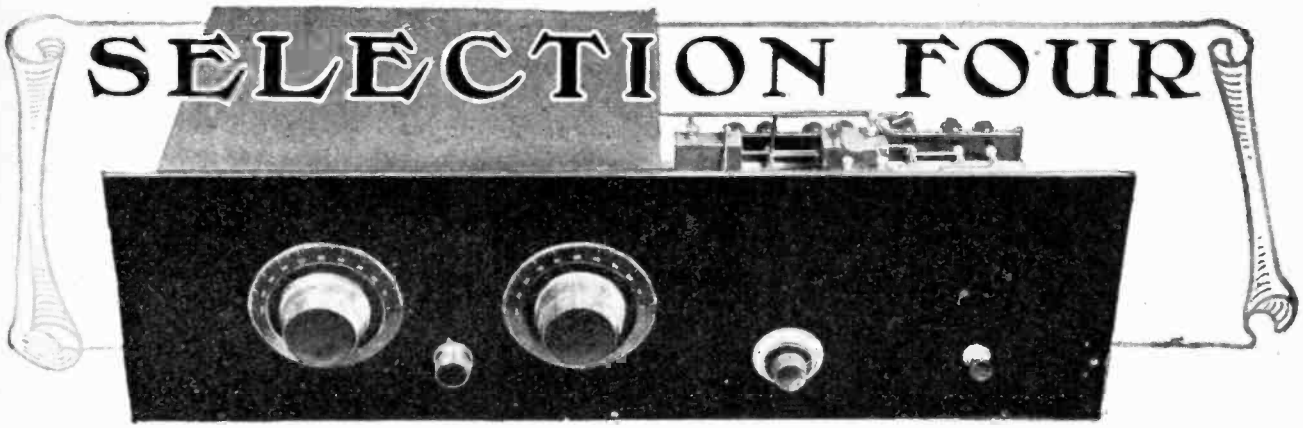
Next we are told that to introduce an identification signal would be "bound to ruin local listening," because it would spoil the artistic value of the programmes. With all due respect to Capt. Eckersley, we think that he is vastly overestimating the seriousness of this objection. Is it so much more distressing to hear, at the end of an enthralling broadcast, a series of musical notes transmitted to identify the station than for the announcer to say "That was Mr. So-and-So, etc.," and are we to assume that when Capt. Eckersley visits the theatre he likes to lie back in his seat at the end of the performance in a sort of artistic trance, or does he, like other people, jump to his feet when the National Anthem strikes up as a climax to the evening?

Next we come to the argument that "music is universal; it is good, bad, or indifferent, and it makes no difference where it is radiated from, provided it is clearly heard." Here we must leave it for our readers to decide individually whether it is their experience that the origin of a transmission is of interest or not.

Promises for the Future.

Finally, we come to the promises which the Chief Engineer holds out to us for the future. He admits that foreign programmes have a value, provided they can be clearly heard, because of their local or national interest and talent, but that direct listening to foreign or distant stations never gives a rendering worthy of the original. The B.B.C., we are told, are working hard in the endeavour to link up Europe by telephone cables and other continents by short waves, so that the B.B.C. can switch on the transmissions of foreign stations direct to their own transmitters. But what will be the gain? Not a choice of programmes, for we shall have just what the B.B.C. picks out from amongst the Continental broadcasts and chooses to give us. We have, too, our own experience of the imperfections of telephone lines connecting the B.B.C. stations in this country with outside broadcasts, and can we hope that Continental cables and lines will produce us the original transmission so very much better in quality than we can obtain by direct reception? On the whole, we feel that Capt. Eckersley has not succeeded in satisfying us that direct listening to foreign stations is a sheer waste of time, and that therefore no system of identifying stations is needed.

SELECTION FOUR



Broadcast Receiver for 200 to 2,000 Metres.

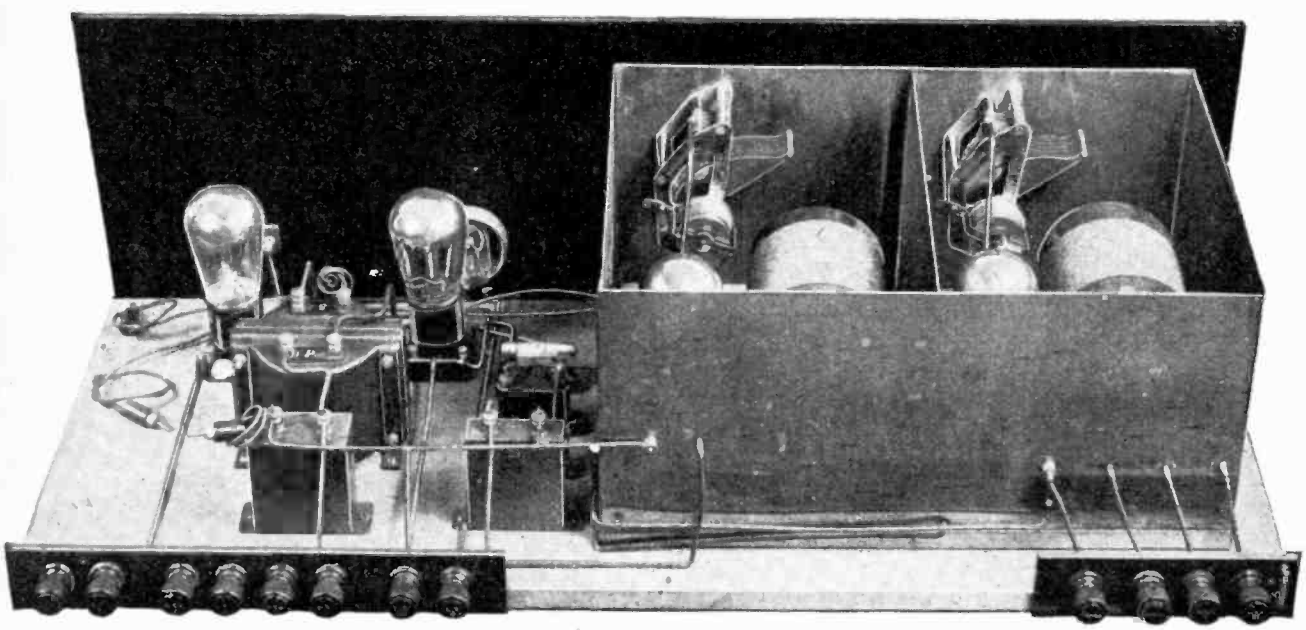
By W. JAMES.

IT has long been recognised that a four-valve receiver having one stage of high-frequency amplification followed by an anode bend detector, the usual low-frequency amplifying valve, and a power stage, is in many respects ideal for the reception of broadcast transmissions. This is because the two tuned circuits used when there is one high-frequency stage provide a degree of selectivity that is sufficient in the majority of instances for the power of the set.

A receiver such as the Everyman Four, for example, is nicely balanced as between its selectivity and magnification. It is only when the set is used within a mile or two of a broadcast station that one feels the need for additional means to help cut out the local station. The receiver itself is sufficiently selective for normal purposes; one can select a distant station from others of about the same power and distance working on a frequency fifteen or twenty kilocycles above or below it. But this in itself does not mean that the local station can be tuned out with ease. We can, however, improve the performance of such a receiver by shielding, and the receiver illustrated here has both its high-frequency circuits contained within a copper box. This shield prevents the coils themselves receiving signals, and therefore reduces the tendency for the local station to be heard over several degrees of the tuning condensers.

The receiver has been designed for the long and short broadcast wavelengths, and uses a circuit and tuning coils similar to those the writer described some time ago.[1] This will be understood from Fig. 1, which shows the

[1] *The Wireless World*, October 26th and November 2nd, 1927.



The finished set complete with coils and valves.

Selection Four.—

circuit arrangement. Valve V_1 is used for high-frequency amplification. It has a tuned grid circuit comprising a transformer T_1 and variable condenser C_1. This transformer has a tapped primary winding, and provision is made for the aerial to be connected to the primary in three ways. With the aerial joined to terminal A_1, fixed condenser C_3 of 0.0001 mfd. is included and only half of the primary winding. When the aerial is joined to A_2 half the primary coil is in circuit, but the full primary coil is used when the aerial is connected to A_3. On the longer wavelengths a slightly different aerial circuit is employed. No separate primary winding is used, and the aerial may be connected direct to the grid end of the coil or in two alternative positions, as can be seen by referring to the diagram.

Adjustable resistance R_1 is included in the negative filament lead of valve V_1, whose grid is thus automatically negatively biased by an amount equal to the fall in voltage over this resistance. As R_1 is varied the filament current changes, and so does the grid bias. When more resistance is included the filament current decreases and the grid is more negatively biased. The anode impedance of the valve is therefore increased. This reduces the amplification given by the high-frequency stage. Resistance R_1 is therefore an effective volume control, but its value must suit the valve. If this is of the 6 volt 0.1 ampere type a resistance of 60 ohms is best, while one of 30 ohms will give adequate control over a valve taking 6 volts 0.25 ampere, or a valve of the 2-volt type. Connected to the anode of V_1 is a high-frequency choking coil and by-pass condenser C_{10} of 0.5 mfd., and between the anode and the negative side of the circuit is joined fixed condenser C_5 of 0.005 mfd. and the primary winding of the high-frequency transformer T_2. Condenser C_5 is used to prevent direct current passing through the primary winding, and the circuit is such that a coil of good mechanical construction may be used.

Transformer T_2 has a balancing winding connected between its low-potential end and the balancing condenser C_6. These two windings (the primary and balancing) are of very fine wire, and one has more turns than the other. Both tuning condensers C_1 and C_2 are mounted on the panel and metal box, and therefore have one side automatically earthed because the screen is connected direct to the earth terminal. It is therefore necessary to use a fixed condenser C_7 and grid leak R_2 in order that the grid bias of the detector V_2 may be controlled.

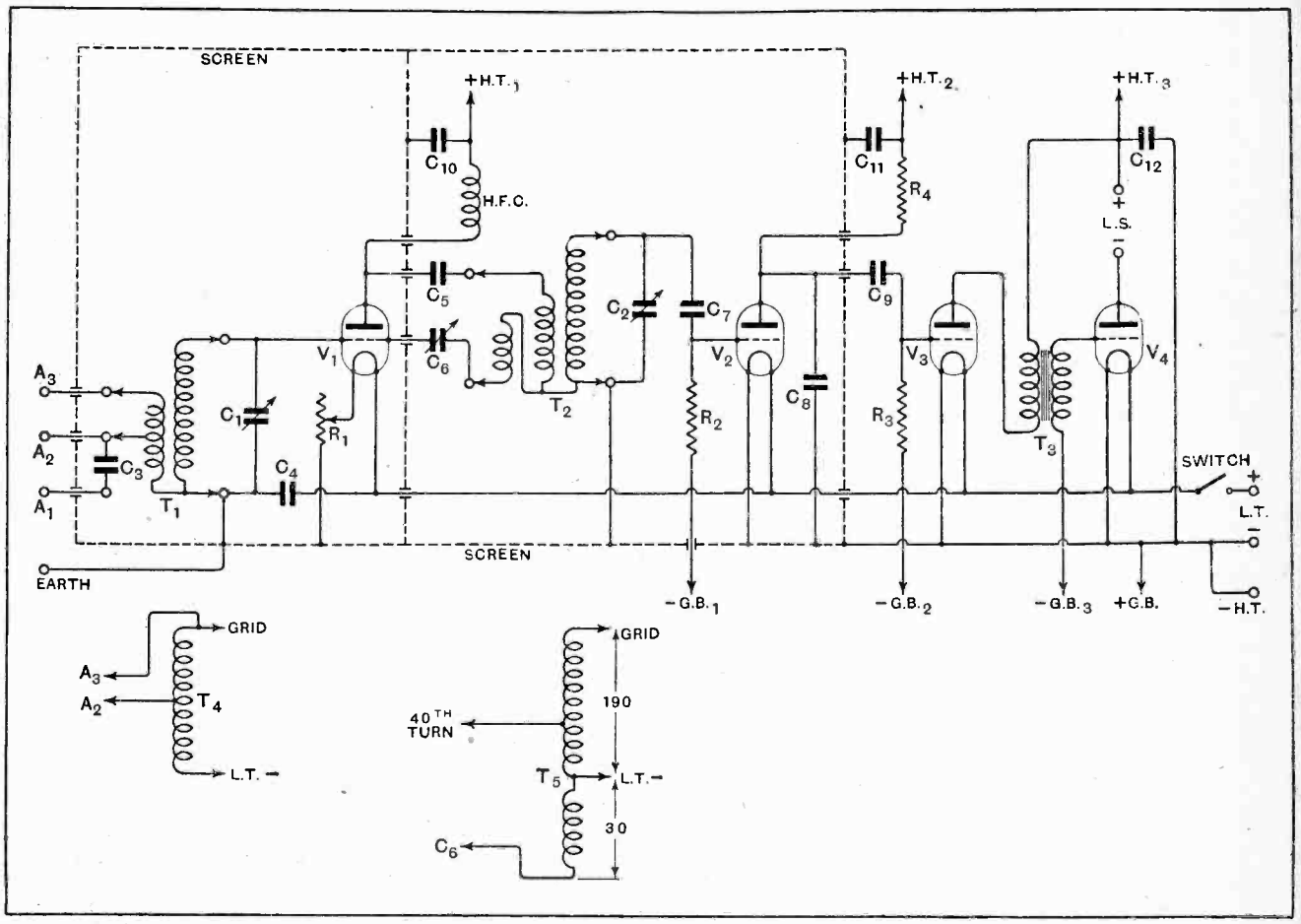


Fig. 1.—Connections of the receiver. T_1, T_4, aerial transformers; T_2, T_5, high frequency transformers; T_3, L.F. transformer, 2.7 to 1; C_1, C_2, 0.0005 mfd. tuning condensers; C_3, 0.0001 mfd. fixed condenser; C_4, 0.5 mfd.; C_5, 0.005 mfd.; C_6, balancing condenser, insulated type; C_7, 0.00025 mfd. series parallel; C_8, 0.0005 mfd.; C_9, 0.01 mfd.; C_{10}, 0.5 mfd.; C_{11}, 1 mfd.; C_{12}, 2 mfd.; R_1, 30 to 60 ohms; R_2, 1 megohm; R_3, 2 megohms; R_4, 250,000 ohms; HFC, high frequency choke coil.

LIST OF PARTS.

1 Ebonite panel, 26in.×8in.×3/16in.
1 Baseboard, 26in.×10in.×½in.
2 Sub-bases, 8½in.×6½in.
1 Transformer, 2.7 : 1 (Ideal, Marconiphone Co., Ltd.).
2 Variable condensers, 0.0005 mfd. (K.C. Dubilier).
4 Valve holders (Whiteline, Bowyer-Lowe).
1 Fixed condenser, 2 mfd. (T.C.C.).
3 Fixed condensers, 1 mfd. (T.C.C.).
2 Fixed condensers, 0.01 mfd. (T.C.C.).
1 Fixed condenser, 0.0001 mfd. (T.C.C.).
1 Fixed condenser, 0.0005 mfd. (T.C.C.).
1 Fixed condenser, 0.0003 mfd. with clips (S/P type, T.C.C.).
2 Grid leak holders (Aermonic, J. Christie & Sons, Ltd.).
2 Grid leaks, 1 megohm and 2 megohms (Ediswan).
1 Resistance, 250,000 ohms. (Ediswan).
1 Neutrodyne condenser (Bulgin).
1 On and off switch.
1 H.F. Choke (Wearite, Wright & Weaire).
12 Ebonite shrouded terminals (Belling & Lee).
4 Wander plugs (Lisenin).
1 Copper box, 8½in.×13in.×6½in. (Wright & Weaire).
1 Rheostat (Peerless, Bedford Elecl. & Radio Co., Ltd.).
2 Aerial Coils and Base (Wright & Weaire).
2 H.F. Transformers and base (Wright & Weaire).
Wire, screws, sleeving, etc.
(Approximate cost excluding coils, £8 : 15 : 0).

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

Anode bend detection would normally be used, but provided the values of C_7 and R_2 are suitable, leaky grid detection may be tried by altering the grid bias. The circuit, however, is designed for anode bend rectification. When condenser C_7 is of 0.00025 mfd. and R_2 is of 1 megohm, either form of detection may be used by connecting the grid bias wire, GB_1, to a point of relatively positive or negative potential on the grid battery.

A resistance coupling is used between the detector and first low-frequency amplifying valve V_3, with a by-pass condenser C_8. The values of the components used in the coupling determine to a large extent the relative amplification of the different musical frequencies. If condenser C_8 is too big, the higher frequencies are weakened relative to the lower ones, while condenser C_9 controls the low tones for fixed values of the grid leak R_3. The values recommended are

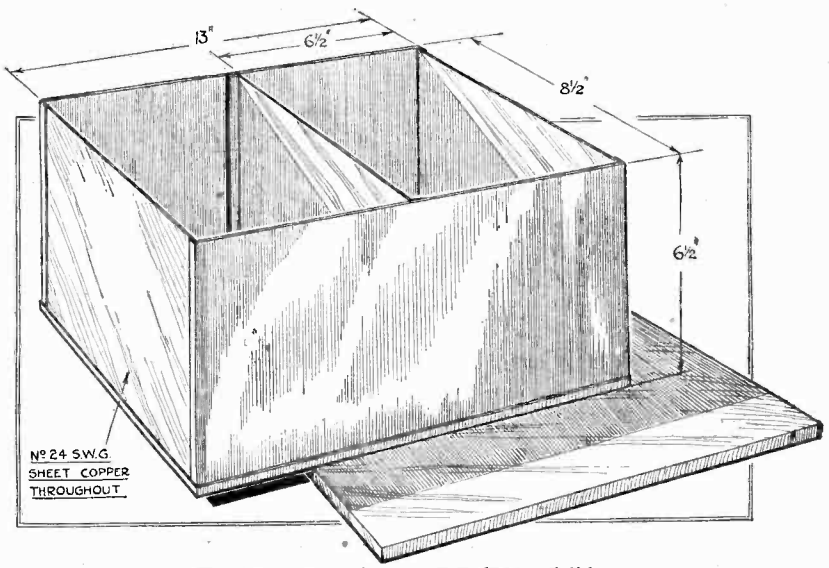


Fig. 2.—Details of the copper box and lid.

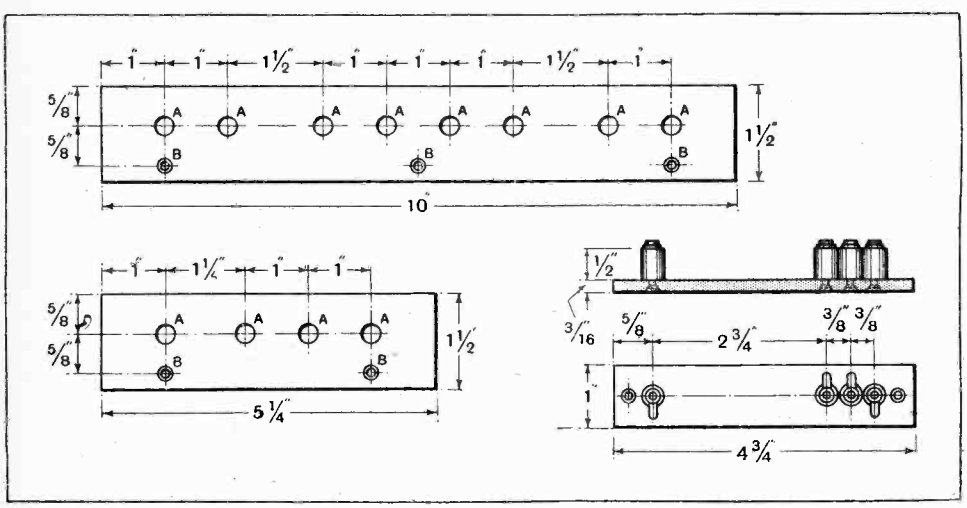


Fig. 3.—The terminal strips and coil base. A, 5/16in. diameter; B, 1/8in. countersunk for No. 4 wood screws. Two coil bases are required.

250,000 ohms for R_4, 2 megohms for R_3, 0.0005 mfd. for C_8, and 0.01 mfd. for C_9; R_4 is less than is often used because leaky grid detection may be tried. Condenser C_9 must, of course, be of the mica dielectric type and have a very high value of insulation resistance.

Valves V_3 and V_4 are transformer coupled. The component used has a ratio of 2.7 to 1; valve V_3 may therefore be of the type having an anode impedance of 20,000 ohms. Such a combination of stages will give reasonably uniform amplification over the whole musical range.

Selection Four.—

A powerful four-valve receiver of this type should be fitted with a power valve in its last stage or distorted loud-speaker signals are bound to be obtained. Its grid must be properly biased, too, for maximum undistorted volume. The receiver has been so arranged that it can be made very easily. On the left-hand side is a copper box divided into two parts, one for the high-frequency stage, and the other for detector. Contained within this box are the components connected to the two circuits, which are therefore shielded from one another. The high-frequency amplifying valve is included in the first compartment, and the detector valve in the second. Before the set can be assembled this box should be constructed; details are given in Fig. 2. All joints should, of course, be soldered, and the lid made a good fit; further comment seems unnecessary. A base of wood has to be fitted in both sections of the box. Details of a coil base are given in Fig. 3 with the terminal strips. Two similar bases are required. They are of ebonite and have four sockets mounted on them as indicated, although the reader may find that in order to use sockets of a different type, another form of construction will have advantages. It is necessary accurately to locate the four sockets in the two bases, and the screw heads should be sunk well below the surface of the ebonite to prevent leakage. One terminal strip is fitted with four terminals for alternative aerial connections and the earth wire, and the longer strip has two terminals for the filament accumulator, four for the high tension and two for the loud-speaker.

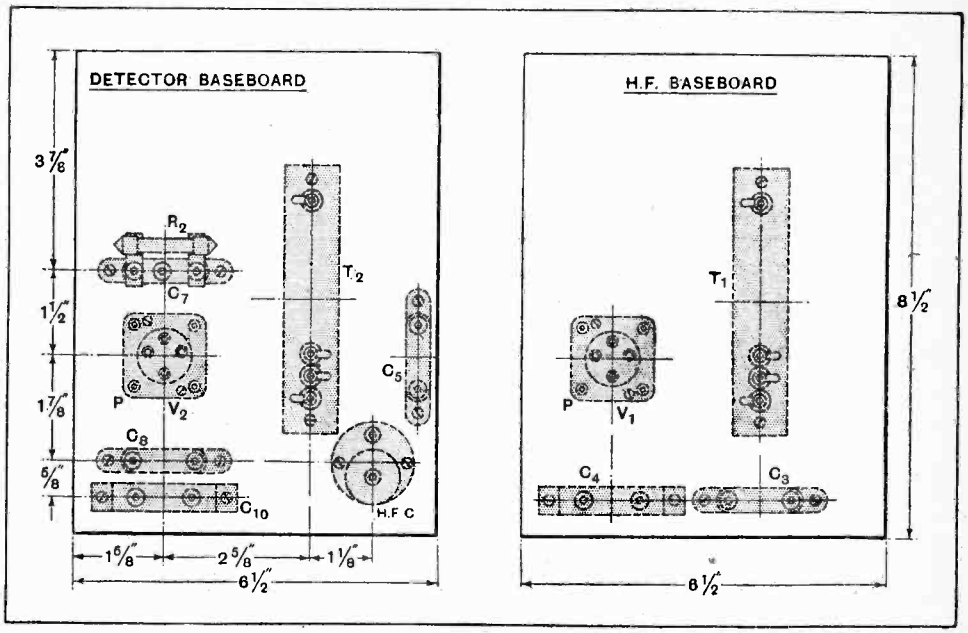


Fig. 4.—Arrangement of the parts in the two compartments of the copper box. These are fitted on wooden bases.

A panel measuring 26in. × 8in. is used with a baseboard 26in. × 10in., and the parts are assembled as shown in Figs. 4, 5 and 6. Fig. 4 shows how the parts are arranged in the high-frequency and detector compartments of the screening box. In the high-frequency com-

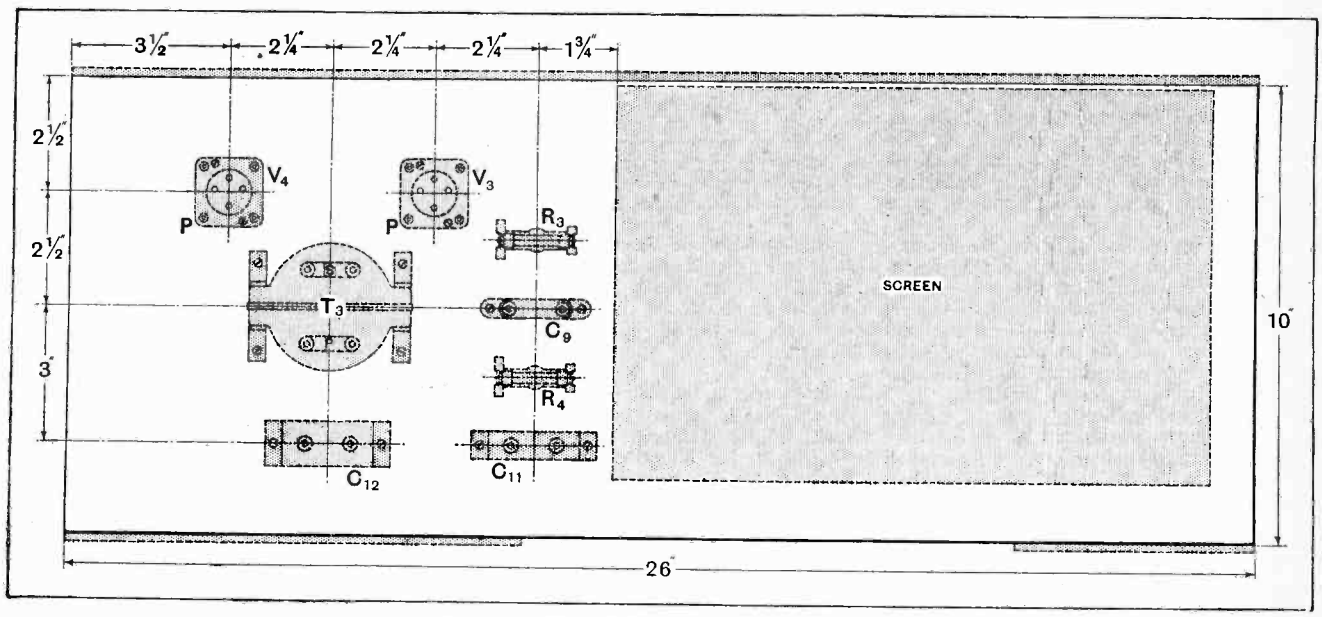


Fig. 5.—Position of the parts on the baseboard.

Selection Four.—

partment is a coil base, a valve holder, 0.0001 mfd. fixed condenser, and a 0.5 mfd. by-pass condenser. In the detector compartment is a high-frequency choke, 0.005 mfd. coupling condenser, 0.00025 mfd. grid condenser of the series parallel type, and by-pass condensers of 0.0005 mfd. and 0.5 mfd. The two tuning condensers are mounted on the panel and so is the balancing condenser, but while the tuning condensers make contact with the metal box, the balancing condenser is insulated. The remainder of the components screwed to the baseboard are clearly shown in the diagrams, and the only additional parts fitted to the front panel are the filament resistance and "on" and "off" switch.

Before the wiring is commenced, it is advisable to mark the position of the holes that have to be made in the copper box. Six have to be drilled in the back of the first compartment; one of these is for a bolt. In the partition two further holes are required. Two more have to be drilled through the back of the detector compartment, one of them being for a bolt. Only three more holes are necessary, and these are made in the end of the box.

(*To be concluded.*)

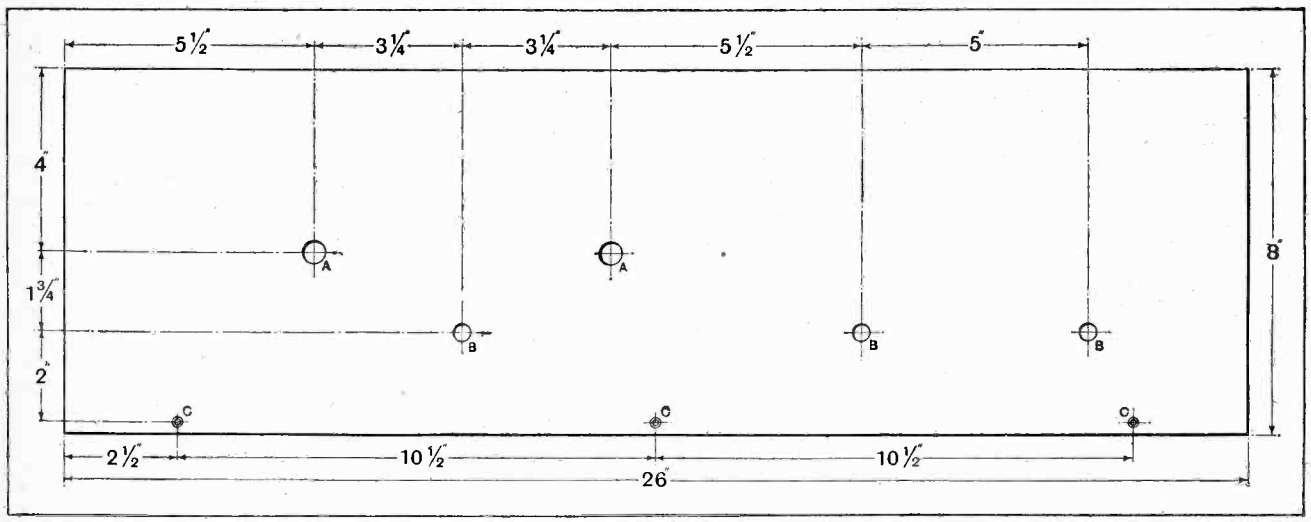


Fig. 6.—Dimensions of the panel. A, 1/2in. diameter; B, 3/8in. diameter; C, 1/8in. countersunk for No. 4 wood screws.

Book Review.

Electric Rectifiers and Valves.

Translated from the German of Dr. A. Günterschultze by Norman A. de Bruyne, B.A. Pp. 212 + ix., with 94 illustrations and diagrams. Published by Chapman and Hall, London, price 15s.

In the translation of Prof. A. Günterschultze's book, "Electrische Gleichrichter und Ventile," Mr. Norman A. de Bruyne has admittedly made several alterations, generally based on material supplied by the German author, and has added paragraphs on the Moullin voltmeter and the tantalum rectifier.

The subject is treated from the point of view of the physicist wishing to study the processes underlying the phenomenon of rectification, and comprises gas valves of the Tungar type, electrolytic valves, mercury arc rectifiers and some mechanical types. The first half of the book is devoted to the physical theories, and the second half to the technical applications of the various methods. The work contains a large amount of valuable information for those desirous of studying the physics of the subject, a mathematical discussion of the currents and powers in the electric circuits of polyphase rectifiers and constructional details of various commercial types.

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BOOKS RECEIVED.

British Standard Specification for Plug-in Coils for Radio-reception purposes, issued by the British Engineering Standards Association, and published by Crosby, Lockwood and Son, London. Price 2s. net.

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Radioamatérsky Slovník. A vocabulary of wireless terms in five languages—German, Czech, Esperanto, French and English. Compiled by Otto Ginz. Pp. 217. Published by "Radiokonstrukce," Prague.

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Emile Berliner, Maker of the Microphone, the life and work of a man whose inventions have contributed greatly towards the present perfection of telephone, by F. W. Wile. Pp. 353, with 30 illustrations. Published by The Bobbs-Merrill Co., Indianapolis, U.S.A. Price, $4.

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Wireless Principles and Practice, the theory of the generation of H.F. alternating currents by spark, arc, alternator and valve, the detection and amplification of signals and the principles of telephony and directional wireless, by L. S. Palmer, M.Sc., Ph.D., F.Inst.P., A.M.I.E.E., of the Victoria University of Manchester. Pp. 504, with 307 illustrations. Published by Longmans, Green and Co., Ltd., London. Price, 18s. net.

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The Hysterical Background of Radio, a light summary of the history of electricity and wireless from the days of Pliny to modern times. Written for the general public, more for entertainment than instruction. By R. P. Clarkson. Pp. 258. Published by J. H. Sears and Co., Inc., New York. Price, $2.

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Der Sprechende Film, an historical survey of the progress of talking films, with a description of the various methods and apparatus employed, by Dénes von Mihály. Pp. 132, with 99 illustrations and diagrams. Published by M. Krayn, Berlin.

QUALITY AND THE ANODE RECTIFIER.

Some Interesting Observations Based on Measurements.

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

THE design of amplifiers, both for low and high frequency, is rapidly becoming more and more of an exact science, and it is now beginning to be possible to design a receiver entirely on paper, with the assurance that when it is built it will operate exactly as expected. In a high-frequency amplifier, for example, the degree of amplification per stage can be anticipated with reasonable accuracy from the properties of the valves and coils to be used, and the selectivity of the completed receiver can be gauged nearly enough, provided the screening is adequate to eliminate most of the stray couplings. Owing to the recent development of the Rice-Kellogg and other loud-speakers, which reproduce practically the whole of the musical scale, so much attention has recently been devoted to the low-frequency amplifier that it is even possible to calculate approximately the amplification to be expected on different frequencies, so that a complete frequency-amplification curve can be roughly plotted before the amplifier is built, while the overall amplification to be obtained can be prophesied to within a few units per cent.

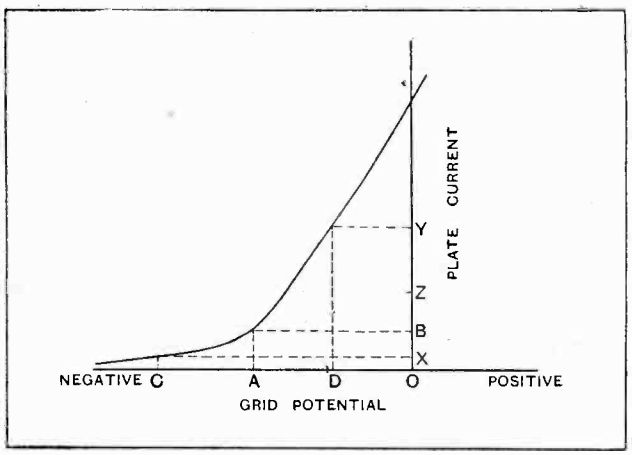

Fig. 1.—Rectification by anode bend. A positive displacement of grid potential at the bend in the curve increases the plate current more than an equal negative displacement decreases it, resulting in an increase in the mean anode current.

But of the detector, the link between these two parts of the complete receiver, much less is generally known, although one or two brilliant theoretical investigations have been carried out (notably Colebrook, E. W. and W. E., November, 1925, to February, 1926). Without at least approximate numerical data about the modern valve used as a detector, there can be little precision in designing a complete receiver, for if one does not know the high-frequency voltage required to operate it one cannot design a high-frequency amplifier to provide that voltage; nor is it possible, if the output voltage of the detector is not known, to design a low-frequency amplifier to give a definite output.

In order to remove his own personal ignorance on this point, the writer has recently made a series of measurements on typical modern valves used as rectifiers, and hopes that the figures obtained, and the conclusions to be drawn from them, may be useful to others.

In the last year or two the anode rectifier has become increasingly popular, partly because valves more suitable for anode rectification have been introduced, and partly because high-frequency amplification has made such vast strides that there is no longer any difficulty in supplying an anode rectifier with the high-frequency input which it requires for adequate detection. Where, owing to the absence or inefficiency of the high-frequency amplifier, a distant station provides only a very small voltage to operate the detector, the grid rectifier is still unchallenged, but as a certain number of tuned circuits are necessary in any case to provide proper selectivity, it is normally more profitable to use these tuned circuits as part of a high-frequency amplifier, when the sensitivity of the grid rectifier ceases to be of any practical advantage, and its propensity to overload becomes quite definitely a nuisance. For these reasons the measurements which are the subject of this article were made on anode rectifiers only.

Anode Bend Detection Explained.

It is perhaps advisable to recapitulate the mode of operation of an anode rectifier, since it must clearly be borne in mind in all that follows. Fig. 1 represents the ordinary characteristic curve of a valve for a single plate voltage, plate current being plotted vertically upwards and grid voltage horizontally. If the grid voltage be fixed at the value A, corresponding to the point of greatest curvature of the characteristic, the plate current will be given by the value B. Now, suppose the grid voltage to be made temporarily more negative by exactly one volt; it will then have the value C, to which corresponds the plate current X. Allowing the grid to return to its normal potential A, and then making it temporarily exactly one volt more positive than this gives the value D, to which corresponds the plate current Y.

Owing to the shape of the curve, the point Y is further from B than is the point X, which indicates that a positive displacement of grid potential increases the plate current more than an equal negative displacement decreases is. If, therefore, we superimpose on the steady grid potential A an alternating potential of one volt (peak value), the resultant grid potential will travel rapidly to and fro between points C and D, while the plate current will move in sympathy between points X and Y, the *average* plate current, as read by an ordinary milliammeter, having a value Z, greater than B. Thus the application of an alternating potential to the grid of the valve results in a small increase of plate current, which provides the rectified potential by which the succeeding valve is operated.

Quality and the Anode Rectifier.—

Since an increase in the A.C. potential applied can only decrease the plate current to zero—which is not far below X—but can produce quite large increases, reaching far beyond Y, it is evident that the efficiency of rectification will increase rapidly as the amplitude of the alternating potential to be rectified increases, the change in plate current being very much greater in proportion to the input when the latter is large. It is on this account that anode rectification is so admirably efficient on loud signals and so very ineffective for weak signals from distant stations.

Effect of Resistance in Plate Circuit.

But there is a limit, in a practical case, to the profitable increase of input voltage to the detector; when this voltage is so large that the grid is made positive for a portion of the positive half-cycle (*i.e.*, when D moves out to the right of O) grid current flows, and the rectifier begins to absorb power from the A.C. supply from which it is fed. With modern low-loss coils this has the effect of increasing their resistance by quite an appreciable amount, and so reducing selectivity and tending to cut down signal strength. This difficulty can be dodged by increasing considerably the high-tension voltage supplied to the rectifier, which has the effect of moving the whole curve, together with the optimum grid-bias point A, bodily to the left, so that greater excursions of grid-potential from A may be made before grid current flows. In practice it is found that quite high plate voltages are necessary in receiving the local station in order to permit a high enough value of grid bias to prevent the flow of grid current, which results in distortion as well as damping of the tuned circuit supplying the valve.

The change in plate current due to rectification is of no use to us directly, since the succeeding valve requires voltage, not current, for its operation; this voltage is readily produced by inserting a resistance in the plate circuit of the detector valve, so that the increase in plate current results in an increase in the voltage dropped across this resistance, which voltage change can then be passed on to the next valve. Since the total voltage across resistance and valve is fixed, being the voltage of the high-tension battery, an increase of voltage on the resistance due to an incoming signal results in a decrease of voltage on the plate of the valve, which makes the mechanism of detection a little different from that described. As, however, the difference can be expressed graphically in any one case by substituting for the curve of Fig. 1 another of less steep slope, and then considering the process of detection exactly as before, we need not concern ourselves here with the detailed behaviour of the circuit including the resistance. We will pass on, then, to some actual measurements of the change in the voltage across the resistance for various values of A.C. input to the grid.

Apparatus for Examining Anode Bend Detectors.

The circuit with which the measurements were made is shown in detail in Figure 2. The voltage to be rectified was obtained from 50-cycle mains through a step-down transformer, and adjusted by means of the fixed and variable resistances shown connected across the secondary of the transformer. In this way voltages from 0.15 up to 1.3 (measured by Moullin voltmeter) were available. Grid bias was applied as shown through the variable resistance, being finely controlled by means of a potentiometer across the filament battery. A voltmeter was connected to read the actual grid voltage in use at any time, and grid battery and potentiometer were shunted with a 10 mfd. condenser.

A condenser of 2 mfd. capacity was connected directly between plate and filament of the valve, this condenser having exactly the same impedance at 50 cycles as the usual 0.0001 mfd. condenser employed on a normal receiver at 1,000 k.c., or 300 metres. By this means the behaviour of the circuit shown at 50 cycles corresponds closely to that of the circuit with normal condenser values at radio-frequency, so that the results obtained at the low frequency may be taken as valid for a rectifier in normal use.

The plate circuit was completed through an ordinary anode resistance R, of which the value could readily be changed, a high tension battery of 120 volts and a microammeter M with which to read the change in plate current. The steady current in M was balanced out by a small current in the opposite direction drawn from a 2-volt cell through a high resistance, and adjusted exactly by means of the potentiometer. By this means the sensitivity of the microammeter could be retained even when the steady plate current, if not balanced out, was great enough to carry the needle right off the scale.

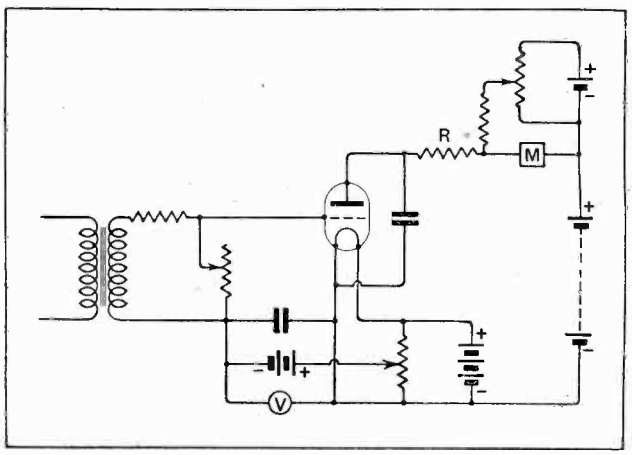

Fig. 2.—Circuit for examining the performance of a valve adjusted as an anode bend rectifier. Alternating input potentials are obtained from a 50-cycle alternating supply and the change of anode current is observed on the microammeter M set for reading from zero.

With the apparatus set up the valve was lighted and the meter adjusted to zero by means of the balancing potentiometer. A small A.C. voltage was then switched on to the grid, and the deflection of the meter noted. Various values of grid bias were then tried, readjusting the meter to zero after each alteration, until that value was found which gave the maximum deflection for the A.C. voltage applied. By this means the grid bias was adjusted to the best point for rectification.

Then various A.C. voltages were in turn applied to the grid, and the deflection of the meter noted in each case. This deflection, which was the change in plate current (in microamperes) produced by the known A.C.

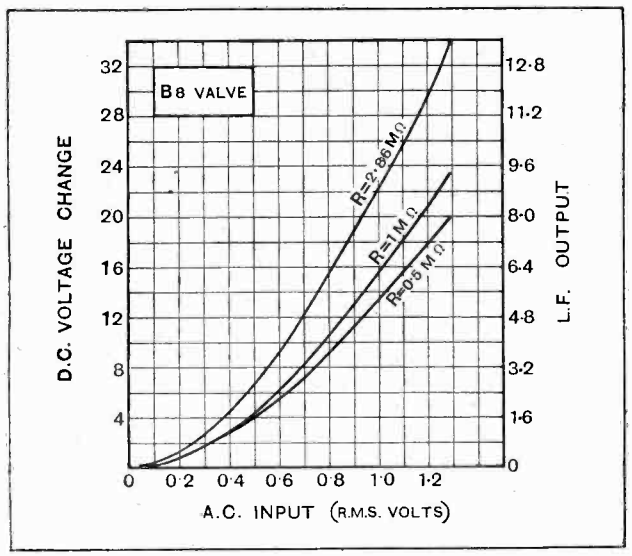

Fig. 3.—D.C. potential changes produced by various values of A.C. potential applied to the grid of a B8 valve arranged as an anode bend detector.

voltage, was multiplied by the value of the resistance R in megohms, the product being the actual voltage change across the resistance. These results were then plotted as curves, which are given in Figs. 3, 4, and 5.

Several Valves Compared.

As representative of the various classes of valve likely to be employed for anode rectification, a series of curves was taken for each of the following:—B.T.H. BS (amplification factor 44, impedance[1] 190,000 ohms), Cosmos SP55/B (amplification factor 28, impedance[1] 58,000 ohms), Mullard PM5X (amplification factor 16, impedance[1] 20,000 ohms). Owing to the space that would be occupied by the actual experimental figures, only the curves are given, drawn to scale so that numerical results can be read off from them with sufficient accuracy for practical purposes. The horizontal scale represents the A.C. voltage applied to the grid of the valve, while the vertical scale on the left represents the corresponding change in D.C. voltage across the resistance R in the plate circuit. It is evident that the greater this D.C. voltage change for a given applied A.C. voltage the more sensitive is the rectifier.

The most striking point about these curves is the remarkable superiority as regards rectification of the high amplification valves used with high plate resistances. This superiority is to a large extent discounted by the fact that use of these valves with such resistance values leads to a considerable accentuation of the effect of stray capacities, so that the higher musical notes are very apt to be entirely suppressed.

[1] The impedance was measured in each case with the valve adjusted for amplification.

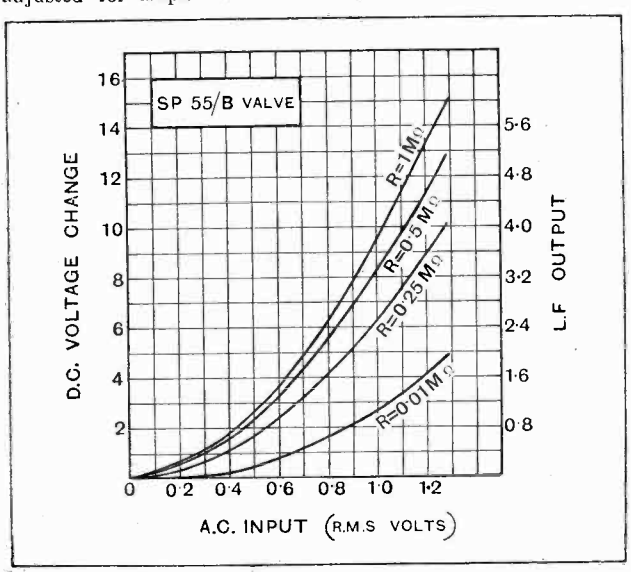

Fig. 4.—Rectification obtained with the SP.55B valve.

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Modulation and Signal Voltage.

But the curves, as they stand, do not give us the information that we started out to acquire, which is the audio-frequency voltage output that we may expect from a known high-frequency input; they give us only the change in voltage due to the unmodulated carrier wave

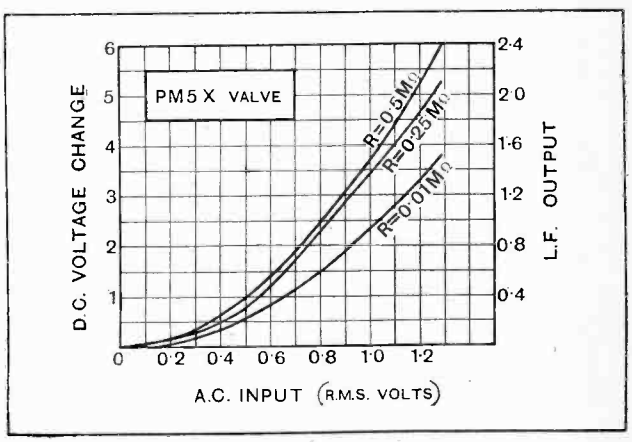


Fig. 5.—Voltage changes produced with the PM5X valve used as an anode bend rectifier.

of the broadcasting station. We require to know the voltages *due to the modulation by signals* that will be set up across this resistance, for it is these signal voltages only that will be passed through the coupling condenser to the next valve.

In order to do this we must assume some percentage modulation of the carrier; since this varies continually as the loudness of the signals varies, we will take the maximum value, knowing that a L.F. amplifier that will deal satisfactorily with the loudest signals will handle comfortably anything less loud. The generally accepted figure for maximum modulation by a B.B.C. transmission is twenty per cent., which we may take as our basis.

If we suppose that a high-frequency input of one volt is applied to the detector by the unmodulated carrier, then when the loudest signals are being transmitted this high-frequency voltage will vary at audio-frequency from 0.8 volt to 1.2 volts. Referring to Fig. 6, in which

Quality and the Anode Rectifier.—

the curve is intended to be typical of any one of those in Figs. 3, 4 and 5, it will be seen that a steady H.F. input of 1 volt causes a voltage change across the anode resistance of 6 volts. If the H.F. voltage varies on full modulation from 0.8 to 1.2 volts, the corresponding values of the D.C. voltage on the plate resistance will vary between 4 and 8 volts according to the curve. This 4-volt variation is the *overall* amplitude of the signal voltage, each half-wave having its maximum 2 volts above or below the mean value. In order that no grid current may flow in the next valve, to which this voltage is applied, it will therefore be necessary to provide for it a grid bias of not less than 2 volts, and to choose a valve of suitable characteristics to work with this bias at the plate voltage available.

The process of rectification will only be distortionless if the curve between the points B and C is a straight

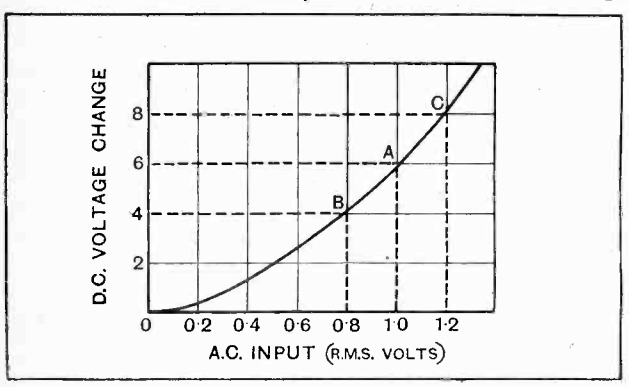


Fig. 6.—A typical graph showing the relation between input H.F. potential and the rectified voltage output of an anode bend detector. Note the curvature of the graph for small input potentials, a condition which will give rise to distortion.

line or a close approximation thereto; if the curvature is appreciable the change in D.C. voltage over the path AC will be greater than that over the path AB, so that the audio-frequency wave will have one half-cycle greater than the other, thereby introducing distortion.

Inspection of the experimental curves will show that the lower portions are considerably more curved than the upper, so that an anode rectifier apparently gives the least distortion when the input is comparatively large. The greater curvature at small inputs is, however, exactly compensated for by the fact that at these small inputs the modulation voltage is also small, so that the points B and C of Fig. 6 are closer together. The distortion introduced by this curvature of the characteristic is actually independent of the input to the rectifier, and depends only upon the degree of modulation of the signals being received.

A further point that emerges from the consideration of Fig. 6 is that the steeper the slope of the curve at the point A corresponding to the steady H.F. potential of the unmodulated carrier wave, the greater is the variation of voltage produced by the modulation. This steepness is indeed the true measure of the sensitivity of the rectifier to telephony, and increases steadily as the input to the rectifier is increased. This is the chief reason for supplying an anode rectifier with a large input. Actually the slope of the curve is such that doubling the input to the rectifier results in approximately quadrupling the output, so that any improvement to the aerial system, or reduction of tuned losses, is well repaid by using this type of rectifier.

The curve connecting the actual low-frequency output with the high-frequency input to the detector is quite a close approximation to a square law curve, and since the experimental curves of the figures also very nearly obey a square law it is possible, by simply using a different vertical scale, to employ these curves as they stand to show the connection between input H.F. volts and output audio-frequency volts for any given percentage modulation of the carrier. On the right of each of the figures there is a scale, marked "L.F. Output," which is based on twenty per cent. modulation. From it can be read off, with an accuracy not worse than about ten per cent., the peak value of the low-frequency output corresponding to any given high-frequency input voltage for any combination of valve and resistance there shown. It is hardly worth while to attempt any greater accuracy than this owing to the variations between individual valves and the discrepancies between the nominal and true values of the anode resistances likely to be used.

Figs. 3, 4 and 5 may therefore be taken as they stand by those who are interested as a numerical basis for the design of receivers and provide the information that the writer set out to obtain.

Irish Stations Heard in Greenland.

Messrs. D. F. and D. M. O'Dwyer (GW 18B), 9, Upper Leeson Street, Dublin, have been in successful communication since December 6th with the Michigan University Expedition in Greenland, whose station, NX 1XL, operated by Mr. Paul Oscanyon, carries out a regular daily schedule with GW 18B at 1800 G.M.T., and supplies them each Saturday with a list of British and Irish stations heard during the week. 1XL is at present on the west coast of Greenland, 66° 50′ N., 51° 00′ W., and listens especially for British stations between 1730 and 1800 G.M.T. on Saturdays. The power input is 250 watts, and his wavelength 46-47 metres. Among the stations reported heard up to January 8th are 5JW, 5YX, 6BR, 6NO, 6OH, 6MN, 6XP, and 6YL in Great Britain, 5WD and 6YW in Northern Ireland, and 11D, 11Z, 12B, and 18B in the Irish Free State, all on an 0-v-1 receiver.

TRANSMITTERS' NOTES

°°°°

General Notes.

Mr. C. S. Bradley, 2AX, asks us to state that his correct address is 10, Montenotte Road, London, N.8. He finds that communications intended for him are being sent to Forest Hill, S.E.

Mr. E. J. Simmonds, 2OD, notifies us that his address after February 1st will be Barclays Bank House, West Drayton, Middlesex.

°°°°

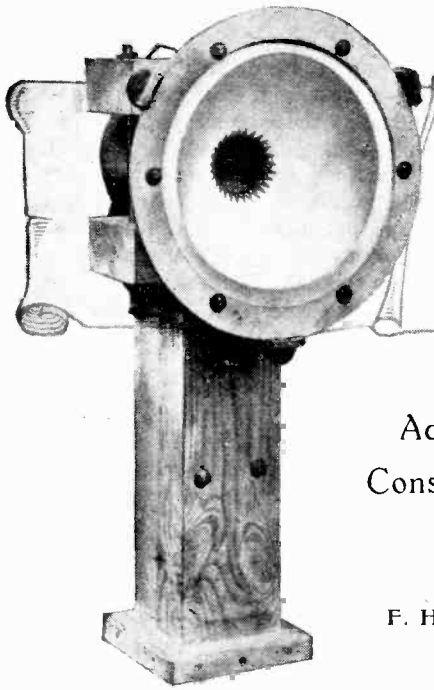
Amateurs in the Azores.

The Western Union Radio Club, whose station, EP 3MK, is at Horta, Fayal, Azores, will be carrying out tests on 23 and 45 metres from February 1st onwards, and will be glad of the co-operation of British transmitters.

°°°°

New Call-signs and Stations Identified.

6GJ	D. Gwyn Johns, "Caereithin," Mumbles Swansea, transmits on 45 metres.
6WY	H. A. Maxwell Whyte, "Burtleigh," Church Road, Forest Hill, S.E.23.
EB 4ED	Rev. W. Thomas, 9, rue Bex, Antwerp.
FL 1AB	Govt. Station, Monrovia, Liberia (Operators: Messrs. McCaleb and Osier).
OZ 2BE	(Ex 3AE) S. Strong, Box 9, Gisborne, New Zealand.



The Moving Coil Loud Speaker

Additional Constructional Data.

By F. H. HAYNES.

SO many queries have come to hand since the publication of the article describing the construction of the moving coil loud-speaker, that it is now possible to gauge the common requirement and to appreciate the particular difficulties. Many weeks of work were devoted to the making up from castings and considering the design of this loud-speaker, and it is not the intention here to introduce new features. Sets of parts made to the design are now available from a number of sources. The loud-speaker was demonstrated and formed the subject of a discussion at a recent meeting of the Radio Society of Great Britain. Except in a few minor points the need for modifications in dimensions or method of construction has not revealed itself.

As it would seem to be the aim of almost every reader to possess a loud-speaker of the moving coil type, this article has been prepared to further the information already given in the constructional article which appeared in the issue of the 28th September last.

Every endeavour has been made to render this instrument as perfect as possible both as regards performance and convenience of construction. The constructional details are here elaborated and additional apparatus is described so that the correct working conditions can be obtained.[1]

The Merits of the Moving Coil.

The moving coil loud-speaker scores principally by virtue of the liberal diaphragm movement which can be obtained. To produce equal sound intensity of all notes of the musical scale the relative amplitude must vary inversely as the square of the frequency. Thus, taking 50 and 500 cycles with a frequency difference of 10 times, an amplitude difference of no less than 100 is needed to produce the same sound intensity. The required amplitude difference becomes considerable when comparing 50 cycles with even such a moderate frequency as 2,000 cycles. It is obvious that no reed movement can produce this effect, the amplitude of the reed being strictly limited. In addition, the ear is less sensitive to the bass frequencies below 60 cycles per second than to frequencies of the order of 2,000 cycles, so that to maintain a realistic effect it might be considered necessary to augment rather than reduce the bass sounds when, as is usually the case with home broadcast reception, the total sound intensity is to be less than that of the artists in the studio. Pleasing results are, however, obtained with reed-driven cones by stimulating response by a process of resonance. A combination of resonances may give a tolerably good output, but there is a vast difference in listening to a bass stimulated by resonance and one where the diaphragm is correctly following the voltages applied to the grid of the output valve. The one is "woolly" and the other "clean" and "crisp" without producing a lowering of tone. Overall sound intensity is principally created by virtue of the bass notes, while it is to the higher frequencies that the quality of the transmission is due. The overtones and harmonics constitute the peculiar differences in the sounds of various instruments when each is emitting the same fundamental note. Coil-driven loud-speakers, therefore, are far less resonant than their predecessors, and their diaphragms are free to be driven through the liberal amplitude requirements proportional to the frequency.

Many listeners will tell you that their horn type loud-speakers give excellent results. Such a loud-speaker may have no response in the lower register, though there may be evidence of bass by virtue of the fact that the low-frequency notes are themselves largely built up of wave-trains of higher frequency, and although realistic results may not be obtained, an effect is produced which conveys the identity of the music and speech in a not unpleasing manner. It would seem the aim of every amateur is to build for himself a moving coil loud-speaker, but unless careful attention is paid to certain details of construction, both in the loud-speaker and the set with output amplifier which is to operate it, the results may appear less realistic than those obtained with other types of loud-speaker.

[1] For the convenience of readers interested in the building of this type of loud-speaker, a booklet, "Moving Coil Loud-Speaker," will shortly be available from the publishers, Iliffe and Sons Ltd., Dorset House, Tudor Street, London, E.C.4, price 1s. 6d. (post free 1s. 8d.), giving complete constructional and operating data.

The Moving Coil Loud-speaker.—

Mains or Batteries?

Before setting about building a coil-driven loud-speaker one must decide between two forms of construction. The first design assumes that electric supply mains, either A.C. or D.C., are available for energising the field magnet, and in the second, steps have been taken to modify the design, so that the current required by the field magnet can be derived from an accumulator battery. Although only a modest 25 to 30 watts is taken from the mains, so that a unit is consumed in about 40 hours, it would be both costly and inconvenient to maintain a load of 5 amperes from a 6-volt battery. Economy in field energising current is effected by making the gap in which the coil drive moves as narrow as possible, so that the thickness of the winding must be kept to a minimum and the clearances with the faces of the gap just sufficient to prevent rubbing. Construction is simplified by using a wide gap, at the same time permitting the adoption of a winding of high inductance, so avoiding the use of an output transformer as well as dispensing with additional fixings to hold the coil in a central position.

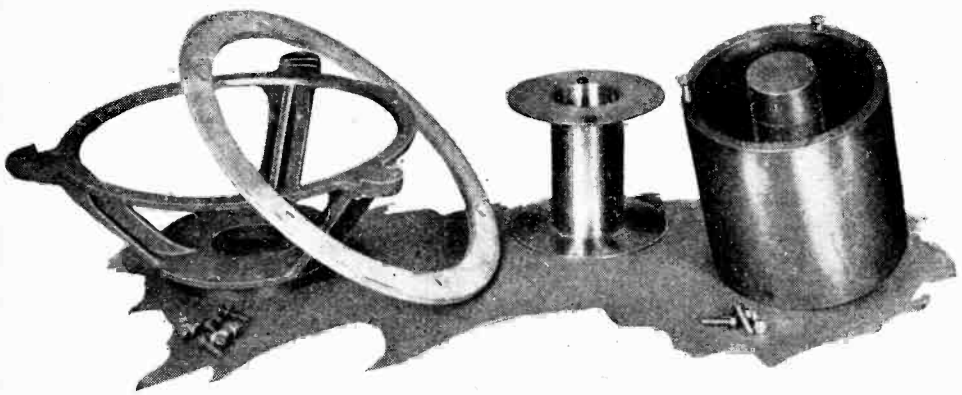
Field Strength.

To produce a field strength of not less than 10,000 lines to the square centimetre across a gap of liberal width, fixed at 5-32in., just over 3,000 ampere turns are required in the field winding. This figure is made up of some 150 ampere turns to produce the required flux density in the iron plus some 3,000 ampere turns necessary to create a field of similar flux density across the gap. When the width of the gap is halved to 5-64in. the energising current required to produce the flux across the gap is also halved. Ignoring the small proportion of the total ampere turns required to give the flux in the iron, it can be assumed that the ampere turns needed to produce a given flux density is proportional to the width of the gap. Thus, if 3,000-ampere turns are necessary with a 5-32in. gap, 1,500-ampere turns will be suitable for 5-64in. gap. In brief a good numerical idea of the ampere turns necessary for this particular form of magnetic circuit is given by multiplying the gap width in centimetres by 10,000, the required flux density.

It becomes significant here that as only a small fraction of the total turns required are needed to set up the field in the iron, that little advantage will be gained by using the special grades of dynamo steel for the magnetic casting, or adopting a bolted-in steel centre pole, and particularly is this true in the case of a gap of liberal width. Another important point should be noted. A halving of ampere turns can be obtained by halving the current through a given winding. This in turn is effected by halving the applied potential, so that the watts consumed (which is the ampere-voltage product) now becomes a quarter of the original value. Thus it is obvious that gap width for a given flux density varies, roughly, as the square of the required watts, so that if 32 watts is necessary with a gap of 5-32in., only 8 watts will be required with a gap of 5-64in. and 2 watts for a gap of 5-128in., or just over 1-32in. In the previous constructional article the writer rather assumed that the use of supply mains was imperative, a conclusion which was supported by the heavy demands of the output valve.

High Resistance *v* Low Resistance Coils.

Many readers are, however, prepared to provide the necessary high anode voltage when a mains supply is not available, so that the question of using a much reduced gap of the order of $\frac{1}{16}$in. must be considered. This raises the question of centring devices and the use of a low-resistance winding with a step-down output transformer. The low-resistance moving coil winding requires a carefully designed output transformer, and by its ratio the speech coil impedance must be matched to the valve impedance. Every care must be taken to avoid saturation of an output transformer, and it might be safer to adopt a push-pull output where the D.C. components of the two output valves are opposite in phase. The load on the secondary reacts on the primary, of course, according to the square of the transformer ratio. So with a 1,000-ohm valve and a 10-ohm loud-speaker the ratio required is $\sqrt{\frac{1000}{10}}$ to 1. The approximate working impedance of the loud-speaker winding must be known.

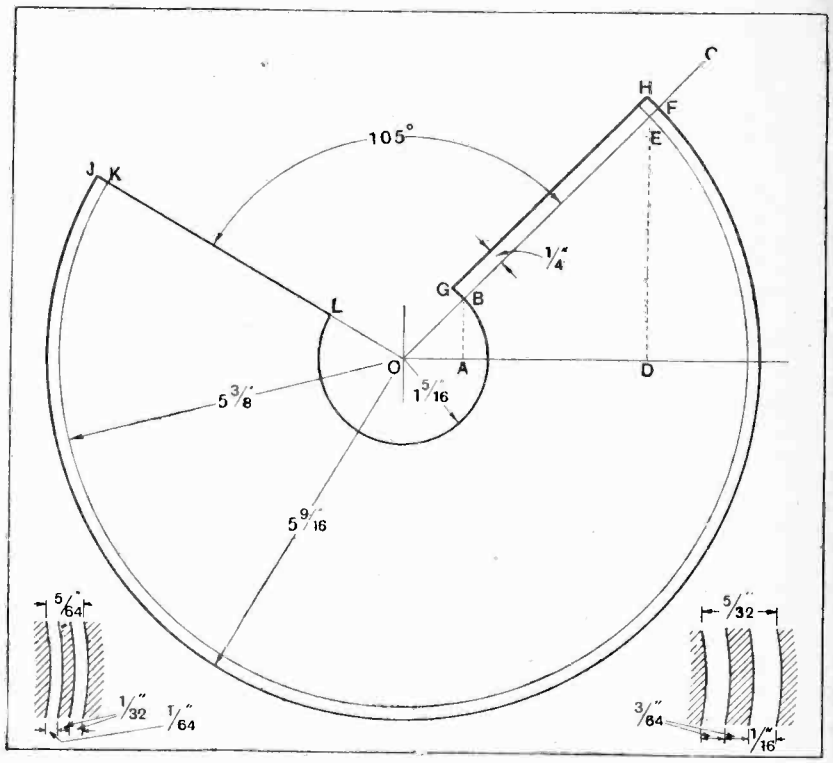


Set of parts made to the dimensions given in the previous article are now available for home construction.

Self-capacity in an output transformer is of little consequence, since, unlike an intervalve transformer, which is practically unloaded, the current which would flow through the stray capacity is small compared with the load. In avoiding the danger of exceeding the permissible maximum flux density one must cautiously guard against the use of an excessive large core which will introduce hysteresis and eddy current losses. The use of an output transformer is beset with many possible chances of introducing distortion, and particularly is there a danger of cut-off in the lower register, possibly below 50 cycles, producing aural discomfort. Using the Ferranti 25 to 1 output transformer and an L.S.5A valve in the output stage, the moving coil winding may consist of 55 turns of No. 36 enamelled wire. With extreme

The Moving Coil Loud-speaker.—

care a high-resistance winding can be accommodated in the narrow gap of 5-64in., or even $\frac{1}{16}$in., by substituting No. 47 S.W.G. enamelled wire for the No. 46 S.W.G. previously recommended. In the winding space of $\frac{1}{16}$in. 1,300 turns can be run on, though one is not recommended to attempt the construction of such a moving coil if unaccustomed to handling fine wires, but, if undertaken, experience will undoubtedly be gained. On the point of using No. 47 gauge wire, exceedingly good results have been obtained with a modest output stage, such as a D.E.5A valve working on 150 volts, when the moving coil is wound with 1,800 turns, as is possible with this finer wire and a liberal gap.

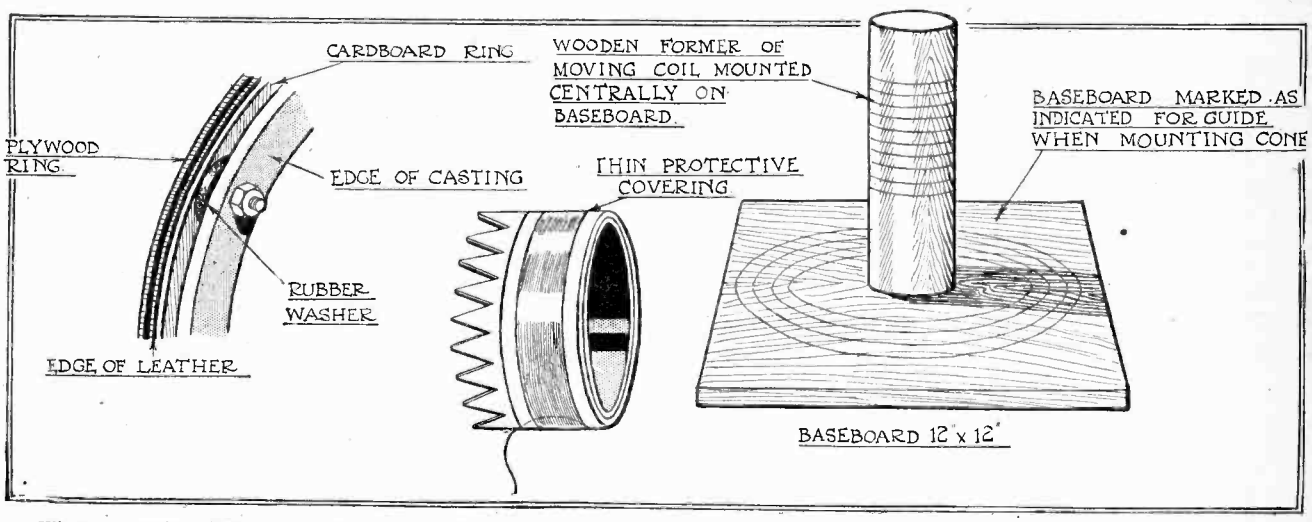


Details for obtaining the cutting out shape of a conical diaphragm. Sections of the gap are also given showing the position of the moving coil. In the narrow gap the moving coil former is made on a hard wood cylinder, 1-25/32in. in diameter. The diameter of the wooden cylinder for constructing the former for the wide gap should be 1-27/32in.

Practical Hints.

A few additional practical hints on the construction of the moving coil may prove useful. An accompanying illustration shows, in section, the position taken by a high-resistance coil in gaps of 5-32in. and 5-64in.,[1] the latter, of course, being adopted in conjunction with some form of centring. It will be seen that the space on the outside of the coil is greater than that around the pole for the reason that clearance with the pole can be observed while contact with the flange cannot be seen, and there is little protection over the winding. Owing to the possibility of the moving coil fouling the walls of the gap, it is advisable to see that no appreciable turning marks appear on the end of the pole or inside rim of the flange. Possible friction may be reduced by polishing these surfaces, though it must not be assumed that the coil may be permitted to rub on the face of the gap, for serious distortion will result. The hard wood cylinder should be examined to see that it is exactly of the required diameter before being wound with the strip

[1] Sets of castings are now available with either small or liberal gap width for use with high or low resistance coils or for mains or battery field current supply.

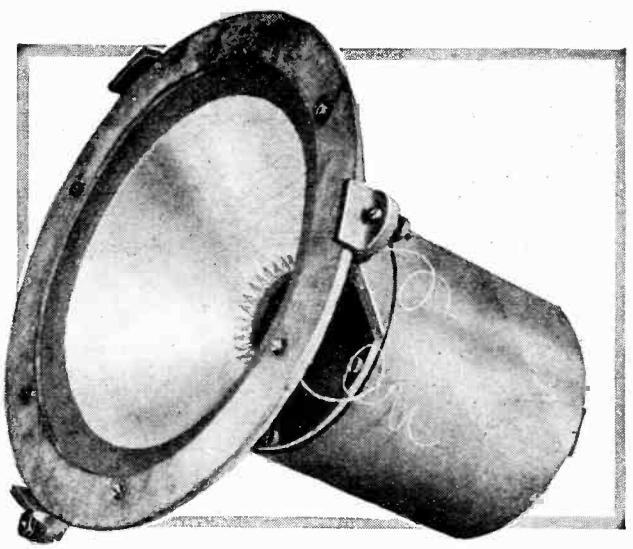


When a centring device is not made use of the finished loud-speaker must be rotated so that the moving coil hangs in the best position concentric with the pole. The insertion of small rubber washers under the plywood ring will provide for tilting the diaphragm for centring the coil. The holes in the plywood ring should be large enough to allow the diaphragm to be carefully centred. The baseboard and column shown here affords a means of correctly assembling the coil former and diaphragm so that they have a common axis. The diaphragm should press tightly against the ridge on the moving coil former from where the connecting wires are led out.

The Moving Coil Loud-speaker.—

of thin drawing paper (detail paper) which is 17½in. × 1 3/16in. The paper is formed into a tube with good shellac varnish, though no varnish should be applied to the underside which is in contact with the wood. Any attempt at baking the former dry will cause it to stick to the former, and it should be frequently tested for freedom. Two 3/16in. strips of paper, 17½in. in length and ⅜in. apart, provide the ridges between which the wire is wound. Although shellac is essentially used as an adhesive for making the former, a trace of "Seccotine" may be used as an alternative prior to applying shellac. "Seccotine" and shellac varnish when mixed will not readily set. Moist "Seccotine" must not be allowed to reach the turns of a high-resistance winding, as it is a comparatively poor insulator.

Winding is not commenced until the former is thoroughly dried out, is perfectly circular, and is a slipping fit on the cylinder. As the leading-out wires both pass out from the diaphragm side of the coil, it is necessary for one end to traverse the former. Without taking the precaution of connecting to a thicker piece of wire, the starting end is passed under the centre narrow strip with the aid of a needle in the groove formed at the end of the paper. The wire may either cross the former here under a piece of very thin paper or the reverse method may be adopted, of crossing the winding on the outside in the small overlap of the thin protecting covering which is applied to the coil on its completion.



A completed loud-speaker. (The front projecting lugs are no longer provided as will be seen in the set of castings shown earlier.)

A hand brace clamped in the vice with the wooden cylinder mounted as a drill makes a good winder. Determine the ratio between cylinder and handle rotation and start by winding on one-quarter of the total turns into a quarter of the winding space, keeping the winding surface level. A good light, a piece of white paper beneath the coil, and an assistant are essential. Avoid the running on of even a single turn near the beginning end when winding the second section, taking up the winding space to the centre. By winding in sections, high potentials will not occur in adjacent turns, and the chances of breakdown are thus minimised. It is perhaps better not to impregnate the finished winding with shellac, owing to the need for warming the coil to drive out moisture and the danger of the former becoming fixed on the cylinder. If varnishing the turns is omitted, the protective covering of a single layer of thin "grease proof" paper may be secured with "Seccotine" thinly applied and only along the edges and overlap. As the successful working of the loud-speaker rests entirely upon making a good job of the moving coil, some little practice in making up formers should be acquired. It is advisable, in fact, to make up two or three formers prior to winding, drying them out, and finishing them as perfectly as possible, eventually selecting the best by virtue of its stiffness, its correctness of size to give suitable clearances, and its conformity to a perfect circle.

Diaphragm Dimensions.

Moving coil loud-speaker performance is largely controlled by the weight and stiffness of the diaphragm. This must be as light as possible. A disc would be floppy unless thick, while a cone possesses considerable strength for its mass. The cone, incidentally, produces a focusing effect of the higher frequencies on the concave side since the air waves cannot move laterally until they have reached the edge of the cone. On the question of weight, the inertia effect is composed not only of the mass of the moving part, but also of the air displacement load, and therefore depends upon both weight and diameter. The greater the diameter up to a point, the greater the displacement at the lower frequencies, and by comparison there is a falling off in the higher register. There are, however, many factors involved, and on this matter a little practice is worth a lot of theory. It is obvious that the ratio mass to diameter must be kept low. Owing to the strength produced, as well as convenience of construction combined with good results, the cone angle adopted is 90°.

A dimensional drawing is given for cutting out the diaphragm, but as slight differences in coil and rim

PARTS FOR MOVING COIL LOUD-SPEAKER.

Set of machined castings including flange and magnet (Collinson's Precision Screw Co., Ltd., Provost Works, Macdonald Road, Walthamstow, London, E.17).
Order with suitable width of gap, 5/32in. if mains are available, or 5/64in. when the magnet is to be energised from a battery.
The leading-out holes should be bushed.
Brass spool with bushed holes.
Plywood ring and screws.
Wire for field coil.
Wire for moving coil, ½ oz. No. 46 or No. 47 S.W.G.
Piece of selected leather (George & Co., 21a, Noel Street, Berwick Street, London, W.).
Bristol board (two-sheet thickness or 0·010in.) and "Detail" paper (thickness 0·004in.).
Sheet of plywood for baffle either 3ft. or 4ft. square, with wood for framing and vertical column.
4 terminals.

(Approximate cost £4 : 5 : 0).

The Moving Coil Loud-speaker.—

dimensions sometimes occur, details as to how the cutting out shape is arrived at may be helpful. A distance OA is set out with the aid of dividers exactly equal to half the outside diameter of the moving coil frame. A line AB is drawn at right angles to this from A, and exactly equal to it in length, OB is joined and extended to C. A circle can then be swung with radius OB. The distance is then determined between the front of the moving former (*i.e.*, the point at which the serrations will be bent over and at which the diaphragm is to be attached) and the front machined face of the casting. When making this measurement the moving coil winding must be symmetrically disposed between front and back of the gap. Great care is needed in accurately arriving at this dimension, and it is then set out as AD. ED is drawn at right angles to AD, cutting OC at E. A circle is swung with OE as radius, which is the front bending edge of the diaphragm. To this radius is added $\frac{3}{16}$in. (EF), which is the piece for attaching to the flexible mount as well as a strip GH, $\frac{1}{4}$in. in width, to be used as a seam. A segment FOJ of 105° is marked off for cutting away. This angle is always 105° in the case of a right-angled cone, and is, incidentally, the sum of 60° and 45°. It is easily arrived at as the numerical ratio between OA and OB brought to a denominator of 360

$$\frac{OA}{OB} = \frac{\text{angle of paper to remain}}{360}.$$

This gives 255° to remain, or 105° to be removed. If necessary the shape can be further checked by calculating the outside circumference of the moving coil former and comparing it with the length LB, while the circumference of the top rim should equal the length KE, which is, of course, $\frac{255}{360}$ths of the circumference of the circle of radius OK. The length BE can also be verified as being the distance across the face of the cone.

(*To be concluded.*)

CLUB NEWS.

Queen's Park Wireless Club.

The Wireless Club of Queen's Park, London, W.10, has embarked upon a new era of activity, and its weekly meetings now include debates, lectures, demonstrations, and Morse instruction. The present course of lectures covers the theory and construction of valves. "Problem Night" is one of the most interesting features of the Society's programme. Each member is supplied with a paper, upon which he is invited to write a question. As each question is read, volunteers are asked to reply in detail or to supply a solution to a particular problem. Finally, a short discussion assists towards the general comprehension and elucidation of knotty points.

All wireless enthusiasts in the neighbourhood are cordially invited to communicate with the Hon. Secretary, Mr. F. Batho, 37, Enbrook Street, Queen's Park, W.10. Experts and beginners are equally welcome.

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Short-wave Plans at Coventry.

At the annual dinner of the Coventry Transmitters' Association on January 3rd the chairman, Mr. P. N. Goulston (2AFS), announced that it had been decided to apply for a licence to use a short-wave oscillator. The past year has been a successful one for the Association, but the hope is expressed that still greater progress will be made in 1928. In connection with the coming short-wave experiments, the chairman remarked on the desirability of apportioning various duties connected with the maintenance and operation of the instrument to different members who were interested in particular phases of the subject.

Hon. Secretary, Mr. L. W. Gardner (5GR), 10, Ludlow Road, Coventry.

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Membership Trebled.

Since its formation in November last, Slade Radio, an organisation appealing to Birmingham wireless enthusiasts, has nearly trebled its membership. To-morrow evening Mr. Derek Shannon will give a lecture, in which he will draw comparisons between gramophone and wireless reproduction.

Hon. Secretary: Mr. H. Clews, 52, St. Thomas Road, Erdington, Birmingham.

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Putney Wireless Classes.

Capt. Jack Frost is conducting the weekly meetings of the Putney Literary Evening Institute Radio Club, which has been formed with the object of providing its members with a good general knowledge of wireless. In conjunction with the lantern lectures by Capt. Frost, interesting demonstrations are given by well-known radio manufacturers, and members also have the opportunity of visiting wireless works and other places of interest.

Meetings are held every Wednesday evening at the County Secondary School, West Hill. Readers interested are asked to communicate with the Hon. Secretary, Mr. H. G. Watkins, 35, Haldon Road, West Hill, S.W.18.

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Moving-coil Loud-speaker Demonstration.

Mr. F. H. Haynes, Assistant Editor of *The Wireless World*, will demonstrate with a moving-coil loud-speaker at a meeting to-morrow (Thursday, January 26th) of the Leyton and Leytonstone Radio Society to be held at 8 p.m. at Haydn House, Fairlop Road, Leytonstone, E.11. Visitors are warmly welcomed.

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Progress at Wigan.

The Radio Society in connection with the Wigan and District Technical College has made rapid progress since its formation a few weeks ago. The membership is over seventy and is drawn from the town and surrounding districts and the College. An appropriate syllabus of lectures and demonstrations is being arranged. All communications should be addressed to the Hon. Secretary, Mr. M. M. Das, B.Sc., at the College.

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Valves in the Making.

A step-by-step description of the manufacture of the thermionic valve was given by Mr. Parr, of the Edison-Swan Electric Co., Ltd., at a recent meeting of the Muswell Hill and District Radio Society. The lecturer added to the interest of his remarks by exhibiting valves in different stages of manufacture. Special attention centred around the new Ediswan valve with two electrode systems in one bulb. An account of the electric furnace used in connection with the exhaustion of valves aroused special interest.

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

FORTHCOMING EVENTS.

WEDNESDAY, JANUARY 25th.

Stretford and District Radio Society.—At 8 p.m. At 6a, Derbyshire Lane. Competition Night.

THURSDAY, JANUARY 26th.

Golders Green and Hendon Radio Society.—Club Dance.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Haydn House, Fairlop Road, E.11. Demonstration of Moving-Coil Loud-Speaker by Mr. F. H. Haynes, Asst. Editor, "The Wireless World."

Slade Radio.—At 8.15 p.m. At 8, Victoria Road, Erdington. Lecture: "Gramophone and Wireless—The Link," by Mr. Derek Shannon.

FRIDAY, JANUARY 27th.

Leeds Radio Society.—At the University. Lecture: "The History of Telegraphy," by Mr. R. E. Timms.

South Manchester Radio Society.—Open Meeting.

Radio Experimental Society of Manchester.—Lecture by Mr. R. M. Kay, B.Sc. (Tech.).

MONDAY, JANUARY 30th.

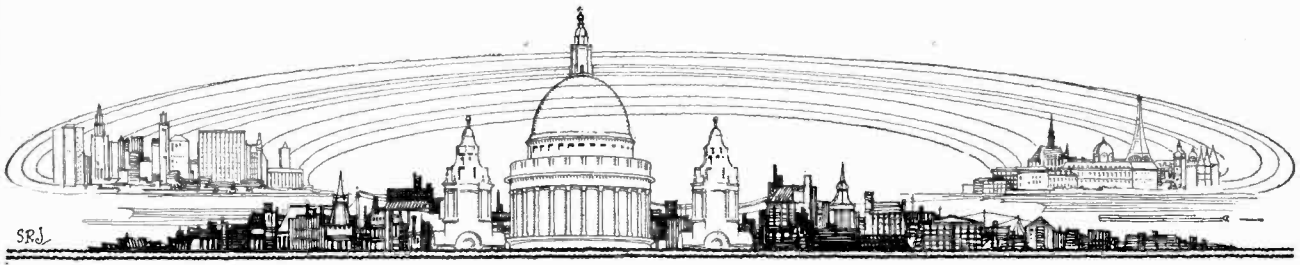
Hackney and District Radio Society.—At 8 p.m. At the Electricity Show Rooms, Lower Clapton Road, E.5. Lecture: "H.T., L.T., and G.B. from D.C. Mains," by Mr. Nicholls.

TUESDAY, JANUARY 31st.

Bradford Radio Society. Open Meeting.

WEDNESDAY, FEBRUARY 1st.

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



CURRENT TOPICS

Events of the Week in Brief Review.

WOMEN AND WIRELESS.

The suggestion that women are not interested in the inner mysteries of wireless finds no support in the experience of *The Wireless World* Information Department. During the present month as many as two or three queries per diem have come from lady correspondents. We hope the number will grow!

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CASE DISMISSED.

The explanation of Frederick Baker, of Lewes, that he thought a month's grace was allowed before the purchase of a wireless licence, was accepted by the Lewes magistrates last week. Baker, who admitted the use of his set without a licence, was discharged on payment of 4s. costs. It was stated that the case was the first of its kind in the district.

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TRAFFIC CONTROL BY WIRELESS.

The value of wireless for traffic control was stressed by Mr. Peccrini, of the London General Omnibus Company, in a lecture before the Institute of Transport on January 17th. It was a practicable proposition, said Mr. Peccrini, to instal control towers wherein the "Stop" and "Go" signals could be radio-triggered off from any reasonable distance. The clocking in and out of omnibuses at terminal points might quite conceivably be centrally registered by wireless in course of time.

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TELEVISION DEMONSTRATED.

A demonstration of the Alexanderson television system similar to that given a few months ago, but on an enlarged scale, was conducted by the General Electric Co., of Schenectady, on January 15th. Television receivers were installed in the homes of several of the company's officials, enabling experts and newspaper men to witness reception in different localities.

According to reports the experiments were markedly successful. The image was received by each instrument on a screen 3in. square, the figure of a man being plainly discernible, even cigarette smoke being visible. Speech was transmitted at the same time, and was received on loud-speakers incorporated in the television sets.

THE DAY OF THE "PORTABLE."

The portable wireless set is coming into favour as a suitable present to retiring celebrities. Mr. George Cresswell, who recently relinquished the chairmanship of the Herefordshire County Council, has been presented with a "portable" by his late colleagues.

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SET CONSTRUCTION IN SCHOOLS.

In many schools the wireless set has been built by teachers and scholars after lesson hours. One of the latest to adopt this scheme is Featherbank School, Horsforth, near Leeds, where the pupils are busily constructing a "four-valver."

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BY DUPLEX TO EGYPT.

The London to Cairo wireless service, hitherto operated by the General Post Office, has been taken over by the Marconi Company. A high-speed duplex service will shortly supersede the present simplex service, and to this end a new receiving station is being erected at Meadi, a few miles south of Cairo, to work in conjunction with the Cairo transmitter.

Two additional beam stations are being erected at Dorchester by the Marconi Company specially for the Egyptian service.

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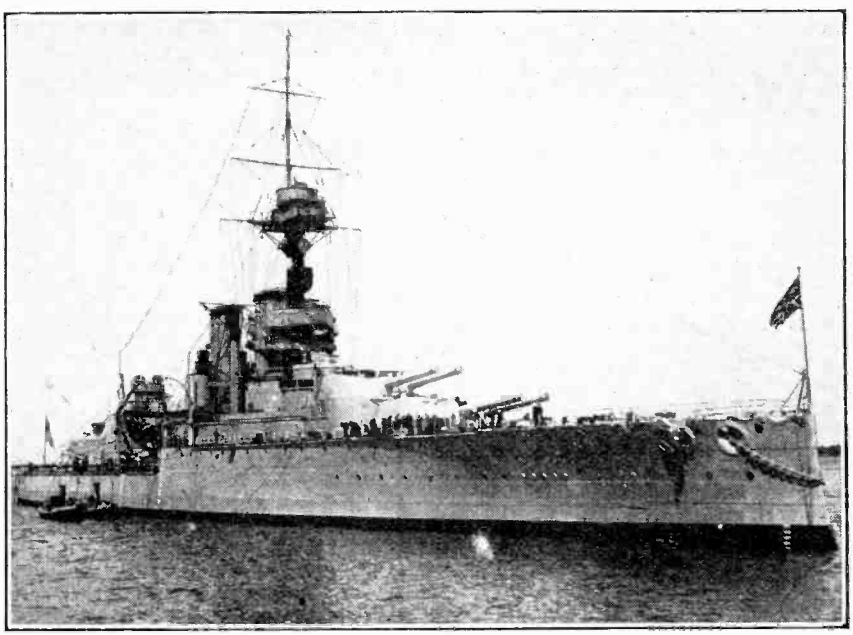
WIRELESS TRAIN CONTROL.

The cost of automatic train stopping devices has hitherto been too high to permit of extensive use on the bulk of lines throughout the country. Improvements in automatic control by wireless have renewed interest in the subject, however, with the result that the Minister of Transport has reconstituted the Committee of Enquiry into automatic train control. Various systems are now under consideration.



WIRELESS-CONTROLLED TARGET SHIP. H.M.S. "Centurion," the discarded battleship, which has been fitted with wireless-controlled machinery for use in gunnery practice. The ship is directed from a destroyer five miles distant and can cruise for four or five hours with no one on board.

OPENING THE DOORS.

Jugo-Slavia has lowered its import duty on British and German wireless apparatus.

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EMPIRE WIRELESS AND CABLES CONFERENCE.

The first two meetings of the Imperial Wireless and Cable Conference were held last week at 2, Whitehall Gardens, S.W., under the chairmanship of Sir John Gilmour, Secretary of State for Scotland. The conference has been called by Great Britain to examine the wireless and cable systems of the Empire with a view to obtaining the adoption of a common policy by the various Governments. The countries represented are Great Britain, Canada, Australia, New Zealand, South Africa, India, and the Colonies and Protectorates.

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DISCOVERING THE TAP-ROOT.

In the absence of precise information it is not possible to assess the value of a startling claim reported to have been made by an Indian scientist, Habid-ur-Rahman Kahn. According to a New Delhi message, Mr. Kahn has "discovered the tap-root of all magneto-electric wireless phenomena, and has formulated his discovery into a new theory on the generation and propagation of wireless waves."

The added information that this Indian gentleman is evolving a new system of wireless dispensing with overhead aerials lacks the romance of his discovery of the tap-root. Details of this will be awaited with interest.

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MUSIC BY MORSE CODE.

A new and extraordinary use was found for wireless a few days ago. King Amanullah of Afghan was approaching Egypt in the P. and O. liner "Rajputana" when the Port Said authorities discovered to their dismay that no one knew the Afghan National Anthem. A frantic wireless message was sent to the "Rajputana" bemoaning this fact, whereupon the purser on board had a happy inspiration which was carried into effect. Note by note the tune was transmitted in Morse code and picked up by the anxious watchers in Port Said. A few hours later when the King landed he was greeted by a faultless rendering of his country's anthem.

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STANDARD PLUG-IN COILS.

A new specification—the third issued by the British Engineering Standards Association dealing with wireless material—has been prepared for the interchangeable type of plug-in coil, and bears the number B.S.S. No. 289-1927. The features standardised are :—(1) Dimensions of the plug portion and the tolerances thereon, in so far as interchangeability is concerned; (2) a range of "sizes" based on the inductance values.

The standard range of coil sizes is designed so as to include coils suitable for all wavelengths from about 20 metres to 25,000 metres when in parallel having a value of 0.001 microfarad or less. The range of coils is divided for convenience into five groups, designated by the letters S, B, M, L and X, which signify that the coils in these groups are suitable for "short," "broadcasting," "medium," "long," and "extra long" wavelengths respectively. The schedule showing the wavelengths to which each coil can be tuned with various condenser-settings also shows the corresponding kilocycle values.

Apart from its usefulness to the manufacturers of coils this specification should prove of great value to the constructors, amateur or otherwise, of wireless receiving sets, and also to all who use plug-in coils for experimental purposes.

Copies of the specification (No. 289-1927) may be obtained from the Publications Department, British Engineering Standards Association, 28, Victoria Street, London. S.W.1, price 2s. 2d. post free.

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A POINT ABOUT LICENCES.

A letter recently addressed by the General Post Office to a Poor Law Institution, but likely to affect other large organisations, raises a point concerning receiving licences which may sometimes be overlooked.

A portion of the letter runs :—"... under the regulations now in force, a single licence taken out by the institution authorities, or by some member of the permanent staff on their behalf, covers the installation and general use of any number of wireless receiving sets or leads from a main set by the inmates and by the staff in common rooms in the institution premises. Separate licences are necessary, however, in respect of stations installed for private use in residential quarters, whether situated in the main building or not."

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SAY IT WITH SHORT WAVES.

The establishment of a chain of commercial short-wave stations in America was one of the proposals made at last week's sitting of the U.S. Federal Radio Commission, whose present task is to satisfy the demands of the many bodies clamouring for space on the short-wave band.

Mr. Mackay, representing the communications system, said that it was desired to instal during the next five years point-to-point short wave services between New York, Chicago, San Francisco, Galveston, and other cities. Other claims included that of the *New York Times* for short-wave facilities to link Washington with the Pacific Coast, and the claim of the Radio Corporation of America for permission to transmit commercial radio photographs from New York to San Francisco.

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BELGIUM TALKS TO AMERICA.

An important extension of the Transatlantic Telephone Service to the Continent of Europe was made on Thursday last, when the service was opened between the whole of the United States and Cuba on the one hand and Brussels and Antwerp on the other hand. Conversation to America from Belgium passes over the Anglo-Belgian cables to the London trunk exchange, and thence by land line to the Rugby wireless station. Speech from the United States to Europe is received by wireless at Cupar in Scotland, passes by land lines to the London trunk exchange, and thence via the Anglo-Continental telephone cables. We understand that extensions of this service to other European countries are planned to take place shortly.

CATALOGUES, &c., RECEIVED.

New Marconi Literature.

A collection of interesting pamphlets has been issued by Marconi's Wireless Telegraph Co., Ltd., dealing with new transmitters and receivers. Leaflet No. 1076 furnishes a description of the "Wireless Beacon Transmitter" with illustrations and operating data. Four standard equipments are available, No. 1 being the most comprehensive as, for emergency purposes, it duplicates all running machinery such as the code sender, motor alternator, time clock and charging plant. No. 4 is designed specially for use in conjunction with submarine signalling gear.

Leaflet No. 1078 deals with "Short Wave Transmitter Type S.250," a telegraph-telephone instrument with 500 watts anode input. Short Wave Receivers Types R.g.16 and R.g.16a are described in Leaflet No. 1079.

The Indirectly Heated Cathode receiving valves K.H.1 and K.L.1 are dealt with in sheets C 28 and C 29 respectively.

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Dry Batteries for Transmission.

A batch of interesting pamphlets dealing with the dry batteries made by the Burgess Battery Co., of Chicago, has reached us from the Rothermel Radio Corporation of Great Britain, Ltd., 24-26, Maddox Street, Regent Street, W.1. One of the pamphlets describes batteries intended specially for transmission work, while another illustrates and gives particulars of especial Arctic radio equipment with battery supply. Some useful tips regarding grid batteries is contained in the leaflet entitled "How to Obtain Proper 'C' Voltages from Burgess Batteries."

The Burgess Co. has also issued a useful radio distance and time map of the world.

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Messrs. Hicks & Mills, 54-60, Britannia Road, Walham Green, London, S.W.6. Catalogue of "Monix" radio labels, dials, switches, etc.

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Regent Radio Supply Co., 21, Bartlett's Buildings, Holborn Circus, London, E.C.4. Catalogue of "Regentone" mains units for A.C. and D.C.

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H. Clarke & Co. (M/CR), Ltd., Atlas Works, Old Trafford, Manchester. Illustrated 48-page price list and catalogue of "Atlas" radio components.

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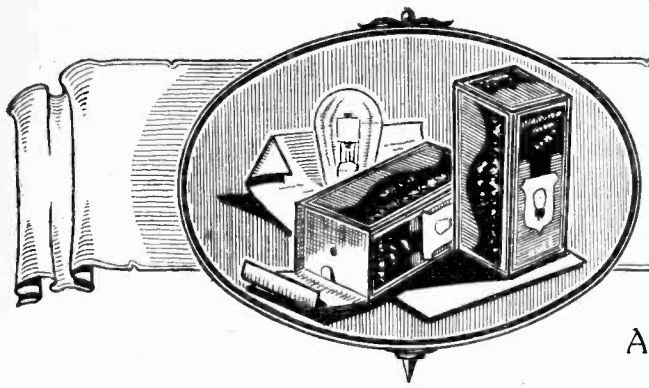
The Electron Co., Ltd., 122-4, Charing Cross Road, London, W.C.2. Booklet covering the Six-Sixty range of glowless valves.



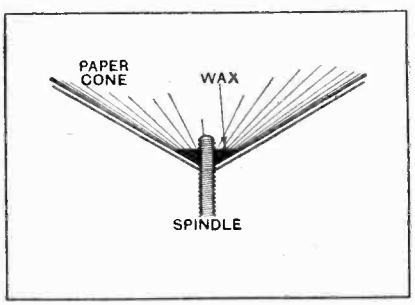
NOVELTIES FROM OUR READERS

A Section Devoted to New Ideas and Practical Devices.

CONE ATTACHMENT.

Amateur constructors of cone loud-speakers with reed movements nearly always encounter difficulty in making a satisfactory joint between the spindle from the reed and the apex of the cone.

The method shown in the sketch will ensure a sound joint free from rattle. A spindle threaded throughout its length should be chosen and allowed to project inside the cone for a short distance. A small quantity of hot wax is then poured into the apex of the cone and allowed to set round the spindle. To ensure that the wax flows into the threads the



Apex joint for cone loud-speaker.

spindle should be gently heated from below before the wax sets.—H. N. M.

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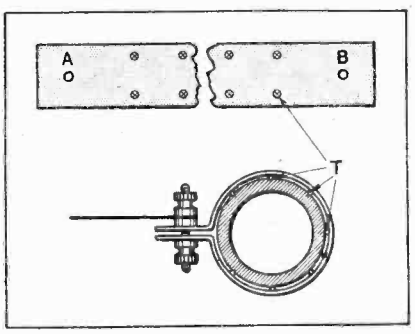
EARTHING CLIP.

The ordinary earthing clip consisting of a flat band of metal clamped round the water pipe often gives trouble through high resistance contact. To overcome this the strip should be prepared as follows:—A stout metal strip about $3\frac{1}{2}$ times the diameter of the pipe is drilled at A and B for the clamping screw and terminal. It is then placed on a piece of soft wood and pierced with a sharp centre punch or nail to raise points T on its surface similar to a nutmeg grater. The strip is then wrapped round the pipe, and before tightening up is given one or two



Improved earth clip.

twists on the pipe in order that the points may cut through any non-conductive film on the surface and make good contact with the metal beneath. This process may be repeated if at any time there is reason to suspect that the earth resistance is high.—W. B. W.

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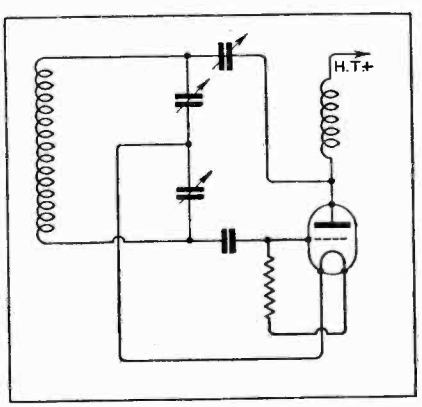
HARTLEY CIRCUIT HINT.

One drawback of the original Hartley receiving circuit was that both sides of the tuning condenser



Twin condenser for overcoming hand-capacity in the Hartley circuit.

were "live" to H.F., and difficulty was experienced with hand-capacity effects. This difficulty may be overcome by using a twin condenser (not gang) in which the moving vanes are mounted on a common spindle and are in electrical contact. By making the moving vanes the electrical centre of the tuned circuit and connecting it to earth or filament as shown in the circuit diagram, all traces of hand-capacity will disappear.—B. M.

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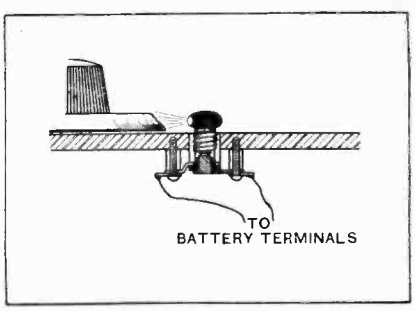
DIAL ILLUMINATOR.

This idea was originally put into use on a wavemeter which had to be



Method of fitting lamp socket for illuminating wavemeter dial.

used in a dark corner of a room in order to obtain the required coupling, but is equally applicable to the tuning controls of receiving sets.

A small lamp socket is fitted near the dial indicator as shown in the sketch, and is connected to the battery terminals of the wavemeter; a $2\frac{1}{2}$-volt flash lamp bulb gives sufficient illumination when a $1\frac{1}{2}$ v. dry cell or 2-volt accumulator is used to actuate the buzzer. To cut off the light the bulb is unscrewed half a turn in the socket. To prevent dazzle the major portion of the bulb may be coated with black enamel.—F. L. K.

THE PHYSICAL SOCIETY'S ANNUAL EXHIBITION.

Some Interesting Radio Exhibits Described.

THE eighteenth annual exhibition of the Physical and Optical Society was held at the Imperial College of Science, South Kensington, on January 10th, 11th, and 12th, 1928, and although the majority of apparatus which was not optical belonged to the laboratory category there were, nevertheless, a number of radio components of interest to the wireless constructor.

So little time has elapsed since the exhibition at Olympia that manufacturers have scarcely had any chance to direct their energies towards the designing of innovations, but attention must perforce be given to the new products of certain concerns.

Stretched Diaphragm Loud-speaker.

Of outstanding interest is the loud-speaker demonstrated by the Gramophone Co., Ltd. The movement is of the coil-driven type, with the usual field winding energised by a local source of current; the speech-coil is attached to a boss at the centre of a flat stretched aluminium alloy diaphragm, which is about 3ft. in diameter, and held at its circumference by no fewer than eighty bolts to a metal ring which forms part of a five-arm casting supporting the pot magnet. The aluminium diaphragm is stretched to the utmost limit of its tensile strength and is only a few mils in thickness. The volume of signals emitted and the quality of reproduction was at least equal to any loud-speaker previously heard by the writer of these notes. A special amplifier employing Marconi transmitting valves is sold as standard equipment to follow a gramophone pick-up device. The construction of the loud-speaker, being unorthodox, and the results obtained from it being exceptional, it is hoped to make further reference to it in the pages of this journal.

On the Marconi stand was to be seen a new short-wave receiver (type R.G.16) covering a waveband of 15 to 150 metres, in which it is claimed that many troubles usually associated with short-wave work are eliminated. The four valves are supported in antimicrophonic valve holders wherein the glass bulb of the valve and its base are held by stockinette, while the four contacts are made by long flexible leads, ensuring the very highest degree of insulation from shock. The whole receiver has external and inter-stage screening, and re-radiation is prevented by a carefully neutralised stage of H.F. amplification placed between the aerial and the oscillating detector valve. Reaction from the plate to the grid of the detector is of the capacity-controlled magnetic type, but a resistance is used instead of a H.F. choke. The leaky grid detector is followed by two stages of L.F. transformer coupling, one of which can be cut out at will by a switch. Although an ordinary aerial will give good results, it is recommended that for the greatest efficiency a doublet

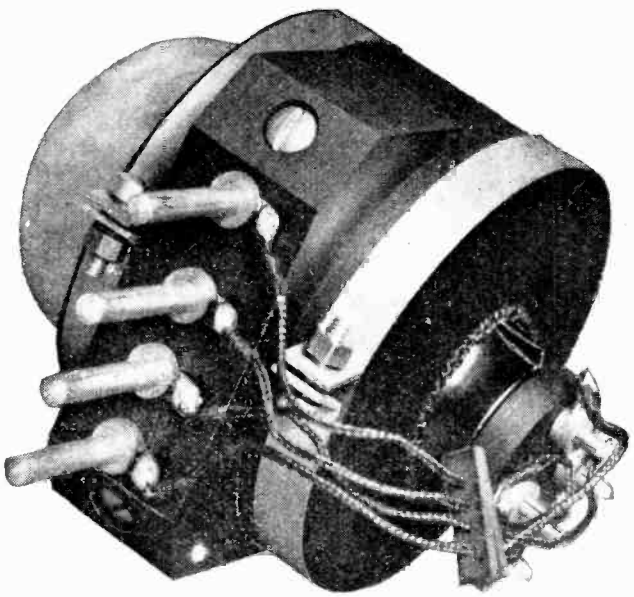


Fig. 2.—Antimicrophonic valve holder used in Marconi short-wave set. The base and glass bulb of the valve are supported in stockinette providing the highest degree of insulation from shock. Note the flexible leads.

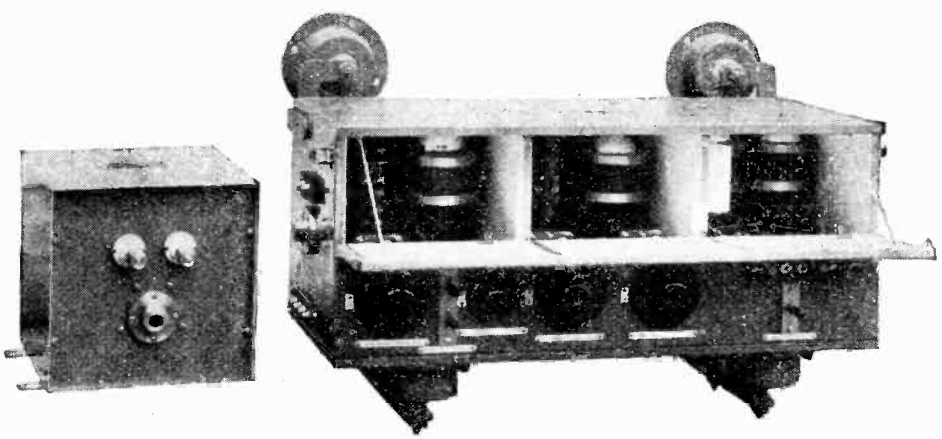


Fig. 1.—Marconi four-valve short-wave set in which one stage of neutralised H.F. amplification is employed. A doublet aerial is connected to the feeder box shown on the left which allows the receiver to be operated at almost any distance.

The Physical Society's Annual Exhibition.—

should be used whose length in metres must be made equal to half the longest wavelength to be received. Well transposed aerial lines link the middle point of the doublet to a metal-screened feeder terminal box, which is connected by an earthed Franklin feeder cable to the receiver, which can thus be placed at almost any distance from the aerial, a point of great importance when the apparatus is used aboard ship.

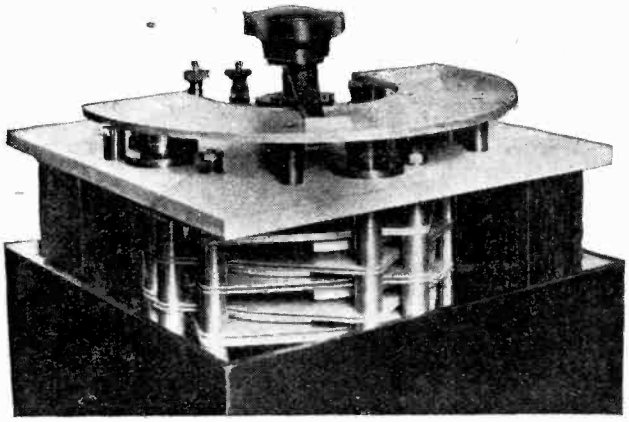


Fig. 3.—The Sullivan-Griffiths Precision condenser for use in accurate wavemeters. Adjacent dielectric gaps are electrically in series instead of parallel and are also complementary.

Messrs. Sullivan were showing the Griffiths Precision condenser, recently described in *Experimental Wireless*.[1] The difficulty of obtaining permanence of calibration in a wavemeter is chiefly due to the moving plates sagging below a point exactly equidistant between the fixed plates, owing to the metal becoming "tired"; there are other points of weakness in the ordinary paralleled-plate type of condenser that has led to the design of the Sullivan-Griffiths Precision condenser, containing interleaved plates where the adjacent dielectric gaps are electrically in series instead of parallel, and are also complementary; adjacent fixed plates are therefore insulated from one another.

[1] *Experimental Wireless*, January, 1928, p. 17.

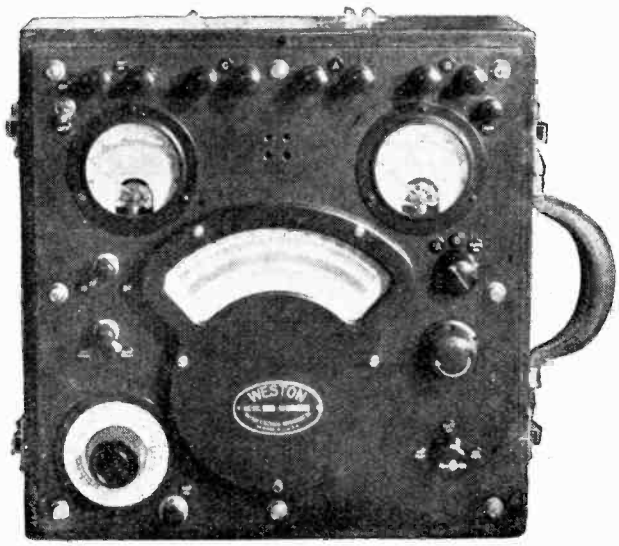


Fig. 4.—Valve characteristic recorder manufactured by Weston Electrical Instrument Company. A.C. resistauce, magnification factor, and mutual conductance, are shown as dial readings.

A valve testing apparatus by the Weston Electrical Company, which gives automatic dial readings of magnification factor, A.C. resistance, mutual conductance, and other characteristics of a valve, is extremely ingenious and should be of interest where a large number of valves have to be tested rapidly. The instrument is designed to be connected to a mains alternating supply of any frequency up to 100 cycles, and of any voltage between 100 and 115. An A.C. voltage is impressed on the grid of the valve so that true A.C. constants are derived. The circuits are changed by the selector switches, shown at the side of the instrument, in such a way that all characteristics are read on the large central multi-scale galvanometer.

Fig. 5.—Pye suspension type moving-coil galvanometer with pointer and scale, in which readings as small as 0.25 microampere can be taken. This instrument is marketed at a very popular price.

Messrs. W. G. Pye and Co., whose chokes and transformers are well known to readers, were showing a sensitive galvanometer of the suspension type having a pointer and scale in place of the usual mirror. The lightness of the moving system is maintained, the pointer being of Duralumin of small section, which is quite dead beat in action. The instrument appears to be robust, and moderately rough handling will not damage the movement; to assist in safeguarding the instrument an automatic coil-clamp comes into action immediately the galvanometer is raised, rendering it necessary to store the instrument on its side. The coil is spring-suspended, and the torsion head is arranged with a definite stop so that the suspension cannot be broken by rotation. The price of a microammeter hitherto has prevented most amateurs from acquiring this most useful instrument, which is almost essential for the measurement

The Physical Society's Annual Exhibition.—

of grid current, value of grid leaks, etc.; the Pye galvanometer sells at the moderate price of £3 3s., and is made with resistances of 12, 50, and 100 ohms, giving sensitivities of one-scale, two-scale, and four-scale divisions respectively per microampere. Provided with a shunt-box, the universal application of such an instrument should be well appreciated.

A neon wavemeter of interest to transmitters was to be seen on Messrs. Dubilier's stand. The glowing of the lamp indicates resonance, while arrangement is made for working on various wavelengths by the provision of a number of carefully calibrated coils. A great deal of inconvenience is experienced by broadcast listeners through local interference from small motors, vacuum cleaners, electro-medical apparatus, etc.; the Dubilier interference eliminator containing a comprehensive filter circuit is a new component which should, therefore, have considerable appeal. The Dubilier A.F.77 type transmitting condenser, selling at the popular price of 17s. 6d., brings a high-class mica dielectric condenser, capable of carrying 5 amperes at 100 metres, within the reach of the enthusiast working on low-power transmission; the capacity range is .00005 mfd. to .015 mfd., while a working voltage up to 1,500 can be safely used.

An electrostatic gramophone pick-up made by Dubilier, and modified in design since the first model shown at Olympia, is a departure from the more usual electro-magnetic variety, and it is claimed that the frequency response curve of the device shows a bass cut-off at a somewhat lower frequency than is usually associated with these instruments. Three leads are necessary when connecting up; two connect the speech oscillations to the input of an amplifying valve, while the third must be joined to a point of positive potential on the H.T. battery.

For controlling the volume of signals a variable resistance can be interposed in the polarising circuit. In order to avoid any alteration in the wiring of a set the necessary complete conversion is effected by plugging into the detector valve holder a special adaptor which has recently been marketed. An interesting application of the pick-up, in which no alteration whatsoever to the receiver is required, employs a radio-frequency oscillator combined with a simple capacity bridge incorporating the capacity pick-up in one of the arms. It is hoped to make further reference to this at a later date.

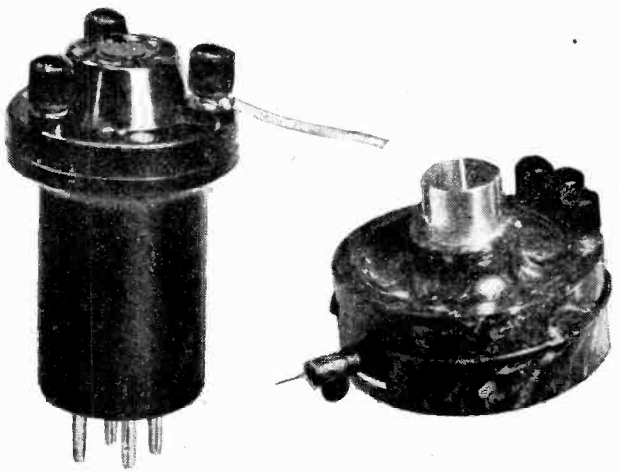


Fig. 7.—Dubilier electrostatic pick-up. On the left is shown an adapter to the plug into the detector valve holder which effects the necessary circuit alteration in a receiver when employing the pick-up.

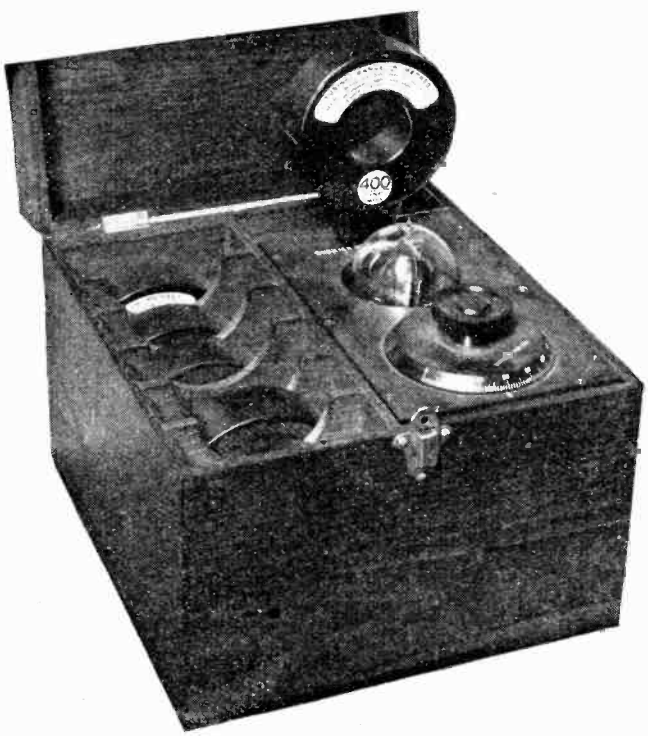


Fig. 6.—Dubilier Wavemeter in which the glowing of a neon lamp indicates resonance.

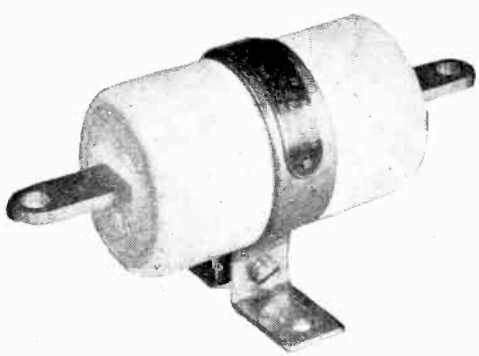
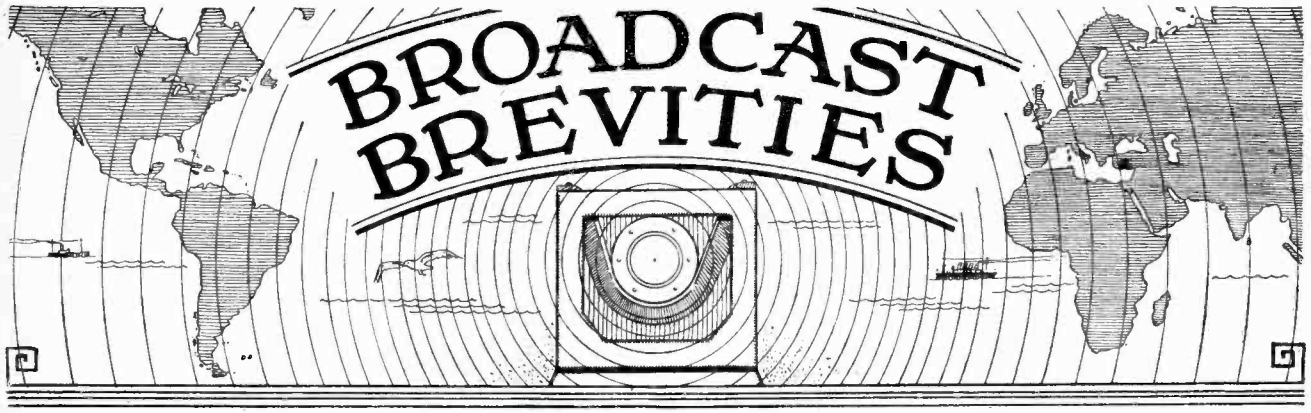


Fig. 8.—A 0·015 mfd. transmitting condenser selling at a popular price and made by the Dubilier Company. It is capable of passing 5 amps when used on 100 metre transmission.

The Zenith Manufacturing Company have designed a series of wire-wound resistances suitable for use in resistance-coupled amplifiers, eliminators, etc.; they are sectioned to minimise self-inductance and capacity. The formers employed consist of vitreous or porcelain-type material, which is undoubtedly of a permanent nature, and the gauge of wire employed is such that the current-carrying capacity is greater than usual. No large metal end-caps are used, and the resistance units measure about 5in. to 6in. in length. W. I. G. P.



By Our Special Correspondent.

Those Continental Relays.—5SW's Wavelength.—Farcical Debates.—New Licence Jump.—Daventry Experiments.—British Band in Berlin.—An Anniversary.

Hope.

The way in which hope springs eternal is exhibited by the rosy stories going the rounds concerning B.B.C. plans for Continental relays. It is suggested that we shall shortly have Vespers from Vienna and dinner music from the Black Mountains; while Berlin, if the accounts are true, will be absorbing Evensong from Westminster or dance chatter from the Savoy.

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Poor Continental Land Lines.

This may, or may not, be alluring enough to arouse the fondest hopes, but there are so many difficulties in the way of early attainment that it would be a pity if too much excitement were caused. The primary difficulty is the inefficiency of the Continental land lines.

The British lines have now reached a high state of perfection, the overhead lines being especially good for broadcasting purposes. On the Continent it is a different story.

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Progress in Germany.

Listeners who remember past attempts to broadcast from Geneva *via* the French line system will not have forgotten the appalling quality of the poor mangled signals which dropped from 2LO.

Some European countries are now making an effort to overhaul their telephone systems, but Germany is the only country showing definite promise of radical improvements in the near future.

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Cost and Maintenance.

Even supposing, in a moment of mad fantasy, that all the European lines were perfect, there is still a difficulty, not bad enough to prohibit international relays, but bad enough to introduce complications. This is the question of line maintenance and costs.

A relay from Berlin to London would involve not only the lines of the countries concerned, but those of Belgium or Holland as well. A relay from Rome would require Swiss and French lines. To make the relays a success each of these countries would have to maintain its lines in good condition, although on many occasions their own nationals would not reap the benefit of the relays. An elaborate system of compromise and conciliation will be called for, and it looks as if the only solution would be the establishment of some sort of clearing house, perhaps at Geneva.

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5SW's Wavelength.

Some optimist has been noising it abroad, possibly because of urgings in these columns, that 5SW is to change its wavelength. Evidently he felt that, since only a moderate success had been attained with the 24-metre wavelength, the Chelmsford engineers would adopt the logical course and change it.

On enquiry at Savoy Hill I found that as far as was known the rumour was baseless.

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Is Daventry's Programme Good Enough?

Sooner or later, of course, a change must take place, probably to something in the neighbourhood of 30 metres. In the meantime, 5SW is still pushing out the Daventry programme, but the only Dominion taking an active interest appears to be the only one that can comfortably get it, viz., Australia. Even there some of the red-hot enthusiasm seems to have evaporated, for no further relays are being attempted.

Dare one suggest that the Daventry programme is hardly up to the required standard of excellence? The Australians put out some very good programmes of their own.

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Aural Indigestion.

A point about Australian broadcasting is its variety. By variety I do not mean entertainment of the vaudeville kind, but the constant flow of highly contrasted material which goes to make up the typical Australian programme. Nothing lasts long enough to satiate. The average turn takes about five or ten minutes, and is often unassociated with anything preceding or following it.

Programmes can, of course, be too

FUTURE FEATURES.

London and Daventry (5XX).

JAN. 29TH.—Orchestral Concert.
JAN. 30TH.—Musical Comedy, "The Lilac Domino."
JAN. 31ST.—Military Band Concert.
FEB. 1ST.—The Lena Ashwell Players.
FEB. 2ND.—Charlot's Hour.
FEB. 3RD.—Symphony Concert.
FEB. 4TH.—Wireless Military Band Concert.

Daventry Experimental (5GB).

JAN. 29TH.—Miscellaneous Choral Concert.
JAN. 30TH.—Variety Programme.
JAN. 31ST.—A Symphony Concert.
FEB. 1ST.—"Dainty Diana," an episode in the life of Sir Roger de Coverley.
FEB. 2ND.—"Colvin's Lane," a play by Gladys Ward, and "Honours Easy," a trifle of patches and powder by A. E. Drinkwater.
FEB. 3RD.—Mendelssohn Programme.
FEB. 4TH.—Chamber Music Concert.

Cardiff.

JAN. 31ST.—A Flapper's Programme.
JAN. 3RD.—Happy Music by Liza Lehmann.

Manchester.

FEB. 1ST.—The "Duds" Concert Party.
FEB. 3RD.—A 'Cello Recital by Garbousova.

Newcastle.

JAN. 31ST.—Schubert Programme.

Glasgow.

FEB. 2ND.—Scottish Choral Programme.

Aberdeen.

FEB. 3RD.—"Mrs. Buggins" Gives a Party.

Belfast.

FEB. 2ND.—An Irish Programme.
FEB. 3RD.—A Military Band Programme.

"snippetty," causing a sort of aural indigestion, but a happy mean between the Australian and British types might discover the secret of universal satisfaction.

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Tabulated Results.

Possibly before these lines are in print the Chelmsford engineers will have issued a tabulated report on the results of the Empire experiments up to date.

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Silly Choice of Subject.

A little more piquancy has been added to the present discussion on controversial broadcasting by the refusal of another prominent debater, Mr. Philip Guedalla, to face the microphone on terms likely to hamper his arguments. The B.B.C. should have known better than to countenance a debate on the subject, "Should Diaries be Burnt?" in the expectation that protagonists could evade all reference to matters of political opinion.

All the most interesting diaries have been intimately concerned with questions of controversy, chiefly political and religious.

Soon, I suppose, the B.B.C. will arrange a non-controversial debate on the Revised Prayer Book.

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Big Increase in Licences.

The month of December showed the biggest jump in the number of receiving licences issued since April last. The net increase over November amounted to 28,656. The number of expiring licences was 216,357, the renewals and new licences amounting in all to 245,013.

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Changes at Daventry.

A natural reluctance to dismantle the 325ft. masts erected with such loving care has led the engineers at 5GB to make experiments with the shape and design of the aerial itself. According to reports the results have been fairly gratifying. To a certain extent the shielding effect of the 5XX masts has been overcome, with the result that Birmingham is less dissatisfied, and certain parts of the country are quite delighted.

Norfolk and Suffolk, for instance, have never enjoyed such a halcyon period since broadcasting was invented; they can now hear a British station even stronger than the German giants.

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Communal Aerials.

The plight of tenement dwellers in Birmingham who are unable to put up outside aerials is still an unhappy one. Formerly they were able to pick up 5IT with an indoor aerial and anything faintly resembling a crystal set. The present contrast in conditions must be rather upsetting.

The best advice one can give to these unfortunates is that they should pool their resources for the erection of communal aerials.

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Signal Strength in Birmingham.

According to the engineers' latest report, the strength of Daventry Experimental in the centre of Birmingham approximates to 18 milli-volts per metre. This is equivalent to the strength of 2LO at an average distance of twelve to fifteen miles.

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News from Spain.

A tale comes from Spain concerning a mischievous announcer at Radio-Barcelona, who is blessed with a knowledge of ventriloquism. The other evening he simulated the accents of a fair damsel with such grace and distinction that offers of marriage are still arriving.

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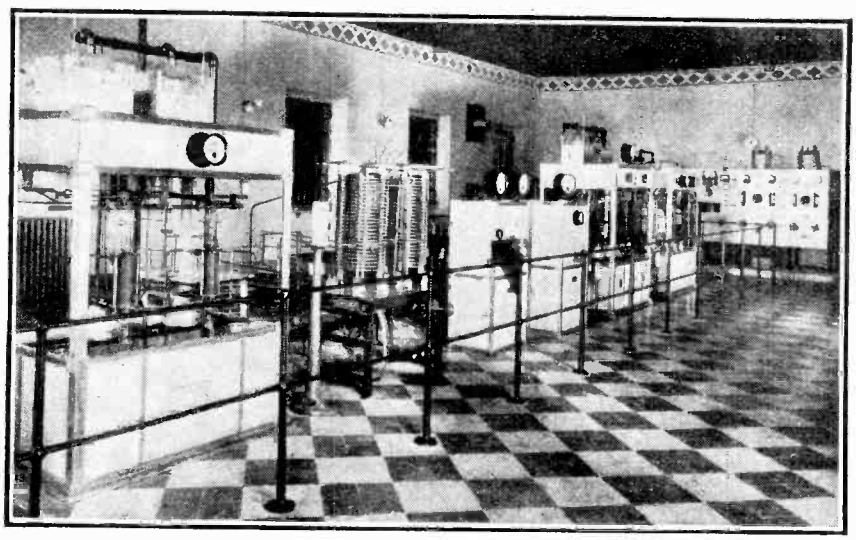
Jack Hylton's Band in Berlin.

Listeners who have enjoyed the transmissions by Jack Hylton and his band from 2LO and Daventry, will, on Friday next, January 27th, have an opportunity of picking up a concert by this famous orchestra from Berlin and several other German stations. The concert, which will be given in the Bachsaal, Berlin, somewhere about 9.30 p.m. G.M.T., will be transmitted by the Voxhaus station on 483.9 m. (240 kc.) 4 kw., and relayed by Koenigswusterhausen (1,250 m., 240 kc., 40 kw.), Breslau (322.6 m., 930 kc., 4 kw.), Frankfurt (428.6 m., 700 kc., 4 kw.), Leipzig (365.8 m., 820 kc., 4 kw.), and Stuttgart (379.7 m., 790 kc., 4 kw.).



BROADCASTING FROM ITALY. Maximum efficiency is suggested by the spick and span appearance of the Milan transmitter, seen in the photograph. Built by the Marconi Company for the Unione Radiofonica Italiana, the transmitter yields an aerial power of 7 kilowatts. The main panels use water-cooled valves, the water being sprayed into tanks mounted on the top of the frames.

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International Rugger Tussle.

After the thrills provided at Murrayfield, when Scotland just scraped home against the Waratahs, Rugger people will look forward to the next international tussle on February 4th, when Scotland meets Wales. A running commentary given by Mr. J. M. MacLennan will be relayed by 2LO, 5XX and all Scottish stations.

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Cyclists at Dinner.

Speeches following the Jubilee banquet of the Cyclists' Touring Club will be relayed from the Connaught Rooms, London, to 5GB listeners on Friday next, January 27th. The toast of the club will be proposed by the Earl of Birkenhead and Mr. William Haigh, chairman of the council, C.T.C., will reply. Both speeches will be broadcast, and a third speech which listeners will also find worth hearing will be that of Sir John Foster Fraser, author, journalist and traveller, who will propose the toast of the "Pastime, Sport and Industry of Cycling."

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Centenarian Programme Compiler.

"Bristol's Hour of Old Favourites" is the title of a programme from Cardiff on February 11th. It has been arranged by Leigh Woods, and items have been chosen by prominent citizens, including the Lord Mayor, the Sheriff of Bristol, Sir John Swaish, Sir W. Howell Davies, and Sir Frank Wills. One song, "The Cottage by the Sea," was chosen by Bristol's oldest resident, Mrs. Miller, of Southmead, aged 105.

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The First Wireless Sermon.

It is seven years since a religious service was first broadcast, and the anniversary of that event has just been celebrated by the church which claims pioneer honours—the Calvary Church of Pittsburgh.

On January 2nd, 1921, the Westinghouse Co. engineers suspended before the pulpit a single microphone which had to pick up not only the preacher's sermon, but organ music, voices from the choir and the singing of the congregation. Now the same job is carried out by eight microphones placed in different parts of the building.

The number of sermons delivered by wireless since that historic date would, placed on end, cover many a weary mile.

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

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

B.B.C. ADVERTISING.

Sir,—As a regular reader of your paper from its earliest issues, I beg to be allowed to encroach upon your valuable space with a protest against the nauseous broadcast advertising by the B.B.C. of their publications, "The Radio Times," and "World Radio."

We are continually forced to listen to the announcer calling attention to the fact that "The Radio Times," on sale to-day, contains interesting items, etc., etc.

Surely it is high time this business was cried down. Apart from the boredom such broadcast advertisement causes most listeners of my experience, it seems a rather questionable practice for the B.B.C. to so advertise their publications, while denying a similar privilege to other publishers.

I hold no brief for any publishers, or printers; in fact, broadcast advertising of any kind is, from my point of view, most unwelcome, and, judging from the acrimonious comments of those who have heard American broadcast advertising, such a practice were better nipped in the bud before it gets any worse.

Teddington, Middlesex. G. H. GUNTER.
January 3rd, 1928.

IDENTIFICATION OF STATIONS.

Sir,—My opinion of Capt. P. P. Eckersley's article on this subject, which you have been fair-minded enough to publish in your January 11th issue, is that he has rendered a public service free of charge to the public. And that if he could be induced, allowed, or commanded by the B.B.C. to give this article as a talk one would not hear much more from the "searchers" on this subject. It could be given as a talk on a controversial subject, which, I believe, is under consideration by the B.B.C.

A TECHNICALLY-MINDED READER.

Chatham.
January 11th, 1928.

Sir,—I have read with considerable interest the recent correspondence on the above subject, and more especially the article by Capt. P. P. Eckersley outlining the official B.B.C. attitude towards the question.

After experience at listening to various Continental station interval notes, I am quite in agreement as to the incongruous nature of such signals, which in many cases make identification even more mystifying.

I feel, however, that, all unconsciously, Capt. P. P. Eckersley touched on the only suitable solution to the problem in his sentence: "It may be Esperanto from Lithuania or French from Canada for all a code could help him!"

The adoption of Esperanto for call announcements, on the lines discussed in *The Wireless World* some considerable time ago, would overcome the objection of incongruity raised against mechanical notes. Even for non-Esperantists the learning of the numerals and the few essential words would be a matter of minutes, and no one country would be at a disadvantage, such as the adoption of, say, French or English would create. Besides, would they adopt another country's tongue? I more than doubt. Racial prejudice, however, would not enter into the question of Esperanto.

Perhaps the B.B.C. fear to initiate an experiment, or possibly they feel that such a course might assist in the spread of the language, which, in spite of their motto "Nation shall Speak unto Nation," they seem to consider undesirable.

Seeing, however, that following the recommendations of the Union Internationale de Radiophonie on the matter of Esperanto, several Continental stations give weekly programme résumés and regular announcements, in addition to lessons in the language, the B.B.C. need have no fear of setting a precedent. Whatever insular opinion the B.B.C. hold it is certain that Esperanto is rapidly increasing in use on the Continent, and even Japanese stations and our Australian friends support it in their programmes, giving frequent lessons and talks in the language.

A step in the direction indicated cannot, therefore, be construed as "stepping where angels fear to tread," but would rather indicate that the initiative and far-sightedness of the B.B.C., which has brought it to its present state of efficiency, is still as vital as ever. E. DONALD DURRANT.

Woodbridge, Suffolk.
January 12th, 1928.

Sir,—Capt. Eckersley's outlook on the identification of stations is typically that of a Government official.

He is sadly misled if he is given to believe that the majority of listeners are content with the local station. In fact, quite the opposite is the case, as in my opinion crystal and 1-valve sets will soon be extinct (except for wireless pirates). The chief attraction of home-made sets is often their ability to receive foreign transmissions. Screened and neutralised H.F. stages have been brought out for this very purpose. In fact, the B.B.C.'s official organ, "World Radio," is issued for the benefit of such listeners. Why, then, try to argue that identification is unnecessary? To my mind, knowing what station I am listening to adds greatly to the pleasure, especially as the foreign programmes (on Sundays) are far more attractive than the B.B.C., and in the majority of cases much easier to tune in. If we have to wait for the promised scheme of linking up Europe by cable to materialise I am afraid the question will cease to trouble the present generation. F. C. RILEY.

"Reinartz," Manchester.

Sir,—I would like to express my entire agreement with Capt. Eckersley on the subject of station identification, but it is a pity that the Corporation's chief engineer cannot refrain in his public pronouncements both from "trying to be funny" and from displaying his appalling personal prejudice against the distant listener. His views are hardly calculated to assist the trade, or even to further the sale of the Corporation's own much-advertised product, "World Radio," and whether or not one agrees that further research on "very multi-valve" reception is required, a *qualitative* statement of the B.B.C.'s efforts to date is quite sufficient to dispose of his theory that "local" radiation of the world's talent via a network of land lines and short-wave stations is anywhere near being a practical proposition. Capt. Eckersley will have to put in a great deal of work before this is achieved, and even then it will only be "stunt broadcasting," not "alternative" programmes—one of the delights of distant listening. To pass to more constructive proposals—after three years of regular listening to both local and foreign transmissions—I have little doubt that those who are more interested in logging station calls than in receiving a programme form a very small minority. These listeners should either use a wave-meter or "look to their sets" and calibrate them. Even owners of powerful sets use the "local" quite a lot of the time and the constant reiteration of its call gets definitely

irritating. I think the language difficulty is over-rated, but *place-names* are more suitable than numbers. In hearing a foreign call one can nearly always get a name, whereas numbers and letters involve a certain knowledge of the language and are therefore unsuitable for international consumption. The same applies to Esperanto, which has a very limited appeal, and which the "proletariat" will not touch either here or anywhere else.

If a uniform system is required I think the announcement "Radio" followed by the geographical name of the station far and away the best solution, but I doubt whether any such uniformity is really necessary. G. M. PART.

Woking, Surrey.
January 12, 1928.

[We do not understand our correspondent's remark that numbers involve a certain knowledge of the language. No serious suggestion has been put forward that numbers should be announced in the language of the country.—ED.]

Sir,—I entirely disagree with Capt. P. P. Eckersley and the identification of stations, and say that anyone who searches would be proud to know to what station he had been listening, whether he understood the programme or not. I am surprised at the suggestion that a play could be ruined by the introduction of pip ponk, pip ponk, per pip, per pip ponk at the end, as I should not expect the station code until the announcer had announced the station's name. R. E. H.

Burley, Leeds.

Sir,—I have followed this correspondence with interest, having a set (the 5-50-1) which has obtained for me so far 57 stations at good strength on the loud-speaker, including Kharkov and Angora.

Frankly, I think the average searcher is too impatient! Also too haphazard! Why not make a pleasure of searching instead of a fretful burden? It has been a real pleasure to me to spend evenings scientifically logging the stations I get, and perhaps my method will be helpful to others. I obtained a list of stations from the back of "World Radio," logged London at 54 on the dial, and turned the dial to the next powerful signal and waited about 20 minutes for a musical item to finish. It proved to be Hamburg at 62 on the dial. In between 62 and 54 I knew, by reference to the station list, that I ought to get Toulouse and Stuttgart at least. I do not know any foreign languages, but I can recognise guttural German from nasal French, and within another half-hour I had Toulouse down for 61 and Stuttgart 58. I went on round the dial, found and identified Langenberg at 80, and then made a note of several stations working in between which I did not stop then to ascertain.

I turned to the long waves, logged Daventry at 60 and Huizen at 84, and then, by reference to the station list, found Berlin at 80, Radio-Paris at 70, and, the other side of Daventry, identified Hilversum at 12. Kalundborg soon followed at 24, and since then I have spent many pleasant hours ascertaining the rest. I have still some to find, and I stalk them as a Red Indian his coveted scalps! I waited a whole evening to identify Moscow, but it was worth it in order to find its dial-number.

This is, therefore, my contribution to the discussion—that one logs two powerful stations a few degrees apart on the set's dial or dials, and then, by reference to a station list, observes whether there are other stations in between the two easily-ascertained ones, and scientifically obtains their dial-readings by the law of proportion and human guess-work.

I do not agree with an obtrusive signal constantly sounding between items. It might be helpful to someone having a general search round by preventing them from missing a station which was working but having an interval, but the purpose of broadcasting is other than to exist for the benefit of "globe-trotters."

Heaven save us from Morse signals! We have enough of those already. My wife considers Morse should be abolished because it encourages swearfulness in husbands! As regards general Morse, I should like to support friend Audigier's proposal.

Bell tones might be useful, but I, for one, very quickly tire of listening, e.g., to Langenberg's studio chimes.

As regards the suggestion sometimes put forward that the announcement before each item or group of items should be simply the name of the station, such as "Berlin" or "Toulouse," it is quite overlooked that this would not suffice because one very often is not ready to pick up the name. During the usual Continental interval of from one to five minutes between items one's attention strays, perhaps to the set, perhaps to the conversation of the family. If the name of the station were announced without a preliminary Hallo or Achtung the word would be said and gone before one's attention could get back quickly enough to it. A better idea would be a simple "H-a-l-l-o, L-o-n-d-o-n!" or "H-a-l-l-o, K-a-l-u-n-d-b-o-r-g!" between each item or group of items, the words being said slowly enough to catch the attention and be understandable.

Finally, let no one be misled by the advertisements crying-up "World Radio," or the little booklet of "Identification Panels." These are presumed to help us any night with any reasonably powerful station, but, although they have their helpful moments they often lack, even where really big stations are concerned. Why are Frankfurt and Toulouse and other big stations often left out of the programme lists? And what on earth is the use of a laconic "Concert" without any recognisable item-titles? I do not doubt that the staff of "World Radio" have real difficulty in getting programmes from some stations, but why boost the paper as though it contained full programmes for every station? ALEX. SIM.

Thornton Heath.
January 11, 1928.

AMATEUR WORKING.

Sir,—As a professional operator with nine years' experience, and having now become an amateur, may I be permitted to offer a suggestion regarding amateur working on 45 metres?

The conditions as they are at present, especially at week-ends, are nothing less than chaotic, and there appears to be no regular procedure in one station calling another. I have heard stations making a prolonged call lasting sometimes two and even three minutes, using their call letters thirty and forty times. I am well aware of the extremely sharp tuning on the ultra short wavelengths, but this does not seem to be sufficient excuse for abnormally long calls.

An operator listening for any special test station often listens to someone else punching out CQ-CQ-CQ *ad lib*, only to find that when eventually the call-sign is given it is not the one he wanted. Surely the commercial method is enough, i.e., ABC ABC ABC de XYZ XYZ, XYZ sent once or twice? This would enable the listening operator to know who he was listening to without having to wait so long before he found out.

I would also suggest that several experienced operators be appointed by the R.S.G.B. to listen for stations who insist on using long calls, and report these stations accordingly.

Torquay. HERBERT A. BARTLETT.
January 10th, 1928. BRS/122.

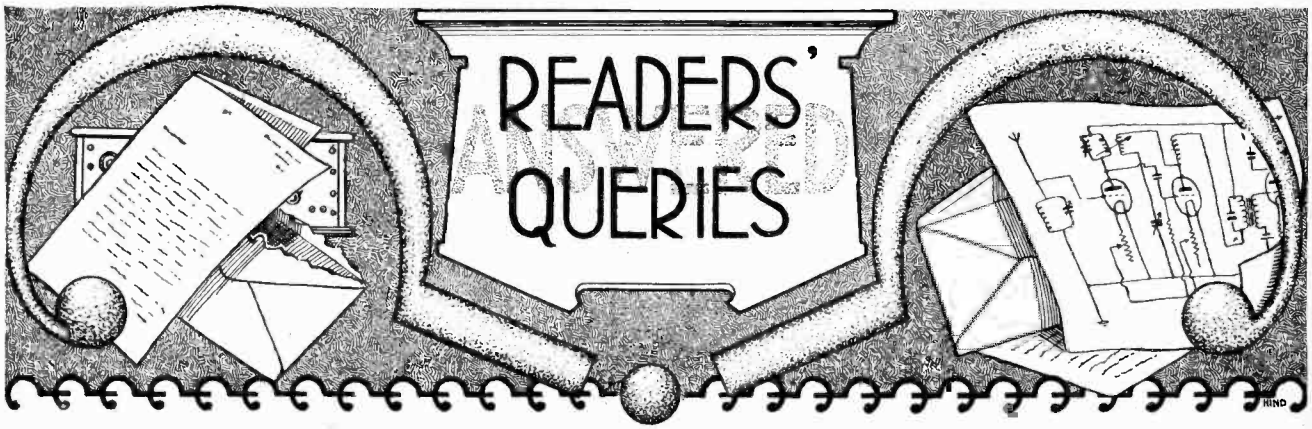
PERFORMANCE CLAIMS.

Sir,—In your issue of December 28th last Mr. S. G. Black states that all Devon and Cornwall, except Plymouth, is far outside the L.S. range of any 3-valve set. As so sweeping a statement seems unfair to manufacturers and advertisers I ask you to issue through your columns an invitation to Mr. Black. If through Torquay R.S. he will get in touch with me I will take him to a 0-v-2 set in a fairly large private hotel, which last summer gave over the half of a lawn-tennis court clear L.S. reproduction of the Menin Gate Dedication, and this Christmas obtained from a full house party the verdict that the reproduction of the chimes from York Minster was "perfect," the best any present had heard.

The set is a perfectly straightforward loose-coupled, magnetic reaction, etc., coil-tuned, made almost entirely of junk I brought here from London in October, 1926.

If old junk will produce these results surely modern units, with suitable modern valves, will do more than required. It must be understood this refers to 5XX only; uninterrupted spark completely spoils all pleasurable reception on the normal band. J. H. REEVES.

Torquay.
January 11, 1928.



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

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

The Two-range Reinartz.

I am building the "Two-range Reinartz" receiver described in your issue of December 15th, 1926, but am having some difficulty with the long wave coil, as I cannot get the specified number of turns into the space provided. Can you help me? R. L. T.

There was a slight error in the description of the long wave coil in this article, but this was corrected in column 2, page 868 of our issue dated December 29th, 1926, and you should refer to this issue, where you will find your trouble dealt with in full.

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Calculating Capacity of Condensers in Series.

I am constructing a short-wave receiver and have a 0.0005 mfd. variable condenser which I wish to utilise. Can you please tell me if this is practical and if by connecting a fixed condenser in series I can reduce the capacity of the variable to 0.00025 mfd.? I should be obliged if you could give me a formula for calculating the resultant capacity when two condensers are connected in series. F. J. C.

The maximum value of the variable condenser can be reduced to 0.00025 mfd. by connecting a fixed condenser of 0.0005 mfd. in series. The formula for calculating the resultant capacity when two condensers are connected in series is :—

$$C = \frac{1}{\frac{1}{C_1} + \frac{1}{C_2}} \text{ mfds.}$$

where C = the resultant capacity and C_1 and C_2 are the capacities of the two condensers connected in series. This formula can be reduced to :—

$$C = \frac{C_1 \times C_2}{C_1 + C_2} \text{ mfds.}$$

RULES.

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

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

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

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

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

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

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

Avoid Switching if Possible.

I have built a receiver based upon the designs of various instruments published by you during the past year, including the "Everyman Four," the "All Wave Four," and the "Regional" receiver. I use interchangeable H.F. transformers. I am within 10 miles of the local station, and desire if possible to insert a switch to cut out the H.F. stage when receiving this station. H. T. L.

In no circumstances do we recommend that you incorporate a switch to cut out the H.F. stage or you will in all probability very seriously impair the efficiency of your receiver on distant stations. You are advised to connect your aerial *via* a 0.0001 mfd. fixed condenser to the top of the tuned grid circuit of the detector valve when receiving the local station. Assuming that you have built your L.F. amplifier on the lines of that used in the "Everyman Four," you will in effect then have an "Economy Two" receiver (*The Wireless World*, October 27th, 1926), with an extra L.F. stage. You can fit an extra aerial terminal and permanently connect it to the top of this grid coil, but only if a short and direct connection can be made, and under no circumstances should a wire be led from the top of this grid coil along the baseboard to this terminal or efficiency will be impaired from the point of view of sensitivity and selectivity when using the H.F. stage.

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Theory and Practice.

I have a high tension battery eliminator connected to a 240 volts D.C. supply main, and intermediate voltages are obtained from a potentiometer shunted across the output of the unit. This is provided with ten tappings equally spaced, the total resistance being 10,000 ohms. Can you tell me, please, what voltage will be available from each tap? V. W.

It is possible to calculate the voltage between any two points on a potentiometer, but this will hold good only when no current is taken from the device. When current is drawn from the eliminator the voltage at the intermediate tapping will drop to a value below the theoretical or calculated value, and the actual voltage available will be governed by the current taken and the nature of the load included in the external circuit. For this reason it is impossible to indicate, with any degree of accuracy the value of the E.M.F. at an intermediate point on the potential divider, and this must be found by measurement, using a good moving coil voltmeter with a resistance of at least 200 ohms per volt. In practice, the correct working voltages can be found by trial and error.