The Wireless World AND RADIO REVIEW

(16th Year of Publication)

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OLYMPIA SHOW COMPETITION.

AS promised last week, we give details in this issue of the results of the Competition organised by *The Wireless World* in connection with the recent Olympia Radio Show, the results indicating the choice made of apparatus in each of a number of classes into which we divided the exhibits.

In the first position, as the outstanding feature of the Show, we have the new Amplion "Lion" loud speaker, and this instrument also wins first place in the loud speaker class. In multi-valve sets, the Marconiphone Portable Receiver, Type 53, comes first, and in sets of four valves and less first place is gained by the Gecophone "Victor Three," manufactured by the General Electric Co., Ltd. Metropolitan Vickers are successful in two classes, gaining first place amongst mains eliminators with their Type B All Mains Unit, which supplies H.T., L.T., and G.B., whilst their Elastic Aerial unit gains the highest number of votes in the components class. Amongst accumulators and batteries the Chloride Electrical Storage Company win with their H.T. accumulator batteries, type W.T.10, and in valves the Mullard Pentode has a large majority of votes.

The names of the readers who are successful in gaining the prizes offered are also given elsewhere in this issue, and each of the winners has now been advised of his success.

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MAINS SUPPLY UNITS.

WE have recently seen an announcement to the effect that the Middlesbrough Electricity Supply Corporation has undertaken to supply consumers of current from their station with mains eliminators for use with wireless sets on the hire system. It is enterprising of the Corporation to undertake this service, and it sets a good example to other electricity supply authorities, but we very much regret to see that the Corporation has encroached upon what we consider to be the legitimate activities of another industry. The Corporation, it is announced, has designed and is manufacturing its own battery eliminator for the purpose, and in view of the fact that there are so many entirely satisfactory eliminators on the market which have been designed and produced by wireless manufacturers, we think that this action on the part of the Middlesbrough Corporation is not only unnecessary but unreasonable. Moreover, if the attitude should be extended to the point of requiring that a consumer should use their eliminator and no other, then it would seem that this would be verging upon abuse of the Corporation's monopoly.

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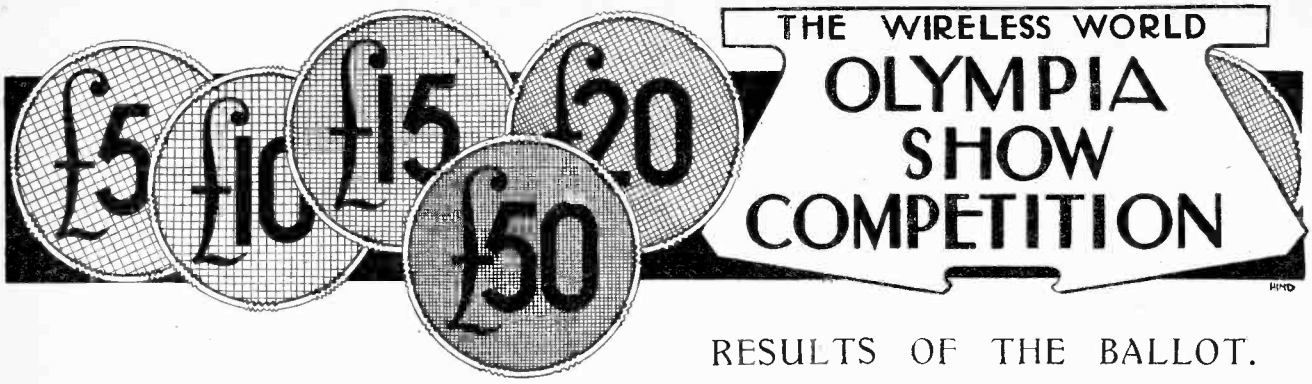
PARIS RADIO SHOW.

IN this issue we publish a review of the Radio Show held at the Grand Palais in Paris, which opened on October 25th. The Exhibition is the equivalent of our annual Olympia Show, and in point of importance in France is no doubt equal to it.

One or two points of special interest show up in reporting upon the exhibits; in particular, the extent to which French designers have concentrated on the superheterodyne almost to the exclusion of every other type of receiver. Unfortunately, the quality of reproduction from the majority of the receivers leaves much to be desired by comparison with British equivalents. There are, however, as one would naturally expect, some notable exceptions.

More attention appears to be given to external appearance and cabinet work in the French receivers than in the British. There are signs that interest in wireless generally in France is expanding, and this impression is confirmed by the very large attendance at the Paris Show.



RESULTS OF THE BALLOT.

AS announced in our last issue, we are now able to publish the results of the Ballot in *The Wireless World* Competition arranged in conjunction with the recent Olympia Radio Show. It will be remembered that the purpose of the Competition was to ascertain what, in the general opinion of our readers, were the best products in various classes exhibited at the Olympia Show.

How Apparatus was Classified.

In order to facilitate the voting, we asked for competitors to enter on the Ballot Form what they considered to be the outstanding feature of the Show, and then to enter what they regarded as the best exhibit in each of the following classes:—

(1) Complete receivers of five valves or more; that is to say, receivers exclusive of loud speaker and batteries, unless these should happen to be incorporated as a part of the receiver.

(2) Complete receivers or amplifiers of four valves or less, similarly defined.

(3) Batteries of all kinds, including accumulators for both high tension and low tension.

(4) Mains supply units, both D.C. and A.C., and including those which provide filament-heating circuits.

(5) Loud speakers of all types.

(6) Valves.

(7) Other component parts, including transformers, fixed and variable condensers, tuning coils, valve-holders, resistances, aerial equipment, etc., etc.

We believed that it would be of very great interest to our readers to have such a means of contributing their views to a general vote, whilst it was also thought that the result would be of general utility, and that it would provide valuable information for the help and guidance of manufacturers themselves. We think it will be agreed that the views expressed by our readers in the Ballot have justified our anticipations.

We take this opportunity of explaining that the nature of the Competition, and the fact that every entrant could make a choice from amongst every article exhibited at Olympia, is the reason for a delay in arriving at the results.

On this page we set forth the names of the manufacturers and the apparatus in each class which have gained first position, and the names of the winners in the Competition, with a note of the prizes which they receive.

Prize Awards.

A cheque for the sum of £50 has been forwarded to Mr. George Ritchie, as the winner of the first prize, whilst the winners of second, third, fourth, and fifth prizes have been invited to forward to us a note of the apparatus which they select to the value of their prize-money, in order that we may arrange for the despatch of the apparatus to them direct.

We propose to illustrate and describe the winning apparatus in the various classes and to give, in addition, one or two illustrations and some descriptive details of the works where the apparatus is produced, as we think that it will be of interest to our readers to have some information as to the organisation behind the production of the apparatus which they have selected as of special merit.

OUTSTANDING SINGLE EXHIBIT AT THE EXHIBITION.

The Amplion "Lion" Loud Speaker.
Graham Amplion, Ltd.

WINNING CLASSIFIED EXHIBITS.

Class 1.
5-valve Portable Receiver, Model 53.
The Marconiphone Co., Ltd.

Class 2.
"Victor Three" Receiver.
The General Electric Co., Ltd.

Class 3.
New Exide H.T. Accumulator, Type W.T.10.
The Chloride Electrical Storage Co., Ltd.

Class 4.
Combined Eliminator for H.T., L.T and G.B., Type B.
Metro-Vick Supplies, Ltd.

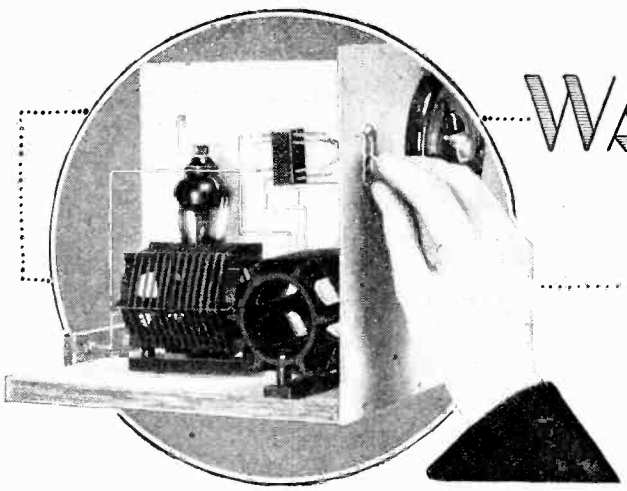
Class 5.
Amplion "Lion" Loud Speaker.
Graham Amplion, Ltd.

Class 6.
P.M. Pentode Valve.
The Mullard Wireless Service Co., Ltd.

Class 7.
Met-Vick Elastic Aerial Unit.
The Metro-Vick Supplies, Ltd.

WINNING COMPETITORS.

1st PRIZE.—£50 . .	Mr. GEORGE RITCHIE, Townhead Place, Kilmacolm, Renfrewshire.
2nd PRIZE. — Apparatus of the winner's selection to the value of £20.	Mr. JOHN MAGUIRE, 46, Flora Street, Lower Broughton, Manchester.
3rd PRIZE. — Apparatus of the winner's selection to the value of £15.	Mr. S. K. DORAN, 3, Junction Road, Romford, Essex.
4th & 5th PRIZES. —These two competitors having tied, the 4th and 5th prizes of apparatus to the value of £10 and £5 respectively, are divided equally.	Mr. W. MUSSELWHITE, Charlton Marshall, Blandford, Dorset, and Mr. JOHN J. GROVER, 84, Clough Road, Rotherham, Yorks.



WAVEBAND SWITCHING

From Short to Long Waves without Changing Coils.

By H. F. SMITH.

THE present-day tendency towards the abolition of plug-in coils in favour of wave-changing by switches may be attributed largely to an increased reliance on radio-frequency measuring instruments on the part of those responsible for the design of receiving gear. At one time it was considered impossible to obtain efficiency except by inserting suitable inductances for the wave range to be covered; this erroneous impression was perhaps due, in part, to the fact that unsuitable components and circuit arrangements were used. We now know that a well-thought-out scheme of switching will introduce a loss so small that it can with difficulty be measured; it will certainly not be audible on a comparative test. Even if it becomes necessary to introduce a compromise between ideal conditions and the requirements of economy and compactness, the resultant falling-off in efficiency need not be too serious; and, most important of all, it can be measured.

It is impossible in a short article to treat all the problems which may puzzle those who wish to include switching in a new receiver or to adapt it to one already built; indeed, bare circuit diagrams of the application of switching to all the more popular types of receivers would occupy many pages. However, an attempt will be made to indicate how this up-to-date aid to easy operation may be applied to typical circuits; changes of more than two wavebands will not be discussed. In all the diagrams given, long- and short-wave coils are denoted, respectively, as L_1 and L_2.

Labour-saving Devices.

The problem, viewed in its simplest aspect, is not a difficult one. Let us consider the tuning arrangements of a simple receiver in which an anode bend detector (which will generally be followed by L.F. amplification) is directly coupled to a tuned aerial coil. The essentials of this arrangement are shown in Fig. 1 (*a*). Instead of changing plug-in tuning coils, how can an equivalent operation be performed by a switch? This is really the fundamental problem, and the solution is given in Fig. 1 (*b*), which shows that the two external circuit connections which remain unchanged are connected to the

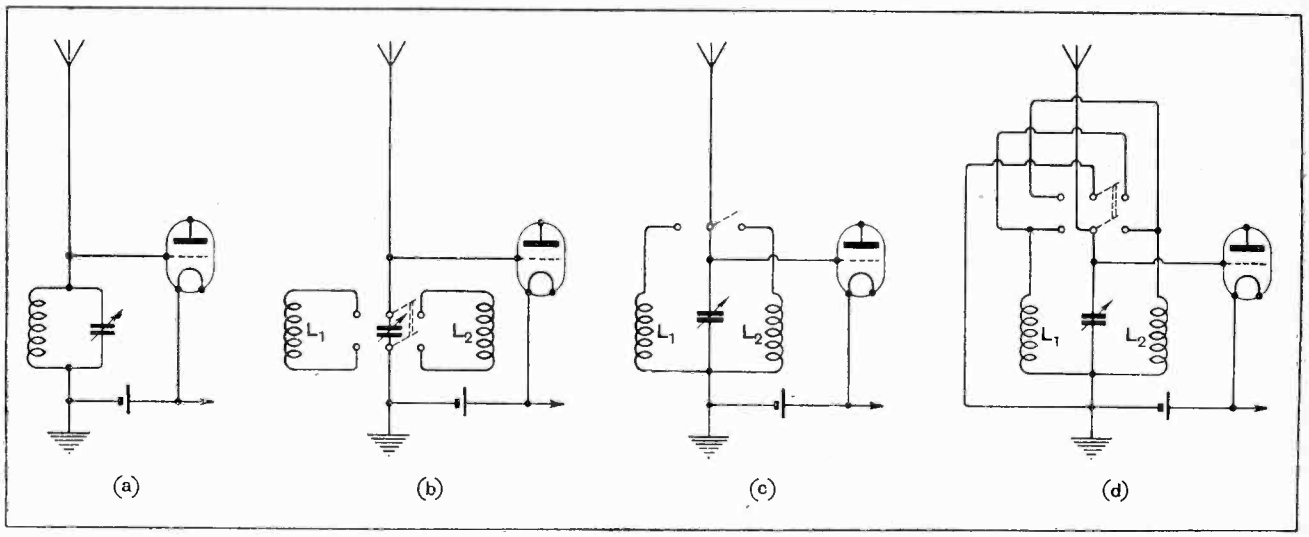


Fig. 1.—An anode bend rectifier directly coupled to a tuned aerial circuit (diagram (a)). Various methods of introducing waveband switching are shown.

Waveband Switching.—centre contacts—and so to the blades—of a double-pole change-over switch, the coils which are to be connected being joined to the outer contacts. It is not difficult to see that coil L_1 will be thrown in circuit when the switch blades are moved to the left, and that L_2 will be completely isolated; the state of affairs will be reversed when the switch arms are moved to the right.

General Considerations.

Although this is not unduly complicated, it is possible still further to simplify matters by using a switch with but a single pole, and permanently connecting together one end of each coil. It is important that the ends so joined together should be those which are connected to earth, either directly or as far as high-frequency voltages are concerned. This arrangement is shown in Fig. 1 (*c*).

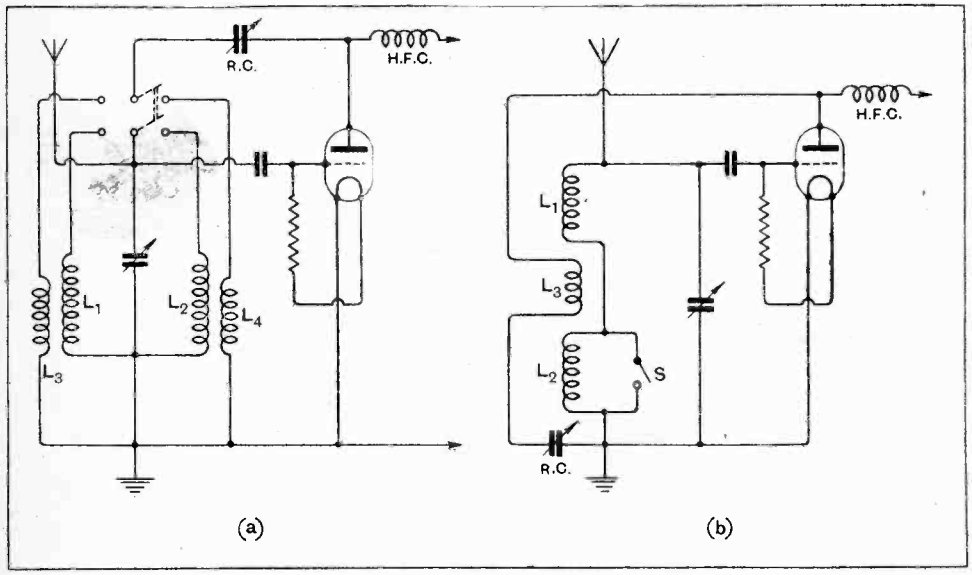


Fig. 2.—Alternative methods of changing wave-ranges in a circuit with regenerative detector.

Before discussing specialised cases, it would appear best to consider some of the general principles involved, and in particular to deal with the relative positions of the coils. It is well known that an inductance can induce energy into another, particularly if they are close together and mounted co-axially, or nearly so; it is therefore a matter of the greatest importance that coils should be suitably disposed, particularly in view of the fact that an inductance designed for covering the longer broadcasting waveband, in conjunction with stray capacities of the values which commonly exist across its ends, has a most unfortunate habit of resonating at a wavelength in the lower band, with the result that it acts as a kind of absorption circuit. The possibility of trouble of this kind can be minimised by arranging the axes of the coils to be at right angles, and also by allowing reasonable spacing between them. As to the exact distance, no hard and fast rule can be laid down, as a good deal depends on the physical size of the coils, etc., but it is generally safe to allow 1½in. between the nearest points.

In some cases this right-angle positioning of coils is inconvenient, or even impossible, and as an alternative we can arrange our switch to short-circuit the winding not in use. The diagram (Fig. 1 (*d*)) showing this scheme may appear complicated at first sight, but the circuits can be easily traced. It will be observed that a switch with an extra pole is required. Again, the spacing between the nearest points of the coils should not be appreciably less than 1½in. We can thus formulate a rough-and-ready rule that when "idle" coils are *not* short-circuited they must be mounted at right angles.

It should be pointed out that interaction between windings increases with their diameter, and there is now a tendency to use smaller coils; unfortunately these are bound to have a somewhat higher H.F. resistance, but this disadvantage can be partially overcome by careful design. If it is desired to effect a compromise in this matter of size it will generally be best to concentrate on maximum efficiency in medium-wave transformers, etc., and to use smaller coils for the long waves. This plan is recommended because losses can more readily be tolerated when receiving on the higher wavelengths.

As to the switches themselves, it must be admitted that the market is by no means flooded with types entirely suitable for insertion in high-frequency circuits. Apart from the obvious requirements of high insulation and small dielectric losses, low self-capacity between the metal parts is almost essential. It should be noted that it is of little advantage to fit small and well-spaced outer contacts if a mass of ironmongery is connected, either metallically or through an appreciable capacity to the moving blades of the switch.

With regard to the actual wiring, it is well to adhere to the old rule as to short leads with adequate spacing; some thought may with advantage be devoted to arranging the relative positions of coils and switch so that this end may be attained. In any case, and in spite of the observance of reasonable precautions, H.F. leads are almost certain to be longer than in a set in which switching is not included, so, where a high-gain H.F. amplifier is used, it may sometimes be necessary to increase inter-stage screening. The need for this addition may often be avoided by wiring in such a way that inductive loops are not produced, and by inserting the decoupling devices which have been described from time to time in this journal.

Some Characteristic Circuits.

It is, of course, immaterial whether the switch knob is raised or depressed for long or short waves, and there is really little need for standardisation in this matter; the writer generally prefers to arrange matters

Waveband Switching —

so that the knob is "up" for reception of the upper waveband.

The use of wave-range switching is seen in its simplest aspects when considering the simple circuit used as an illustration of the principles involved; some loss of this simplicity will inevitably arise, for instance, when we come to add reaction to a leaky grid detector

do well to follow a well-tried specification rather than attempt to design a coil assembly for himself.

Hartley circuits (including modifications) lend themselves particularly well to waveband switching, as will be obvious if Fig. 3 is carefully considered. The unmodified circuit (*a*) is converted by the simple expedient of joining the outer ends of long- and short-wave coils to the outer contacts of a double-pole, change-over

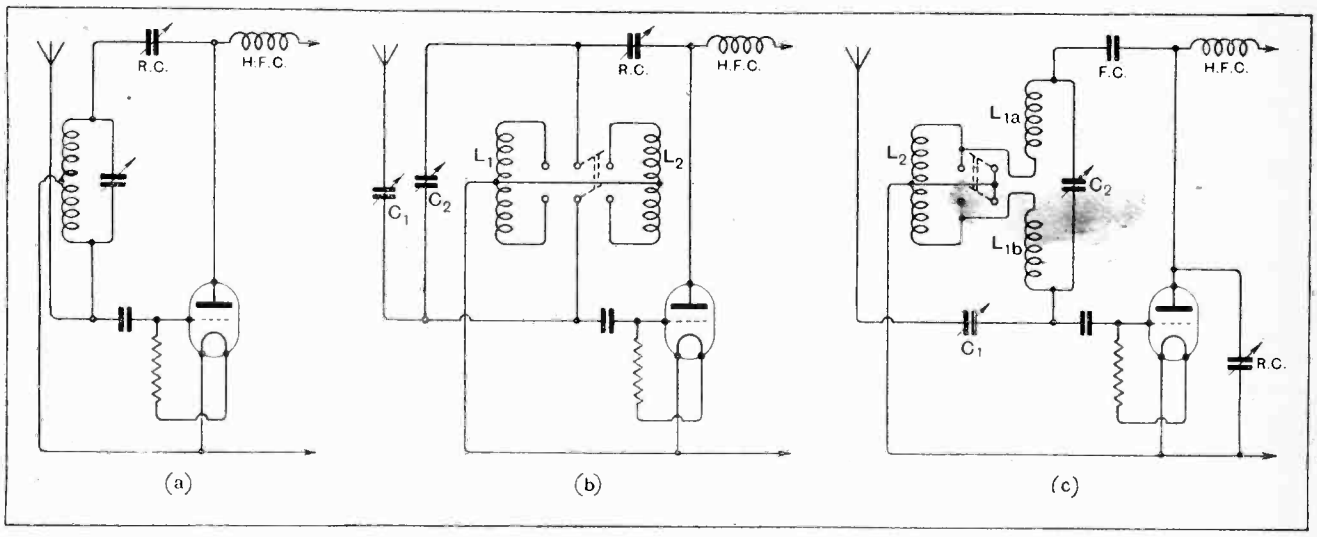


Fig. 3.—Plain Hartley circuit (diagram (a)) with method of switching. A modified arrangement is shown in diagram (c). C_1, aerial coupling condenser; C_2, tuning condenser; R.C., reaction condenser; F.C., feed condenser.

arrangement, as shown in Fig. 2. The first diagram (*a*) indicates an obvious but quite satisfactory method of procedure to be followed when reaction is controlled by means of a condenser (R.C.). The grid coils L_1 and L_2 are connected by one blade of the switch exactly as in Fig. 1 (*c*), the associated reaction windings L_3 and L_4 being placed in circuit by a second pole. On tracing the circuit it will be observed that R.C. is at high potential, and is not connected to the earth sides of the reaction coils. This arrangement is adopted in order to avoid further complications, and, in view of the fact that condensers with insulated and shielded rotors and stators are now obtainable, is free from any serious objections.

Advantages of Hartley Circuits.

What is probably the simplest, and certainly one of the most popular, methods of switching a regenerative detector receiver is that shown in Fig. 2 (*b*). Here it will be seen that the long-wave loading coil L_2 is merely short-circuited by means of a switch when receiving on the medium band. The reaction coil L_3 is common to long- and medium-wave grid inductances, and is so arranged that it is in inductive relation with both of them. This means, in practice, that L_1 and L_2 will be wound co-axially, and as a rule they will be wound on the same former, with the reaction coil between them. Although the arrangement is attractive, in view of its freedom from complication and the need for special components, it calls for care with regard to windings and coupling, and the less-experienced amateur would

switch, the moving blades of which are connected across the tuning condenser. It is probably because ordinary commercial centre-tapped coils are suitable for this circuit that it has such a wide appeal.

The throttle-control Hartley circuit, as used in the "Everyman Portable," and, with the substitution of a differential reaction condenser, in the "Pentode Two" receiver, is particularly successful in a "switch-over" set. It is illustrated in Fig. 3 (*c*), and need not be described, beyond saying that the short-wave tuning

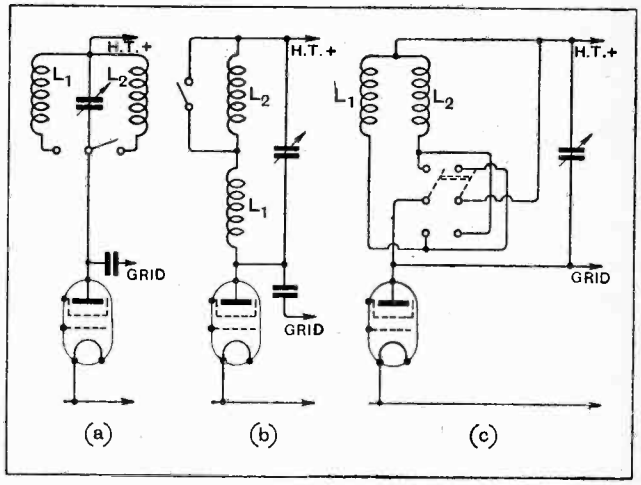


Fig. 4.—Changing tuned anode inductances in an H.F. amplifier with screened-grid valve.

Waveband Switching.—inductance is divided into two halves (L_1 (*a*), L_1 (*b*)); to receive the long waves a loading coil L_2 is inserted at this point, and is short-circuited when required by means of a switch.

When we come to the switching of H.F. coupling circuits, it is found that the requirements are not vastly different from those obtaining in the grid circuits of a detector valve, especially when screened-grid valves are used in conjunction with tuned anode couplings. Fig. 4 (*a*) shows the simple and obvious method of throwing different anode coils into circuit. The alternative method of joining long- and short-wave windings in series, and short-circuiting the former, will certainly appeal, on account of the fact that a simple, single-pole switch only is required. This is shown in diagram (*b*). Another arrangement, which is preferable when the spacing between the coils is insufficient to prevent interaction, is that suggested in diagram (*c*); here a D.P.D.T. switch is arranged to place the appropriate coil in circuit and at the same time to short-circuit the other. All these forms of connection are applicable only in cases where reaction on to the anode coil is not applied.

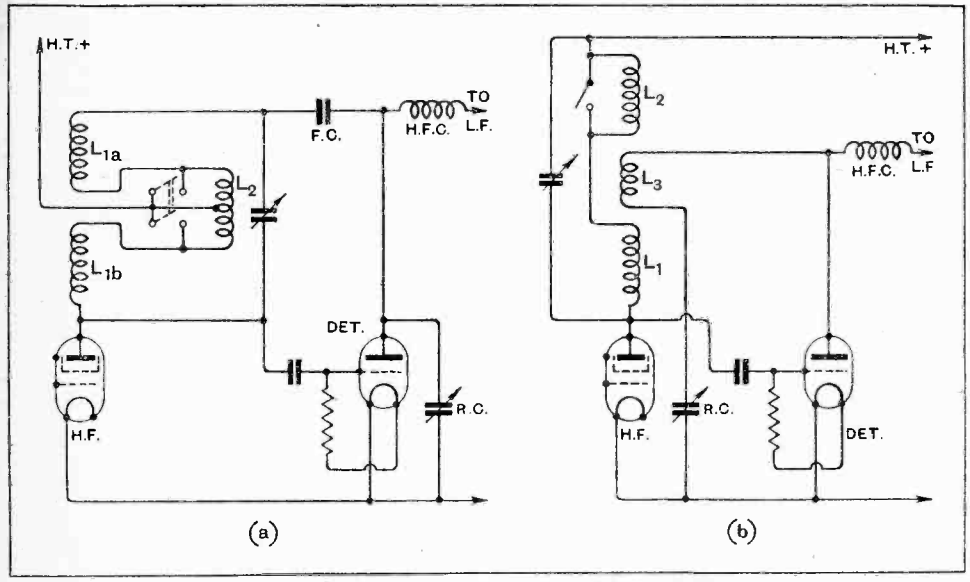


Fig. 5.—Tuned anode coupling circuits with reaction.

Switching Regenerative Circuits.

As in the case of a plain detector valve, the addition of reaction to an interstage coupling is bound to introduce some complication, but there are fortunately means of attaining the desired results without expending too much effort. The arrangement of Fig. 2 (*a*)—with the obvious modification of connecting the low-potential ends of the coils to the high-tension positive terminal instead of to earth—is in some ways the most satisfactory, although it calls for a double-pole, double-throw switch in conjunction with separate pairs of specially wound tuning and reaction coils.

Two other circuits for tuned-anode-and-reaction couplings are given in Fig. 5. The first (*a*) is an adaption of the throttle-controlled detector arrangement already discussed, and has the same advantages in that it affords almost perfect reaction control. Although it requires a special split short-wave winding, L_1 (*a*), L_1 (*b*), the long-wave loading coil may be an ordinary centre-tapped inductance of compact design. It should be pointed out that this coupling is suitable only when the valve following it is operating as a grid detector, but, from the fact that the application of reaction is being discussed, we can safely assume that this will be the case. The second method, Fig. 5 (*b*), is akin to that of Fig. 2 (*b*); the same care is necessary with respect to the relative spacing of the three coils and the number of turns in the reaction winding L_3. This is certainly the most popular arrangement of to-day, as it is both simple and effective.

When screened-grid valves are used in conjunction with tuned transformers as intervalve couplings, there seems to be no real alternative to connecting a D.P.D.T. switch so that plate and grid of preceding and succeeding valves are connected to the high-potential ends of appropriate coils. If it is possible to allow fair spacing between the transformers short-circuiting of the idle coil is unnecessary, but where space is restricted it is desirable to connect the third blade of a three-pole switch to carry out this operation in the manner shown in Fig. 6; it will be sufficient if one winding—preferably the secondary—is short-cuited.

In commercial receivers it seems to be considered

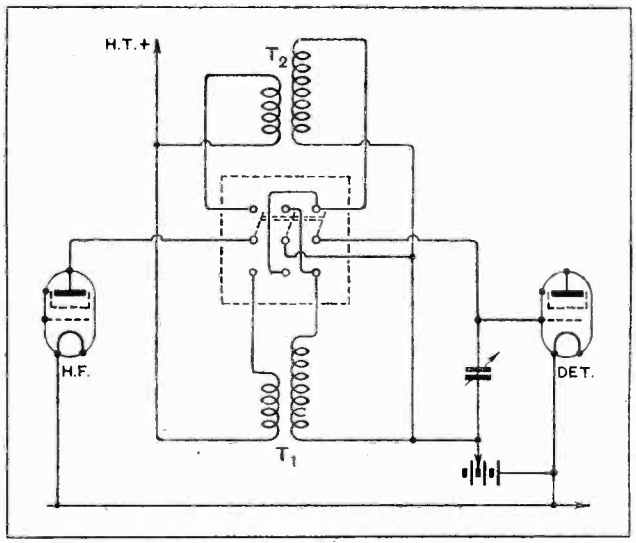


Fig. 6.—Transformer coupling with screened-grid valve: a switch change-over with short-circuiting device.

Waveband Switching.—essential that wave-changing should be effected by operation of a single knob. In detector-L.F. sets this presents no difficulty; but where efficient H.F. stages are used it becomes necessary to provide separate switches for each grid and plate circuit. As to whether these switches should be mechanically coupled in a home-constructed set is a matter for the amateur himself to decide.

In the various diagrams of grid circuits which have been given, directly-connected aerials are shown, although it is nowadays usual to provide an inductive or auto-transformer coupling. A desire to avoid making the subject appear more complicated than it really is was responsible for this deviation from standard practice. A coupled open circuit can easily be added by using an extra pole on the switch and joining the aerial to its centre contact; the outer contacts are joined either to the primary windings or to the tapping points of appropriate coils. These remarks do not apply to the Hartley circuits given in Fig. 3.

A SUGGESTED EXPLANATION OF THE CRYSTAL DETECTOR.

Rectification Phenomena may be Traced to Piezo-electric Action.

AN interesting theory of the contact detector has been published by F. Regler in the *Physikalische Zeitschrift* based on research carried out in the Physical Institute of the University of Vienna, and which may contain the solution of this difficult problem. Regler starts with experiments in which the crystal is used as a rectifier for large currents and high voltages; in this direction he has already achieved considerable success. He has succeeded, for example, in rectifying ordinary alternating current at 110 volts. 50 cycles with the aid of two carborundum crystals, and has obtained in this way direct current up to 0.5 ampere. Further, he found it possible to increase the voltage up to 5,000 volts., and to rectify this with a carborundum crystal and a plate of stainless steel, obtaining a direct current of 0.1 ampere.

Glow at Point of Contact.

During these researches with high-voltage alternating current Regler noticed a distinct glow at and near the point of contact of the crystal, very similar in character to that seen on piezo-electric crystals. It was apparently in this way that Regler arrived at the idea that the rectifying action of the crystal detector might be traced to piezo-electric action, and has tested this theory of his in detail, so that he has been able to explain all the known phenomena of the crystal detector, though these have often seemed contradictory in the light of previous researches.

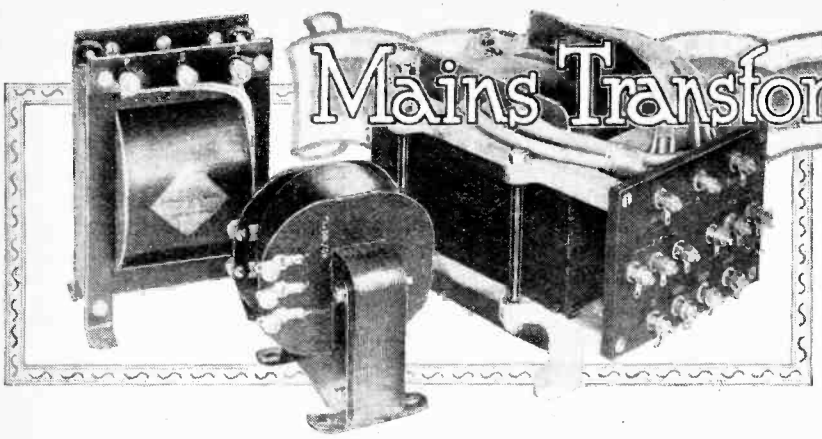
Regler makes a distinction between good and bad detectors. By good detectors he means combinations of two crystals, or of one crystal and a metal; bad detectors on the other hand are combinations of two metals. So far as these bad detectors are concerned, their operation appears to be due primarily to small crystals of metal oxide; furthermore, the phenomenon of the density of electrons on a metal point probably plays an important part. From the practical point of view only the good detectors, consisting of crystal against crystal or crystal against metal, need be considered. For these cases Regler assumes that the crystal contracts during one half-wave of the alternating current, and expands during the other, thus increasing or decreasing the resistance of the contact. It is clear that in this way a rectifying action will occur.

It might be advanced against this theory that the strongly piezo-electric crystals cannot be used for rectification. The reason for this however apparently lies in the fact that the highly piezo-electric crystals conduct but badly, while detector-crystals must have a reasonably low resistance. As a matter of fact, all known crystals are more or less strongly piezo-electric, and apparently extremely small variations of contact pressure, such as are imaginable at a carefully chosen crystal point, suffice to provide for operation as a detector. In addition, the resistance of the piezo-electric crystal varies under the influence of the contraction and expansion, which possibly accentuates the effect of the varying pressure at the point of contact.

Oscillating Crystals.

According to Regler his theory gives an explanation of the oscillating crystal of Lossey, and other similar phenomena which have been observed in the last few years in connection with rectifying crystals. Regler has also succeeded in explaining, with the aid of his theory, various other effects, such as that of jarring on crystals that have become insensitive, the effect of heating, the need for a biasing voltage with carborundum crystals, the direction of the rectified current, and the characteristic of the detector.

Before the problem can be regarded as finally solved, the comments of other physicists on the new theory must be awaited, but it is by no means improbable that the theory correctly explains at least the majority of observed phenomena.



Mains Transformer Design

PART II.

Procedure for Determining the Actual Losses in Transformers.

By H. B. DENT.

(*Concluded from page 572 of October 24th issue.*)

IN the first part of this article we discussed the nature, and the method of determining the magnitude of the losses common to all transformers of the type dealt with here. As we have now reached a stage in the design when sufficient information is available to calculate these we will apply the method to the present case, taking, to commence with, the copper losses. From the scale drawing of the core, the mean length of one turn is found to be $8\frac{7}{8}$ inches—for convenience we will take this as 8.8 inches—and if the total number of turns on each winding is multiplied by this figure the estimated amount of wire in each coil will be sufficiently accurate for the present purpose. Taking the primary first, we calculate the length of wire as $\frac{1,440 \times 8.8}{12 \times 3} = 324$ yds., and from the table the resistance per yard of No. 26 S.W.G. is found to be 0.094 ohms, consequently the D.C. resistance of this coil is $324 \times 0.094 = 31.4$ ohms. Now, assuming the primary current to be as decided earlier, the I^2R loss will be $0.24^2 \times 31.4 = 1.88$ watts. Treating the high-voltage secondary in a like manner, the amount of wire here amounts to $\frac{3,000 \times 8.8}{12 \times 3} = 730$ yards, the resistance $730 \times 0.53 = 387$ ohms, and the I^2R loss $0.05^2 \times 387 = 1$ watt. The copper loss in the low-voltage secondary will be found to be $\frac{36 \times 8.8 \times 0.0075 \times 3^2}{12 \times 3} =$ 0.6 watts. Therefore, the total copper loss in the transformer is $1.88 + 1 + 0.6 = 3.5$ watts approximately.

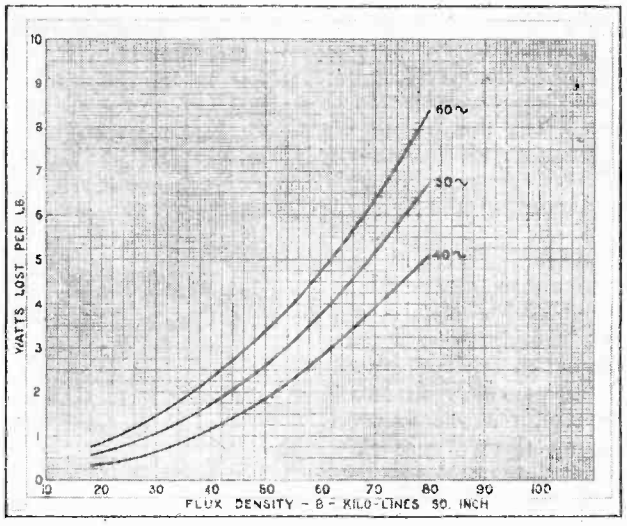


Fig. 4.—Curve showing watts lost per lb. of iron at various flux densities. *(Courtesy Jos. Sankey & Sons, Ltd.)*

The first step in working out the iron loss is to find the volume of iron in the core by multiplying together the three outside dimensions, taken from the scale drawing, deducting from this a volume equal to the two winding spaces, and multiplying the remainder by the iron space factor. Thus; $3\frac{9}{16} \times 3\frac{3}{16} \times 1\frac{5}{8} = 18.4$ cubic inches, and the winding spaces $2\ (2\frac{5}{16} \times \frac{7}{8} \times 1\frac{5}{8}) = 6.6$. Therefore, the total volume of iron is $18.4 - 6.6 \times 0.9 = 10.6$ cubic inches. To convert this to pounds, we multiply by 0.28 $(10.6 \times 0.28) = 3$ lb. approximately.

From the curve, Fig. 4, it will be seen that at a flux density of 50 kilo-lines and for 50 cycles supply, the watts lost are 2.6 per lb., so that the iron loss is $3 \times 2.6 = 7.8$ watts. By adding together the copper and iron losses we find the total watts lost in transformation, and thereby determine the efficiency factor of the device. In this case the losses are $3.5 + 7.8 = 11.3$ watts, or 20 per cent. approximately. Thus the efficiency of the transformer will be in the order of 80 per cent., or somewhat higher than we estimated at the commencement. This difference will have some slight bearing on our calculations as regards primary current and copper loss in this coil, but it is not sufficiently serious to warrant revision of the working. Of course, in all designs based on assumed dimensions, as in the present case, a slight discrepancy between certain assumed values and true values must creep in, but in very few cases will this be serious.

Before embarking on the construction of the transformer, it would be advisable to ascertain the magnetising current, as although this will normally have no bearing on the efficiency, being a wattless current, it would affect it if found to be too large. In designing a transformer for power work, this would be given consideration in the very early stages, but in the present case the method is based partially on the result of measurements made with components of a similar type, and, within certain limits, the mode of procedure

Mains Transformer Design.—

explained in the foregoing chapters is admissible; it is also a short cut to results which could be obtained otherwise only by lengthy and tedious calculation.

Although the magnetising current is responsible for the flux in the core, and is accordingly a part of the current in the primary, normally it is 90 deg. out of phase with the supply voltage, and will have no effect, therefore, on the reading of a wattmeter. As electricity is sold at a definite rate per unit (current × volts per hour), the consumer pays nothing for magnetising the iron; this is, perhaps, one of the few instances where something useful can be obtained gratis. Should the magnetising current reach a comparatively large value, it may cause a considerable reduction in the efficiency and will certainly lead to over-heating, as under these conditions it will have a component in phase with the supply voltage which will add to the primary current and consequently to the I^2R loss in this coil.

Formula for Magnetising Current.

The magnetising current depends on the ampere-turns per inch length of the iron circuit required to produce the working flux density in the core, also upon the magnetic resistance of the iron. This will vary with different samples, and the curve given in Fig. 5 shows the relationship between flux density and ampere-turns per inch for "Stalloy" transformer iron.

The formula for determining the magnetising current is as follows:—

$$\frac{l \times \text{ampere-turns per inch}}{1.41 \times \text{primary turns}} \quad \ldots\ldots\ldots\ldots \quad (3)$$

where l = mean length of the iron circuit.

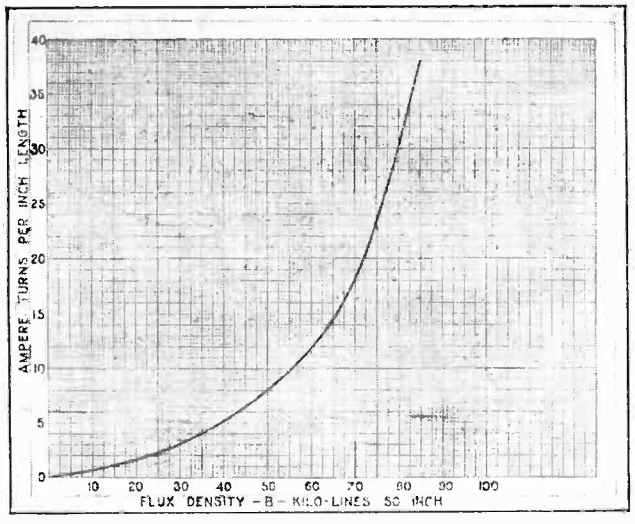


Fig. 5.—Relationship between ampere turns per inch length of magnetic circuit and flux density. *(Courtesy Jos. Sankey & Sons, Ltd.)*

From the curve in Fig. 5 we find that at a flux density of 50 kilo-lines per square inch the ampere-turns per inch will be eight, and the mean length of the iron circuit 8½in. (scale drawing of core). Therefore, the magnetising current is as follows: $\frac{8 \times 8.5}{1.41 \times 1,440} = 0.033$ ampere, which is 17 per cent., approximately, of the full-load primary current. Although this figure would hardly be acceptable to those concerned with the design of transformers for power work, the writer has found that in small components of the type discussed here the danger point is not reached until the magnetising current exceeds 20 per cent. of the full-load primary current.

Coil Winding.

This article would hardly be complete without a reference to the method of constructing and assembling the coils to comply with the conditions previously discussed. It will be recalled that a suggestion was made to the effect that the primary and high-voltage secondary should each be divided into two coils of equal turns, and all be mounted in a symmetrical manner, as far as coupling is concerned, on the centre limb of the core. This naturally postulates a slab type of coil, and we will now give attention to a consideration of the most suitable thickness for each. The length of the centre limb is $2\frac{5}{16}$ins., and the available depth for winding ⅞in. Now, having regard to the relative claims each winding has on the space available, we will decide to make each primary coil ½in. thick, each high-voltage secondary $\frac{5}{16}$in., and the filament coil ⅜in. This would appear to leave just over ¼in. to spare. It must be remembered that the coils will be bound with tape after winding, also they will probably swell slightly when the former is removed, so that actually there will be little or nothing to spare in this direction.

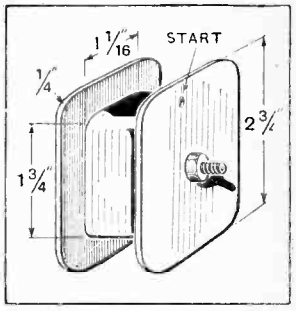


Fig. 6.—The coils described in the text could be wound on a former of this type.

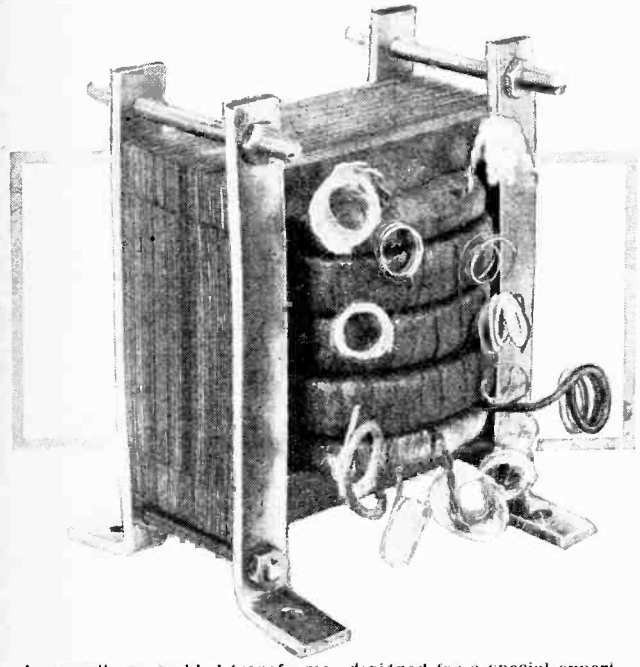
Any tendency on the part of the coils to swell when the winding former is removed can be mitigated by adopting the following method of construction. In the first case two or more formers should be made up to the dimensions given in Fig. 6, but those used need not have an exhibition finish, although the essential dimensions should be accurately reproduced. The side cheeks and centre bosses can be cut from any hard wood available, and the three pieces comprising each former held rigidly together by a nut and bolt passed through clearance holes in the centres. A small hole will be required in one side piece close to the centre boss, to pass the commencement of the wire through, and should be positioned so as not to bring the wire out of the coil at a side which is adjacent to the iron. As the long sides of the coil will pass through the window, the hole should be drilled in one of the short sides.

Before the first turns of wire are put on, two or three layers of thin paper should be wrapped round the centre boss to prevent the insulation being damaged when this is removed from the finished coil. If alternate layers of wire are given a coating of thin shellac varnish it will help to hold the coil together, and a layer of thin paper put on occasionally will help to maintain an even winding surface. The constructor must be very sparing with

Mains Transformer Design.—

the layers of paper, and should keep an even tension on the wire during winding, otherwise the coil will finish too large to fit on the core. When the required number of turns have been put on and a further coating of varnish applied the wound former should be placed in a warm oven to bake for about an hour, and then laid aside to harden. In the meantime another coil can be wound in a similar manner on one of the spare formers.

Before the varnish on the first coil has become too hard the side cheeks of the former should be carefully removed and the exposed wire given another application of varnish and again baked. When this has set, a very rigid coil will result, and it will be possible to remove the centre boss without affecting the shape of the coil. Now bind each coil with some thin linen or silk tape, using only just sufficient to completely cover the wire, after which a final touch of the shellac brush, to impart a workmanlike finish, and a short spell in the oven, will see the end



A partially assembled transformer designed for a special experiment. The secondary windings give 2, 6, 8 and 30 volts. Rating 50 watts output.

of this work. It might be worth while to tie a small tag on each coil before binding with tape, as in some cases the gauges of wire may be so close that identification by this means alone would be impossible. Needless to say, the same direction of winding should be maintained throughout, then if the coils are assembled with the inside ends all coming out to the left, for example, the direction of winding will be the same in all coils. The reason for this is obvious, as the primary and one of the secondaries are in two parts but connected in series, consequently the direction of winding must be the same in both halves of the coil.

A few hints with regard to the assembly of the core would not be out of place here, especially as this will

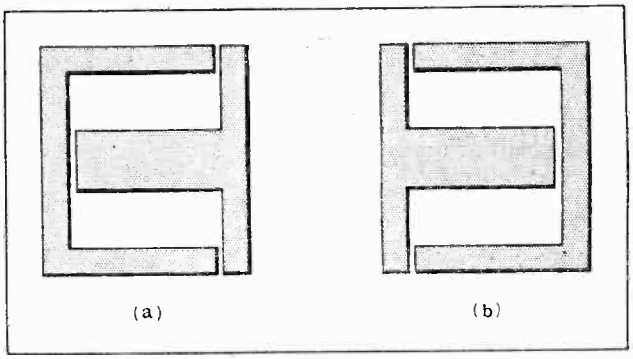
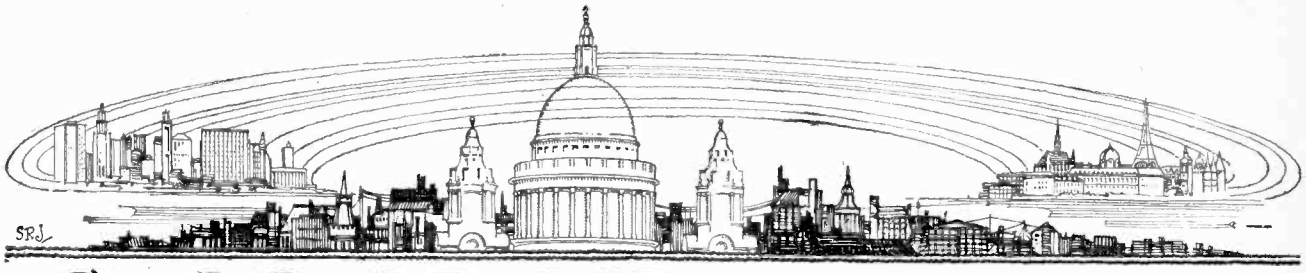


Fig. 7.—Air gaps in the core introduce serious losses so that adjacent pairs of laminations are assembled in reverse order. If (a) represents the first pair, the second should be as in (b).

have a bearing on the efficiency of the transformer. If air gaps are present the magnetic resistance of the iron circuit will increase enormously, and the efficiency of the device will be greatly reduced. The "No. 4" stampings referred to in this article consist of "U"- and "T"-shaped laminations, one of each, or a pair, giving the required shape to the core. The core should not be assembled in such a manner that all "U" and "T" pieces are the same side, otherwise three longitudinal air gaps will be formed. The correct mode of assembly is to reverse the order in each layer; thus if Fig. 7 (a) is the arrangement of the first pair, then the second should be assembled as in (b). By adopting this method of building up the core the gaps do not coincide. Needless to say, as each stamping is provided with insulation on one face, all laminations must be placed in position so that the insulated surface of one pair is adjacent to the bare surface of the other pair. As regards the clamping together of the core, it will suffice to say here that all holding bolts should clear the edges of the stampings, for the reasons discussed earlier in the article, and the final touches, such as fitting of terminal strips, will be left to the ingenuity of the constructor.

This opportunity is taken to correct an unfortunate error in the fundamental formula on page 569 in the first part of this article. The formula should read $4.44 \times F \times f \times t = 10^8$, and not as given.

In conclusion, the writer wishes to thank Messrs. Jos. Sankey and Sons, Ltd., 168, Regent Street, London, W.1, for kindly placing at his disposal the data from which the B/H and "iron loss" curves with regard to "Stalloy" transformer iron were prepared.



CURRENT TOPICS

Events of the Week in Brief Review.

ROYAL SET-BUILDER.

One of the latest recruits to the ranks of home constructors is King Alexander of Jugoslavia, who, according to a European correspondent, is himself constructing a short-wave set to receive America direct. His Majesty is described as "an inveterate radio fan."

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WHERE "X's" ARE PLENTIFUL.

"Let no one at home ever grumble again about atmospherics," writes a correspondent in South Africa. "I have been out here three months with broadcast and short-wave receivers, and one is truly in luck's way if one hears any station above 20 metres free from a very virulent form of static!"

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WIRELESS AND RAILWAY ACCIDENTS.

That trains should carry wireless transmitters in order to send out warning messages to other trains when stranded in remote districts is the suggestion of a correspondent in an evening newspaper.

A better application of wireless for train safety would probably be in the form of wired-wireless, whereby a train standing in one section would sound an automatic alarm in another train entering the same section.

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SOVIET'S SHORT-WAVE PROJECT.

Russia is constructing new short-wave stations. According to a Moscow message, the People's Commissariat for Posts and Telegraphs has decided to build several new short-wave radio stations in Middle Asia, namely, in the Pamiro, Khorog and Hassan-Kuli. It may be assumed that these are for administrative use and not for broadcasting.

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MUNICIPALITY PROVIDES BATTERY ELIMINATORS.

The Middlesbrough Corporation has completed arrangements whereby electricity consumers can be provided with wireless battery eliminators on a preliminary payment to the Corporation of £1, with half-yearly payments of £1 completing the purchase in five years.

The device has been designed by Mr. R. H. Scotson, the Borough Electrical Engineer; it can be plugged direct into an ordinary light socket, and will supply high and low tension current to any kind of valve set.

CHATS WITH PUEBLA.

On Thursday last, the Transatlantic Telephone Service was made available (in addition to the towns in Mexico to which the service has already been extended) to the town of Puebla. The minimum charge for a call to Puebla is £12 covering three minutes' conversation.

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I.E.E. WIRELESS SECTION.

The Wireless Section of the Institution of Electrical Engineers will open the winter session this evening (Wednesday) at 6 o'clock at Savoy Place, W.C.2, with an inaugural address by the chairman, Commander J. A. Slee, C.B.E., R.N.

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INDIAN BROADCASTING TO CONTINUE.

According to Bombay reports, the local Marconi interests have consented to finance the Indian Broadcasting Co., whose prospects hitherto have been so unsatisfactory as to lead to the resignation of Mr. Eric Dunstan and other European members of the staff.

ANY OFFERS?

A wartime spark station installed by the Navy in the Seychelle Islands, Indian Ocean, is for sale. The Admiralty has no further use for it, and the Governor of the Seychelles invites tenders.

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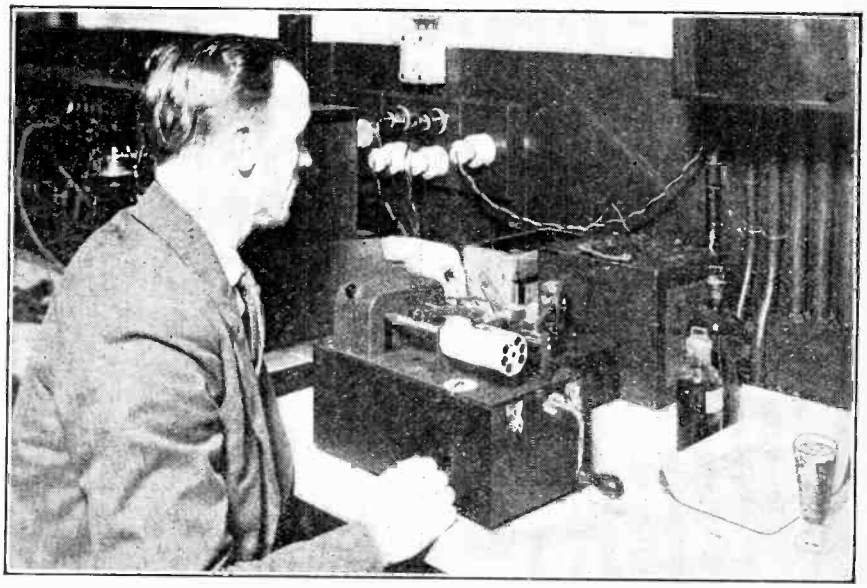
THE "CRIMINAL HAND."

A search for the "criminal hand" in wireless is being conducted by the Radio Club, Catalana, Barcelona. In an appeal to the world in the columns of its journal the club refers to the false news broadcast from time to time by unknown stations, and cites the case of the Nungesser and Coli Transatlantic flight attempt, which was accompanied by erroneous wireless reports.

Emphasising that the dissemination of false news is "absolutely criminal and inhuman," the Club proposes that all listeners on short-waves should "in case of reception of this kind of news, switch on a frame aerial so as to be able to find the direction from which the news is radiated."



PICTURE RECEPTION AT SAVOY HILL. The "Fultograph" receiver at B.B.C. headquarters used to check the picture transmissions from Daventry. The pictures are sent daily (except on Sundays and Mondays) from 2.0 to 2.25 p.m.

BREACH OF ACCUMULATOR REGULATIONS.

For each of five breaches of the Accumulator Regulations of 1925, C. T. Rhodes, a maker of wireless accumulators, was fined £1 at Halifax last week. It was stated that he had failed to make provision for efficient exhausts, for a health register to be kept where lead was burnt, for new employees to be medically declared fit for the job, and for suitable overalls, waterproof aprons, and footwear for the employees.

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IRELAND-AMERICA TEST ON 10 METRES.

The first transmission on ultra-short-waves between the Irish Free State and America was accomplished on Sunday, October 21st, at 4.30 p.m. G.M.T. The stations who took part were W.2JN, operated by Mr. C. K. Atwater, of Upper Montclair, New Jersey, and GW-17C, owned and operated by Messrs. J. B. and R. D. Scott, of 9, Upper Garville Avenue, Dublin. According to the *Irish Times*, trustworthy contact was maintained, with full daylight over the entire distance, signals being easily readable at each end, and messages were exchanged for one hour. The wave-length used was approximately 10 metres.

It will be remembered that the first contact between America and Europe on this wavelength took place at the beginning of this year, when the American amateur referred to above exchanged 10-metre signals with M. Pierre Auschitzky, EF8CT, of Gironde. M. Auschitzky's own account of the achievement appeared in *The Wireless World* of August 15th last.

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GAUGING HEIGHT OF HEAVISIDE LAYER.

As a by-product of the researches to be carried out by the Byrd Expedition party, now in the Antarctic regions, it is hoped that information will be forthcoming on several radio problems. Mr. L. V. Berkner, of the U.S. Bureau of Standards has been specially deputed to make an investigation of fading phenomena, particularly of short-wave transmissions. It is expected, says the *Radio Service Bulletin*, that the equipment available will give information on the effect of the concentration of the earth's magnetic field at the South Magnetic Pole, of auroras, temperature, and also the height of the Heaviside layer.

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CRISIS IN AMERICAN BROADCASTING.

All America, when it finds time to forget the Presidential Election, is registering the hope that the great re-assignment of broadcast wavelengths on November 11th, in pursuance of the ruling of the Federal Radio Commission, will bring to an end the chaos which has existed in the American ether for the last three or four years. At the present moment the signs are not propitious. Several parties are still hotly contending for wavelengths other than those allotted to them, although reallocations at this time of day will probably upset the delicate fabric of the scheme.

Among the unsatisfied stations is WGY, which recently asked for a power of 150 kilowatts, despite the Federal Commission order restricting stations to a maximum of 25 kilowatts. The station also objects to its "daylight only" assignment of 379.5 metres, the wavelength which it has used regularly for many years at all times of the day and night.

If every station is content when November 11th comes round, the Federal Commission will be free to cope with the anticipated riot of complaints when it is discovered that the scheme is prettier in theory than in practice.

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SUPER-BROADCASTING FOR GREECE?

An international competition is being opened, according to the Ministry of Communications in Athens, for the establishment and working of a broadcasting monopoly in Greece for a period of 20 years. At the expiration of that period all the installations will pass free of charge into the possession of the State.

It is stipulated that a central transmitting station must be established in Athens, capable of supplying the whole of Greece with a satisfactory service. Details of the competition are shortly to be communicated to agents abroad for publication.

NEWS FROM THE CLUBS.

Running a School Demonstration.

The wireless society in the rôle of public benefactor was illustrated recently by the Muswell Hill and District Radio Society which provided continuous demonstrations of high quality radio and gramophone reproduction at a local school bazaar, the latest B.T.H. coil-driven loud speakers being used in conjunction with a B.T.H. pick-up. Music was also relayed to the refreshment room for the entertainment of visitors at tea. The amplifier included a bank of four super-power valves in the output stage with 240 volts on their anodes. The whole of the apparatus was provided and installed by members of the Society.

Hon. Secretary, Mr. G. S. Sessions, 20, Grasmere Rd., Muswell Hill, N.10.

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Getting New Members.

A campaign in search of new members is about to be instituted by the South Croydon and District Radio Society, and it is understood that several original ideas are to be exploited in this direction. At the meeting at the Surrey Drovers' Hotel on Tuesday, Oct. 23rd, a Questions and Answers evening was held, an important feature of the meeting being practical demonstrations to assist members in overcoming difficulties. Enquiries regarding membership should be addressed to the Hon. Secretary, Mr. E. L. Cumbers, 14, Campden Rd., South Croydon.

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A New Radio Club.

A new organisation—The Faraday Radio Club—has been inaugurated at the Walworth Men's Institute, Beresford St., London, S.E.5, for the benefit of all in the neighbourhood who are interested in radio research. Meetings are held on Mondays and Thursdays from 7.45 to 9.45 p.m. under the direction of Dr. F. A. Williams, M.Sc. The activities of the Society will include lectures and demonstrations, besides the solving of members' wireless difficulties. Visits are to be made to transmitting stations, wireless factories and other places of interest. Communications should be addressed to the Hon. Secretary, Mr. T. D. Hawkings, 72, Invicle Rd., Walworth, S.E.17.

Makers' Valve Curves Confirmed.

"How Valve Curves are Made" was the title of a lecture by Mr. H. E. Mellor, chairman of the South Manchester Radio Society at the meeting on Friday, Oct. 26th. Some popular and well-advertised valves were employed for making comparative graphs, and the results showed very little deviation from the standard graphs published by the makers.

The Society is seeking new members, who are offered the benefit of an attractive series of lectures and demonstrations during the coming session. Enquiries will be welcomed by the Hon. Secretary, Mr. G. A. F. Mercer, 5, Ruabon Rd., Didsbury, Manchester.

FORTHCOMING EVENTS.

WEDNESDAY, NOVEMBER 7th.

Institution of Electrical Engineers (Wireless Section).—At 6 p.m. (light refreshments at 5.30). At the Institution, Savoy Place, W.C.2. Inaugural address by the Chairman, Commander J. A. Slee, C.B.E., R.N.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration by Mr. P. Turner, of Messrs. Graham Amplion Ltd.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove. Business meeting, followed by Lantern Lecture.

North Middlesex Radio Society.—At 8 p.m. At St. Paul's Institute, Winchmore Hill. Demonstration: "Fault Finding," conducted by Mr. E. H. Laister.

Edinburgh and District Radio Society.—At 8 p.m. at 117, George Street. Business meeting.

THURSDAY, NOVEMBER 8th.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Grove House, High Road, Leyton. Elementary Wireless Lecture.

Ilford and District Radio Society.—At the Wesleyan Institute, 16, Cleveland Road, High Road, Ilford. Demonstration by the Mullard Radio Valve Co., Ltd.

MONDAY, NOVEMBER 12th.

Newcastle Radio Society.—At 7.30 p.m. At 11, Saville Row. Lecture: "Mains Operated Receivers," by Mr. J. G. Ogg.

Holloway Radio Society.—At 7.30 p.m. At the Holloway Secondary School, Hilldrop Road, N.7. Loud-speaker Demonstration by Messrs. S. G. Brown, Ltd.

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Gramophone Pick-up Tests.

A reproduction of gramophone records on a coil-driven loud speaker associated with a three-stage amplifier was conducted by Mr. F. W. Smurthwaite at the last meeting of the Croydon Wireless and Physical Society. Among the interesting tests carried out was the removal of the loud speaker from its cabinet mounting and the substitution of a baffle. Excellent results were obtained.

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

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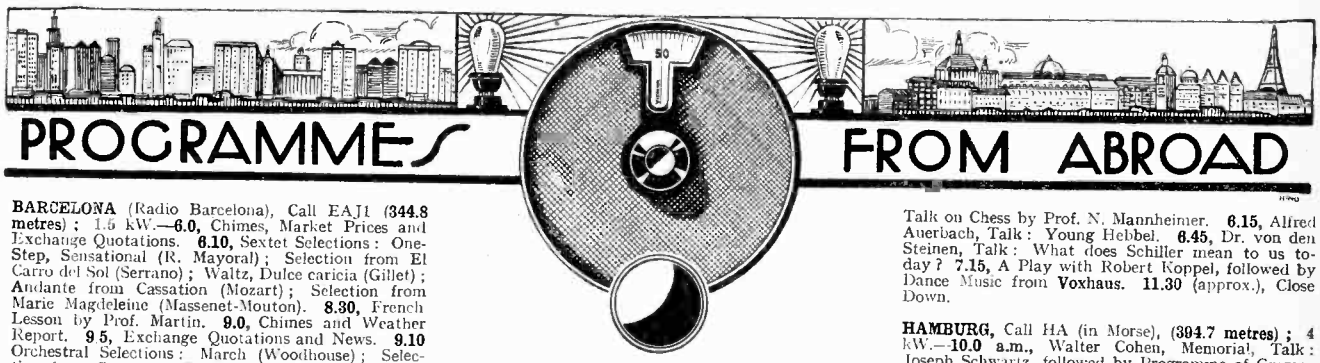
A Film of a Radio Tour.

A Continental trip with a radio-equipped car was shown cinematographically by Capt. Plugge to members of the Wembley Wireless Society on Friday, Oct. 26th. For their travels, Capt. Plugge and his party used an ordinary car fitted with frame aerial and multi-valve apparatus with which it was possible to tune in any station in Britain and many Continental stations while travelling at high speed.

Friday last, Nov. 2nd, was "Members' Evening," and was devoted to a general discussion on difficulties encountered in operating sets under varying conditions. Meetings of this kind are a feature of the Society's activities, and anyone in the neighbourhood interested in wireless would do well to avail himself of the opportunities presented by informal meetings of this kind. The Society still has vacancies for a few members. The syllabus and full particulars can be obtained from Mr. H. E. Comben, B.Sc., 24, Park Lane, Wembley.



PROGRAMMES FROM ABROAD

SATURDAY, NOVEMBER 10th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (**344.8 metres**); 1.5 kW.—**6.0,** Chimes, Market Prices and Exchange Quotations. **6.10,** Sextet Selections: One-Step, Sensational (R. Mayoral); Selection from El Carro del Sol (Serrano); Waltz, Dulce caricia (Gillet); Andante from Cassation (Mozart); Selection from Marie Magdeleine (Massenet-Mouton). **8.30,** French Lesson by Prof. Martin. **9.0,** Chimes and Weather Report. **9 5,** Exchange Quotations and News. **9.10** Orchestral Selections: March (Woodhouse); Selection from Cavalleria Rusticana (Mascagni); Waltz, Wine, Woman and Song (J. Strauss); Dance, La niña flamenca (Fernández); Serenata, Napoli (d'Ambrosio); Overture to The Bohemian Girl (Balfe). **10.0,** Programme relayed from **Madrid,** EAJ7.

BERGEN (**370.4 metres**); 1.5 kW.—**6.0,** Talk for Girls. **6.30,** Programme for Children. **7.0,** Orchestral Selections. **7.20,** Jon Auklend, Talk: Vittorino da Feltre. **7.50,** Topical Talk. **8.0,** Recitation by Mr. Erichsen. **8.30,** Song Recital: Blåbaerli (Grieg); Modersorg (Greig); Queen Bertilla's Cradle Song (Sverre Jordan); To a Child (Sverre Jordan); Snow (Feyling); Aase's Song (Feyling); Folk Songs (a) Jeg lagde mig saa sildig, (b) I kveld er eg glad, (c) Liti Kirsti, (d) Ormekongen, (e) Vesle guten uppi Bakken. **9.0,** Weather Report, News and Time Signal. **9.15,** Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) (**1,250 metres**); 40 kW.—**3.0,** Shorthand Dictation by Fritz Westermann. **3.30,** Programme from **Hamburg.** **4.30** Herr Ehrmann, Talk: The State and People. **5.0,** Dialogue with an Electrician, by Otto Elchner. **5.30,** Elementary Spanish Lesson. **5.55,** Dr. Elias Hurwicz, Talk: Russia. **6.20,** Talk by O. Schmitz. **7.0,** Programme from **Voxhaus.**

BERLIN (Voxhaus) (**484 metres**): 4 kW.—**9.10 a.m.,** Market Prices. **9.15 a.m.,** Weather Report, News and Time Signal. **10.0 a.m.,** Programme of Gramophone Records. **10.15 a.m.,** Albrecht Thaers Centenary Memorial Programme. **2.30,** Talk by Dr. Th. Saling. **3.0,** Dr. Paul Frank, Talk: Medical Hygiene. **3.30,** Gramophone Selections of Songs by Josef Schwarz, followed by Concert: Overture to A Midsummer Night's Dream (Mendelssohn); Waltz from Faust (Gounod); Impression italienne (Charpentier); Unter den Sternen (Courtioux); Pierettes Liebesgetändel (Fresco); Spanish Fantasy, Ein Fest in Aranjuez (Demersseman); Tango, Zwei dunkle Augen (Holländer); followed by Announcements. **6.0,** Dr. Paul Ostwald, Talk: Truth and Fiction in the History of the Japanese Empire. **6.30,** Talk on the following Transmission. **7.0** "Symphonic Mass" (Windsperger), relayed from the High School for Music, followed by Weather Report, News, Time Signal, Sports Notes and Dance Music. **11.30** (approx.), Close Down.

BERN (**411 metres**); 1.5 kW.—**6.29,** Time Signal and Weather Report. **6.30,** Dr. Streit, Talk: Weather and Weather Forecasting. **7.0,** Readings, followed by Selections by the Kursaal Orchestra. **8.0,** Cabaret à la Montmartre, relayed from **Geneva** (760 metres). **8.45,** News and Weather Report. **9.0,** The Kursaal Orchestra. **9.35,** Dance Music. **11.0** (approx.), Close Down.

BRESLAU (**322.6 metres**); 4 kW.—**3.0,** Review of Books. **3.30,** Orchestral Concert, relayed from **Gleiwitz** (329.7 metres). **5.0,** Herbert Brunar, Talk: The American Negro. **5.25,** Esperanto Talk by Alfred Hanuschke. **5.35,** Herr Sperling, Talk: South Silesian Frontier Questions. **6.20,** Legal Shorthand Lesson. **6.50,** Talk: The Pilgrim of St. Just. **7.15,** Variety Programme by the Wireless Dance Orchestra and Robert Koppel. **9.0,** News. **9.30,** Dance Music. **11.0** (approx.), Close Down.

BRÜNN (**441.2 metres**); 3 kW.—**3.30,** Programme for Children. **4.30,** Dr. Vetterl, Talk: The Principles of Music. **4.45,** German Transmission. **5.15,** Weekly Review by Prof. Dostal. **6.0,** Programme from the National Theatre. **9.0,** Programme from **Prague.** **9.25,** Tzigane Music relayed from **Bratislava** (300 metres.

BRUSSELS (**508.5 metres**); 1.5 kW.—**5.0,** Orchestral Concert from the Restaurant of the Palace Hotel.

6.0, Elementary English Lesson. **6.25,** Advanced English Lesson. **6.45,** Pianoforte and Violin Recital. **7.0,** Gramophone Selections of Dance Music. **7.30,** "Radio-Chronique." **8.15,** Concert: Prelude (Rachmaninoff); Scheherazade (Rimsky-Korsakoff); Air from Prince Igor (Borodin); On the Steppes of Central Asia (Borodin); Romance for Horn (Scriabine); Ana (Rimsky-Korsakoff); Topical Talk; Gopak (Moussorgsky); Les forçats (Gretchaninoff); Orientale (Cui); Serenade (Glazounoff); Les Cosaques du Kouban; Danse de la Kovantchine; Prelude (Scriabine); Dances from Prince Igor (Borodin). **10.10,** News and Announcements. **10.15,** Orchestral Selections from the Restaurant of the Palace Hotel. **11.0** (approx.), Close Down.

BUDAPEST (**556.6 metres**); 20 kW.—**4.10,** Talk. **4.40,** Symphony Concert from the Café Ostende. **6.0,** Talk: The Hungarian Iron Industry. **6.35,** The Letter Box. **7.30,** "Prince Bob"—Operetta in Three Acts (Huszka). **10.10,** Concert from the Grand Hotel Britannia.

CRACOW (**566 metres**); 1.5 kW.—**6.0,** Miscellaneous Items. **6.30,** Talk by Mr. Kumaniecky. **6.55,** Time Signal from the Observatory. **7.0,** Inter-Relay Programme from **Cracow, Posen, Vilna, Warsaw** and **Kattowitz,** in celebration of the Tenth Anniversary of Polish Independence: Scenes from Kosciuszko à Raclawice (Anczyc), from **Cracow;** Silesian Songs from **Kattowitz;** Wielkopolska from **Posen;** Selections from the Works of Szamotulsky and Zielensky from **Cracow;** "How Vilna was Liberated" from **Vilna;** Selections from the Works of Chopin from **Posen;** "Through Silesia" from **Kattowitz;** Selections from the Works of Stanislas Moniuszko, from **Vilna;** Interval of Twenty Minutes. **10.0,** Concert (continued) for Listeners and Friends of Polish Wireless in Other Lands: Talk in English and French on the National Fête, from **Kattowitz;** Selections from "Akropolis" (Wyspiansky), from **Warsaw;** Marche de la Liberté (Marczowsky) from **Warsaw;** Modern Polish Music, Music from the Works of Niewiadomsky, Rózycky, and Szymanowsky, from **Warsaw;** Selections from the Works of Walewsky, Jachimeky and Zelensky, from **Cracow;** Programme from **Posen**—Selections from the Works of Paderewsky, Pandiewicz and Gadomsky, from **Kattowitz;** Selections from the Works of Mieczyslas Karlowicz from **Vilna.**

DUBLIN. Call 2RN (**319.1 metres**): 1.5 kW.—**1.30** Weather Report and Gramophone Selections. **7.20,** News. **7.30,** Recitations by May Pitchford. **7.45,** Irish Lesson by Seamus O'Duirinne. **8.0,** "The Open Gate"—Sketch, by the Crofton Repertory Company. **8.30,** Pianoforte Solos by Eileen Braid. **8.45.** "Il Trovatore"—Opera (Verdi). **10.30,** News, Weather Report and Close Down.

FRANKFURT (**428.6 metres**); 4 kW.—**2.55,** Hints for the Housewife, by Fini Pfannes. **3.35,** Concert of Operetta Music: Overture to Frühlingsluft (J. Strauss); Waltz from A Day in Paradise (Eylser); Song; Selection from Eva (Lehár); Overture to Der Fremdenführer (Ziehrer); Waltz, Red Roses (Lehár); Song; Selection from The Countess of Chicago (Kálmán); Waltz from Polenblut (Nedbal); in the Interval, News and Announcements. **5.10,** Reading from Kurd Lasswitz "On Two Planets," by O. W. Studtmann. **5.30** The Letter Box. **5.45,** Talk on Chess by Prof. N. Mannheimer. **6.15,** Alfred Auerbach, Talk: Young Hebbel. **6.45,** Dr. von den Steinen, Talk: What does Schiller mean to us today? **7.15,** A Play with Robert Koppel, followed by Dance Music from **Voxhaus.** **11.30** (approx.), Close Down.

HAMBURG, Call HA (in Morse), (**394.7 metres**); 4 kW.—**10.0 a.m.,** Walter Cohen, Memorial, Talk: Joseph Schwartz, followed by Programme of Gramophone Records. **2.30,** Review of Books. **3.0,** Illustrated Music Talk by Dr. Wilh. Heinitz. **3.30,** Concert: Gavotte and Musette (Bach); Two Minuets (Krebs); Three Dances from Céphale et Procris (Grétry); Minuet (Bach); Gavotte (J. Christ. Bach); Minuet (Boccherini); Two Dances (Mozart); Two Dances (Beethoven); Polonaise (Krebs); Polonaise (Bach); Polonaise in A Major (Chopin). **4.30,** Request Programme. **5.30,** Prof. Rob. Wilbrandt, Talk: What is the Meaning of Social Legislation and What is its Aim? **6.0,** Dialogue: The fight against the sand. **6.50,** Frankfurt Exchange Quotations and Weather Report. **6.55,** Programme from **Voxhaus.** **9.10,** Weather Report, News, Sports Notes and Programme Announcements. **9.30,** (approx.), Cabaret Concert. **10.50,** North Sea and Baltic Weather Report

HILVERSUM (**1,071 metres**); 5 kW.—**11.40 a.m.,** Police Announcements. **12.10,** Concert of Trio Music. **1.40,** Orchestral Concert, conducted by Max Tak, from the Tuschinski Theatre, **Amsterdam.** **3.10,** Talk, followed by Italian Language and Conversation Lessons. **4.40,** French Language and Conversation Lessons. **5.30,** Orchestral Concert: Overture to Morning, Noon and Night in Vienna (Suppé); Weana G'muth Waltz (Schrammel); Selection from the Circus Princess (Kálmán); Bells Serenade (Eckert); The Trumpets of Jericho (Lindemann); Gallop, Radio-Funken (Lüding). **6.30,** German Language and Conversation Lessons. **7.25,** Police News and Time Signal. **7.45,** Programme arranged by the Workers' Radio Society—Concert and Talk. **10.10,** Concert relayed from the Royal Picture House, **Amsterdam.** **11.15** (approx.), Close Down.

HUIZEN (**340.9 metres**); 4 kW.—Transmits on 1,870 metres from 5.40 p.m. **12.10,** Concert of Trio Music. **2.40,** Programme for Children. **5.10,** Talk by M. Laur. **6.10,** Gramophone Selections. **6.30,** Catholic Report. **6.40,** English Lesson. **7.10,** Dressmaking Lesson. **7.40,** Prof. Haag, Talk: Economics. **8.0,** Concert of Choral and Orchestral Selections, Soprano, Tenor and Baritone Solos. Talk by M Schwartz.

JUAN-LES-PINS (Radio LL) (**244 metres**); 1.5 kW.—**1.0,** Orchestral Concert. **9.0,** Concert with Tenor Solos by M. Bessi. **10.0** (approx.), Close Down.

KALUNDBORG (**1,680 metres**); 7 kW.—Programme also for **Copenhagen** (337 metres). **8.30 a.m.,** Morning Gymnastics. **10.0 a.m.,** Weather Report. **12.15,** Educational Talk. **2.0,** Programme for Children. **2.30,** Concert of Instrumental Selections. In the Interval, Recitations by Karen Margrethe Jensen. **5.20,** Talk by Carl Schionning. **5.50,** Weather Report. **6.0,** News and Exchange Quotations. **6.15,** Time Signal. **6.30,** Agricultural Talk by Karl A. Jorgensen. **7.0,** Chimes from the Town Hall. **7.2,** Concert of International Old-Time Dances. **8.0,** Selected Danish Lyrics: Frisk op, naar Djaevlen gor sig vred (Anders Bording); Hver har sin Skaebne (Thomas Kingo); Ked af Verden og Kaer af Himlen (Thomas Kingo); Lyrics (Ambrosius Stub), (a) Livet som en Sejlads, (b) Den kedsom Vinter gik sin Gang, (c) Du dejlig Rosenknop, followed by News. **8.45,** Concert: Spanish Comedy Overture (Kéler Béla); Dansons la Tarantella (Ryder); Grand Galop infernal (Kölling); Recitation of Old Danish Love Poems; March, The Toreador (Kottam); Waltz, Hortensia (Lange); March from Polenblut (Nedbal). **9.45,** Dance Music by the Industri Restaurant Orchestra. **11.0,** Chimes from the Town Hall. **11.15,** (approx.), Close Down.

KATTOWITZ (**422 metres**); 10 kW.—**3.0,** Concert of Gramophone Selections. **4.10,** Music Lesson by Mr. F. Sachse. **4.35,** Children's Letter Box. **5.0,** Programme for Children. **6.0,** Announcements. **6.30,** Mr. K. Rutkowski, Talk: Impressions of a Journey to Greece. **6.56,** Time Signal. **7.0,** See **Cracow.**

Programmes from Abroad.—

LAHTI (1,522.8 metres); 35 kW.—**4.0,** Talk. **4.35,** Concert: March (Arptharp); Waltz (Lanner); Overture to La Belle Galathée (Suppé). **5.15,** Talk. **5.35,** Orchestral Selections from Othello (Verdi). **6.0,** Talk: The Education of Children. **6.50,** Concert. **7.45,** News in Finnish and Swedish and Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres), and **Münster** (250 metres).—**11.10 a.m.,** Gramophone Selections. **12.5,** Orchestral Concert: Overture to Hunyady Laszlo (Erkel); Intermezzo from Si (Mascagni); Suite No. 1 (Micheli); Impromptu in E Flat Major (Schubert); Potpourri, Der Zigeunerprimas (Kálmán); Waltz, Goldregen (Waldteufel); Selections (Krome), (a) Eine Frühlingsmärchennacht, (b) Blues, Rose-Marie; Czardas No. 8 (Michiels). **1.30,** Hints for the Housewife. **3.0,** Dr. Jost, Talk: Wireless Regulations. **3.30,** Talk for Women by Dr. Krause. **4.0,** Dr. Huber, Talk: Pictures of Old Babylon. **4.20,** Prof. F. Hase, English Talk. **4.45,** Relay of the Martinmas Procession, from Düsseldorf. **5.30,** Popular Legal Questions. **6.15,** Herr W. Stern, Talk for Workers: Social Problems of a large City—Architectural Problems. **6.40,** Dr. Otto Förster, Talk: German Cathedrals. **7.0,** Popular Programme, followed by News, Sports Notes, Business Announcements and Concert from the Breidenbacher Hof, **Düsseldorf.**

LEIPZIG (365.8 metres); 4 kW.—**3.30,** Concert Children's Symphony (Romberg); Overture to The Nuremburg Doll (Adam); Little Grandmother (Lange); Children's Corner (Bizet); Doll's Minuet (Mello); The Toy Shop (Jessel); Doll's Gavotte (Stolz); Children's Songs, March (Lindemann). **4.45,** Wireless News and Talk. **5.20,** Weather Report Time Signal and Labour Exchange Report. **5.30,** Programme from **Königswusterhausen. 6.0,** Josef Greff, Talk: Psycho-Analysis. **6.30** Prof. Herrnberg, Talk Modern Socialism. **7.0,** "Lilac Time," Operetta in Three Acts (Schubert), relayed from the Operetta House, Dittrichring, **Leipzig. 9.45** (approx.), News, Sports Notes, Sunday Programme Announcements, and Dance Music, relayed from **Voxhaus.**

MADRID (Union Radio), Call EAJ7 (375 metres); 3 kW.—**7.0,** Chimes and Concert by the Station Sextet: Selections from (a) Los Gavilanes (Guerrero), (b) Hamlet (Thomas), (c) Laguardia amarilla (Giménez), Interlude by Luis Medina. **8.0,** Dance Music. **8.25,** News and Announcements. **9.45,** Weekly Market Prices. **10.0,** Chimes and Selection from "El Key que Rabio"—Musical Comedy (Chapi-Carrión), followed by News. **12.30 a.m.** (approx.) (Sunday), **Close** Down.

MILAN, Call 1MI (549 metres); 7 kW.—**7.15,** Wireless Notes and Announcements. **7.35,** Time Signal and Music Talk. **7.45,** News, followed by Variety Concert: Trio in D Major (Ferroni); Violin Solos (a) Hebrew Melody (Auer), (b) Pasquinade (Tirindelli); Baritone Songs (Schubert); 'Cello Solos (a) Litany (Schubert), (b) Vito (Popper); Pianoforte Solo, Ballad (Debussy); Reading; Selections from the Works of Mancinelli, (a) Overture Romantica, (b) Contralto Song, La prière des oiseaux, (c) Orchestral Selection from Cleopatra, (d) Eros and Leander Prologue for Contralto, (e) La fuga degli amanti a Chioggia. **9.55,** News. **10.0,** Dance Music, relayed from the Fiaschetteria Toscana. **10.45** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Boden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres), **Sundsvall** (545.6 metres).—**5.30,** Old Dance Music. **6.30,** Talk: Occupations: The Shoemaker. **6.45,** Pianoforte Recital. **7.0,** Balalaika Concert. **7.25,** Recital of Negro Spirituels: Go down Moses; You may bury me in de seas; Swing low, sweet chariot; Little David, play on yo harp; All God's children got wings; Deep River; Dere's no hidin' place down dere; Nobody knows de trouble I see; O, wasn't dat a wide river? Sometimes I feel like a motherless child; Oh, didn't it rain? Waterboy; Old Folks at home; My old Kentucky home; Dixie. **8.0,** Topical Talk. **8.45,** Dance Music. **12.30 a.m.** (approx.) (Sunday), Close Down.

NAPLES, Call 1NA (333.3 metres); 1.5 kW.—**3.45,** Weather Report and News. **3.50,** Reading. **3.58,** Chamber of Commerce Report. **4.0,** Variety Concert: Orchestral Selections, (a) Intermezzo, Ivresse (Frontini), (b) Intermezzo, Mattinata (Brogi); Soprano Solo, April (Gounod); Orchestral Selection, Intermezzo, Scene della spiaggia (Blon); Soprano Solo, Amor fa morire (Rotoli); Orchestral Selection, Potpourri, Haschisch (Ponti); Soprano Solo, Luce ideale (Denza); Orchestral Selection, Graziella (Cipollone); Soprano Solo, from Manon Lescaut (Puccini); Orchestral Selections, (a) Intermezzo from Mestizia arcana Camandoli) (b) Waltz, Odette (Franceschi). **4.30,** Time Signal. **4.35,** Foreign Report. **7.20,** Wireless Notes. **7.30,** Announcements. **7.40,** Time Signal. **7.45,** News. **7.48,** Harbour Notes. **7.50,** Concert: Orchestral Selection, Overture to Preciosa (Weber); "Scampolo"—Comedy (Niccodemi); in the Intervals, Suite No. 2 from Pelleas and Melisande (Sibelius); Rustle of Spring (Sinding); Carillon (Liadow); Hymn to the Sun (Rimsky-Korsakoff); Morning, Noon and Night Overture (Suppé). **9.0,** Weekly Review, News, Calendar, Programme Announcements. **10.0,** Dance Music from the Trocadero. **10.30** (approx.), Close Down.

Saturday, November 10th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres), and **Rjukan** (448 metres).—**6.15,** Weather Report, News, and Agricultural Report. **6.30,** Mlle. Helga Berger, Talk: Siena and St. Katherine. **7.0,** Time Signal. **7.01,** Orchestral Concert: March, Monte Carlo (Schreiner); Ballet Suite (Popy); Barcarole appassionata (Murzilli); Valse (Durand); Romance (Rubinstein); La lettre de Manon (Gillet); Ruisseau sous bois (Chillemont); Humoresque (Dvorák); Hymn to the Sun (Rimsky-Korsakoff); Rhapsofantasy on Liszt (Artok). **8.0,** Recital of Norwegian Poems. **8.30,** Weather Report and News. **9.0,** Recital of Operetta Melodies. **9.30,** Dance Music from the Grand Hotel. **10.30** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—**6.30,** "Radio-Journal de France." **8.0,** Legal Talk. **8.15,** Talk by Dr. Grunberg. **8.30,** Concert, followed by News and Weather Report, and Dance Music from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (2,650 metres); 5 kW.—**5.0,** Pasdeloup Concert. **7.10,** Weather Report. **7.30,** "Le Journal Parlé."

PARIS (Petit Parisien) (340.9 metres); 0.5 kW.—**8.45,** Gramophone Selections, Talk, News and Announcements. **9.0,** Concert: Overture to The Merry Wives of Windsor (Nicolai); Ballet Music from Les deux Pigeons (Messager); Finale of the Sixth Pastoral Symphony in F Major (Beethoven); Finale from the Brandenburg Concerto, No. 2 (Bach); Selection from Manon (Massenet); Dance from Siang-Sin (Hüe); Parade galante (Ganne), News in the Intervals.

PARIS (Radio Paris), Call CFR (1,750 metres); 5 kW.—**12.30,** Concert of Gramophone Selections: I Pagliacci (Leoncavallo), by the New Queen's Hall Light Orchestra, under the direction of Percy Pitt; Overture to The Mastersingers (Wagner); Allegro vivace from Roma No. 2 (Bizet), by the Band of the Garde Republicaine; Quartet in G Major No. 19 (Mozart), by the Lener Quartet; Organ Solo, Fantasia in G Minor (Bach), by M. Cornette; Seven Spanish Songs (de Falla) to accompaniment by the Composer; Song, Ramona, by Chick Endor; Waltz, Chiquita, by Paul Whiteman and his Orchestra; Fox-Trot, I'd rather cry over you, by Paul Whiteman and his Orchestra. **1.0,** News and Exchange Quotations. **1.15,** Concert (continued). **2.0,** Exchange Quotations, Market Prices and Religious Information. **3.45,** Dance Music by the Joss Ghislery Symphonians; News in the Intervals. **7.0,** Agricultural Report. **7.45,** Talk, followed by Market Prices. **8.15,** Literary Programme. **8.45,** Dance Music; News in the Intervals.

POSEN (344.8 metres); 1.5 kW.—**4.45,** Talk: Scouts. **5.0,** Literary Programme. **5.30,** Musical Interlude. **6.0,** Herr Rubach, Talk: Excursions in the Posen District. **6.25,** Advanced English Lesson by Dr. Arend. **6.50,** Talk for Women by Mme. Sabina Swidzinska. **7.0,** See **Cracow.**

PRAGUE (348.9 metres); 5 kW.—**3.30,** Dance Music. **4.30,** Cultural Transmission. **4.40,** Talk. **4.50,** Agricultural Report. **5.0,** German Transmission. **6.0,** Programme relayed from the National Theatre, **Brünn. 9.0,** Time Signal and News. **9.25,** Tzigane Music relayed from **Bratislava** (300 metres).

SCHENECTADY, Call 2XAD and 2XAF (**21.96 and 31.4 metres**); 30 kW.—**12.0 Midnight,** Statler's Pennsylvanians, directed by Johnny Johnson, from **New York. 12.30 a.m.** (Sunday), Concert from the Hotel Sagamore, **Rochester. 1.0 a.m.,** Concert from the Hotel Onondaga, Syracuse. **1.30 to 4.0 a.m., New York** Relay. **1.30 a.m.,** "The Park Bench." **2.0 a.m.,** Variety Programme. **3.0 a.m.,** Lucky Strike Programme. **4.0 a.m.,** Time Signal and Dance Music from **Buffalo. 5.0 a.m.** (approx.), Close Down.

STAMBOUL (1,200 metres); 5 kW.—**5.15,** Concert of Turkish Music. **7.30,** Weather Report and Time Signal. **7.40,** Orchestral Concert: Symphony No. 2 (Beethoven); Songs; Violin Solo; March from The Prophet (Meyerbeer). **9.0,** News and Announcements. **9.10** (approx.), Close Down.

STUTTGART (379.7 metres); 4 kW.—**4.0,** Relay of the Opening Ceremony of the Stuttgart Artificial Lighting Exhibition: Greetings by the Mayor, followed by Talk on Light. **4.30,** Songs by the German Workers' Choral Society, relayed from the Market Place and Chimes from the Town Hall. **5.0,** Time Signal and Weather Report. **5.15,** Talk by Dr. Karl Laux, relayed from Mannheim. **5.45,** Talk by Herr Schwaebsch. **6.15,** Book-keeping Lesson by Dr. Wolff. **6.45,** Time Signal, Weather Report and Sports Notes. **7.0,** Concert from the Railway Hotel, **Mosbach:** Choral Selections, (a) Walderwachen (Ratgeber), (b) Die Vesper (Beethoven); Songs, (a) Sei nur still (Frank), (b) Die Allmacht (Schubert); Choral Selections, (a) Wächsen mir Flügel (von Weinzierl), (b) Drinking Song (Bruch); Six Gellert Songs (Beethoven), (a) Bitte, (b) Busslied, (c) Gottes Macht und Vorsehung, (d) Die Liebe des Nächsten, (e) Vom Tode, (f) Die Ehre Gottes aus der Natur; Songs, (a) Ach, ich habe sie verloren from Orpheus (Gluck), (b) Eboli's Song from Don Carlos (Verdi); followed by News. **10.30,** Dance Music from the Pavilion Excelsior.

ROME, Call 1RP (447.8 metres); 3 kW.—**3.50,** Wireless Talk. **4.15,** Agricultural Report. **4.29,** Time Signal. **4.30,** Vocal and Instrumental Concert: Pianoforte Solo, Suite (Alderighi); Soprano Solos from (a) Il re Pastore (Mozart), (b) Scioglo le labbra a un cantico (Magaldi); Tenor Solo from La Rondine (Puccini); Barcarolle from A Masked Ball (Verdi); Three Pianoforte Solos (Vatielli); Festa di contadini boemi (Smetana); Soprano Solo, Enigma (Zanella); Scherzo (Respighi); Tenor Solos from (a) La Wally (Catalani); (b) Germania (Franchetti). **6.50,** Time Signal, Wireless Notes and Announcements. **7.10,** Sports Notes, News, Exchange Quotations and Weather Report. **7.26,** Topical Talk. **7.39,** Time Signal. **7.45** "Cendrillon"—Opera in Four Acts (Massenet). In the Intervals, Review of Art and Literature by Lucio D'Ambra, and Fashion Review. **9.50,** News. **10.0** (approx.), Close Down

TOULOUSE (Radiophonie du Midi (391 metres); 3 kW.—**12.45,** Concert. **8.0,** Exchange Quotations and News. **8.30,** Concert: Pianoforte Solo, Grand Polonaise (Chopin); Selections of Old French Songs, (a) Envoi de fleurs, (b) La chanson de Marinette, (c) Les trésors de ma mie, (d) Le cœur de ma mie, (e) Bonsoir, Madame la Lune, (f) Le temps des cerises; Waltzes, (a) Santiago (Corbin) (b) España (Chabrier). **9.0,** Selections (Delibes) (a) Ballet Music from Coppélia, (b) Selections from Lakmé. **9.55,** Balalaika Music; Chant sans paroles (Tchaikovsky); Song of the Volga Boatmen; Clair de lune; Toreador and Andalouse (Rubinstein). **10.15,** North African News. **10.30,** (approx.), Close Down.

VIENNA (577 and 517.2 metres); 1.5 and 15 kW.—**5.25,** Walther von der Vogelweide's 700th Centenary Programme. **6.30,** Violin Recital by Joseph Szigeti, relayed from the Music Society Hall: Teufelstriller Sonata (Tartini); Solo Partita in E Major (Bach); Sonatina in D Major (Schubert); Violin Solo, Sonata in G Minor (Ysave); La Fontaine d'Arethuse (Szymanowsky); Tremolo Caprice in G Minor (Paganini); La Fille aux cheveux de lin (Debussy); Spanish Dance (de Falla-Kreisler), followed by Orchestral Concert: Coronation March from The Prophet (Meyerbeer); Overture to the Impressario (Mozart); Delirium Waltz (Jos. Strauss); Fantasia on Dvorák's, The Old and New Worlds (Leopold); Waltz from Der Lebemann (Grünfeld); Waltz for Two Violins, Nachtfunken (Lanner); Ballad and Polonaise for Violin (Vieuxtemps); Potpourri, All round the World (Hennings); Dance Song, Die ganze Welt spielt Rummy (Engel-Berger); March, Man ist nur einmal jung! (Hummer). Phototelegraphy Transmission.

VILNA (435 metres); 1.5 kW.—**3.10,** News in Lithuanian. **3.30,** Announcements. **3.45,** Talk for Women by Mme. Ela Buncler. **4.10,** Programme from **Warsaw. 5.0,** Literary Programme. **5.50,** Art Talk by Prof. Jules Klos. **6.15,** News. **6.30,** Programme from **Warsaw. 6.55** Time Signal and News. **7.30,** See **Cracow.**

WARSAW (1,111 metres); 10 kW.—**4.10,** Prof. A. Sujkowski, Talk: The Tenth Anniversary of Poland's Independence Day. **4.35,** Talk by Prof. H. Mosciski. **5.0,** Programme for Children. **6.0,** Miscellaneous Items. **6.30,** "Radio-Chronique" by Mr. M. Stepowski. **6.55.** Time Signal. **7.0.** See **Cracow.**

Programmes from Abroad—

BARCELONA (Radio-Barcelona), Call EAJ1 (**344.8 metres**); 1.5 kW.—**11.0 a.m.,** Chimes relayed from the Barcelona Cathedral followed by Report of the Provincial Meteorological Service of Barcelona. Weather Report and Forecast for Europe and North East Spain and Aviation Route Conditions. **1.30,** The Iberia Trio in a Concert of Light Music with Gramophone Records in the Intervals. **2.45 to 6.0,** No Transmission. **6.0,** Opening Signal and Stock Exchange Quotations. **6.10,** Concert of Light Music by the Station Orchestra and Vocalists: Tenor Songs by Señor Eusebio Carasusan; Romance from "Los Gavilanes" (Guerrero). In the Interval from **7.0 to 7.20,** Weekly Report of the Catalonian Agricultural Institute at San Isidro. **8.40,** Sports News. **9.0** (approx.), Close Down.

BASLE (**1,010 metres**); 1.5 kW.—Programme relayed from **Bern.** **7.0,** Concert. **7.30,** Programme relayed from **Zürich.** Tenor Solos by Karl Melzer of the Zürich Municipal Theatre. **9.0,** Sports Notes, late News Bulletin and Weather Report. **9.15** (approx.), Close Down.

BERGEN (**370.4 metres**); 1.5 kW.—**9.30 a.m.,** Service relayed from the Korschurch. **11.30 a.m.,** Weather Report and Forecast and General News Bulletin. **5.0,** Evening Service relayed from the Korschurch. **7.0,** Concert by the Station Orchestra. **7.50,** Topical Talk. **8.0,** Song Recital by Gudrun Nordraak-Feyling. **9.0,** Weather Report and Forecast, Late News Bulletin and Time Signal. **9.15,** Programme of Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) (**1,250 metres**); 40 kW.—**7.55 a.m.,** Relay of Garrison Church Chimes from Potsdam. **8.0 a.m.,** Morning Recital with Address in the Interval, relayed from **Voxhaus** and followed by Berlin Cathedral Chimes. **3.30,** Concert relayed from **Voxhaus.** **5.0 to 7.0,** The "Deutsche Welle" Series of Talks followed by relay of another German programme. **9.15,** Late News Bulletin and Sports News. **9.30,** Dance Music. **11.30** (approx.), Close Down.

BERLIN (Voxhaus) (**484 metres**); 4 kW.—**7.55 a.m.,** Chimes relayed from the Garrison Church at Potsdam. **8.0 a.m.,** Morning Concert with Vocalists and Address, followed by Relay of the Berlin Cathedral Chimes. **3.30,** Programme of Music followed by Advertisements. **5.40 to 7.0,** Three Talks. **7.0,** Popular Programme. **8.30,** Instrumental Music. **9.15,** Weather Report and Forecast, Time Signal, Sports Notes and Late News Bulletin. **9.30,** Dance Music by the Otto Kermbach Orchestra. **11.30** (approx.), Close Down.

BERN (**411 metres**); 1.5 kW.—**9.30 a.m. to 10.30 a.m.,** Religious Address. **12.0 Noon,** Time Signal and Weather Report and Forecast. **12.5,** Concert. **6.29,** Time Signal and Weather Report. **7.0,** Concert of Songs and Violin Solos. **8.45,** Sports Notes, Late News Bulletin and Weather Report. **9.0,** Concert by the Kursaal Orchestra. **9.35** (approx.), Close Down

BRESLAU (**322.6 metres**); 4 kW.—Programme relayed by **Gleiwitz** (329.7 metres). **8.15 a.m.,** Relay of the Christ Church Chimes. **10.0 a.m.** (approx.), Evangelical Festival of Music with address in the interval. **11.0 a.m.,** Concert with Choral and Instrumental Solos. **1.0,** Ten Minutes for the Amateur Gardener. **1.10,** Talk or Literary Selections. **1.35,** Chess Talk by Adolf Kramer. **2.0,** Stories for Children. **2.30,** Talk for Farmers. **3.0,** Talk. **6.50,** Talk. **7.30,** Probable relay from **Gleiwitz.** Festival of the Beatben Choral Society. **10.0** (approx.), Relay of Dance Music. **11.0** (approx.) Close Down.

BRUSSELS (**508.5 metres**); 1.5 kW.—**5.0,** Light Music, relayed from the Palace Hotel, Brussels. **6.0,** Entertainments for Children by Bonzo and Sylvia of the Théâtre des Enfants. **6.30,** Instrumental Music by the Station Trio. **7.30,** "La Radio-Chronique." **8.15,** Concert on the Anniversary of the Armistice. Programme of works by Belgian Composers. "La Brabançonne." **10.15,** News from the Evening Press. **10.30** (approx.), Close Down.

BUDAPEST (**556.6 metres**); 20 kW.—**8.0 a.m.,** Press Review and Beauty Hints. **9.0 a.m.,** Relay of Morning Service. **11.15 a.m.** (approx.), Musical Programme. **3.45,** Time Signal and Weather Report. **6.45** (approx.), Concert or Operatic Relay. **9.30,** Light Music. **10.30** (approx.), Close Down.

COLOGNE (**283 metres**); 4 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Langenberg** (468.8 metres), and **Münster** (250 metres).—**7.5 a.m.,** Summary of Forthcoming Programmes in Esperanto. **7.15 a.m.,** Lute and Guitar Lesson. **7.35 a.m.** to

SUNDAY, NOVEMBER 11th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

7.55 a.m., Esperanto Instruction by Alfred Dormanns **8.0 a.m.,** Morning Recital of Music and Address **10.0 a.m.,** Talk by Fritz Worm on The Value of the German Language. **11.35 a.m.,** Readings by Helene Thimig. **12.0 Noon,** Concert, with Soloists, followed by Literary Talk and Notes for Chess Players. **3.30,** Afternoon Concert. **7.0,** Concert of Orchestral Music, followed by Late News Bulletin, Sports Notes and Dance Music conducted by Herr Eysoldt. **11.0** (approx.), Close Down.

CORK, Call 6CK (**400 metres**); 1.5 kW.—**8.30,** Concert by the Station Sextet, and Pianoforte Solos by Horace Somerville. **11.0,** National Anthem and Weather Report and Forecast. **11.15** (approx.), Close Down.

CRACOW (**566 metres**); 1.5 kW.—**11.0 a.m.,** Relay of the Ceremony on the Occasion of the Laying of the Foundation Stone of Marshal Pilsudki's House. **11.30 a.m.,** Orchestral Concert relayed from **Warsaw.** **9.0,** Programme relayed from **Warsaw.** **9.30,** Concert of Light Music. **10.30** (approx.), Close Down.

DUBLIN, Call 2RN (**319.1 metres**); 1.5 kW.—**8.30 to 11.15** (approx.), Programme relayed from **Cork.** Vocal and Instrumental Concert with Mezzo-Soprano Solos by Mary Maguire. **11.0,** National Anthem and Weather Report. **11.15** (approx.), Close Down.

FRANKFURT (**428.6 metres**); 4 kW.—Programme relayed by **Cassel** (252.1 metres).—**7.30 a.m.** (approx.), Morning Concert. **12.0 Noon,** Transmission arranged by the Agricultural Institute at Wiesbaden. **7.30,** Musical or Literary Programme. **9.30** (approx.), Dance Music. **11.0** (approx.), Close Down.

HAMBURG, Call HA (in Morse), (**394.7 metres**); 4 kW.—Programme relayed by **Bremen** (272.7 metres), **Hanover** (297 metres), and **Kiel** (254.2 metres).—**7.25 a.m.,** Time Signal. **7.30 a.m.,** Weather Report and Forecast and General News Bulletin. **8.0 a.m.,** The Week's Legal Notes. **8.15 a.m.,** Morning Festival. **9.55 a.m.** (for **Kiel** only), Morning Service from the Kiel University Church. **11.55 a.m.,** Time Signal relyed from **Na1en.** **12.5** (for **Hamburg** and **Kiel**). Concert. **12.5** (for **Bremen**), Music Recital. **12.5,** (for **Hanover**), Gramophone Records. **1.0,** Programme for Children by Funkhemzelmann. **2.0,** Concert of Orchestral Music. **4.30** (approx.), Literary or Musical Programme. **6.30,** Talk by arrangement with the Hamburg School of Physical Training. **6.40,** Sports News. **6.55,** Weather Report and Forecast. **7.0** (approx.), Concert or Play. **9.20,** Weather Report, Late News Bulletin and Concert of Light Music. **11.0** (approx.), Close Down.

HILVERSUM (**1,071 metres**); 5 kW.—**12.40,** Concert by the Hilversum Wireless Trio. **2.10,** Selections of Music. **7.40,** General News Bulletin and Sports News. **7.50,** Programme from the Studio; Performance of "Tristan and Isolde" (Wagner), conducted by Albert van Raalte. **11.0** (approx.), Close Down.

HUIZEN (**340.9 metres**); 4 kW. Transmits on 1,870 metres from 5.40.—**8.10 a.m. to 9.10 a.m.,** Relay of Morning Service and Address. **12.10,** Concert by the Katholieke Radio Omroep Trio. **1.10,** Religious Instruction. **2.10,** Concert. **5.0,** Relay of Evening Service from **Veendam** (on 1,870 metres): Sermon by the Minister, the Rev. N. Postems. **7.30** (approx.), Concert. **10.25,** Choral Epilogue, conducted by Mr. Jos. H. Pickkers. **10.40** (approx.), Close Down.

JUAN-LES-PINS (Radio L.L.), (**244 metres**); 1.5 kW.—**1.0 to 2.0,** Concert of Light Music with Children's Corner. **9.0,** General News Bulletin and Sports Notes. **9.15,** Orchestral Concert. **10.0,** Dance Music. **10.30** (approx.), Close Down.

KALUNDBORG (**1,680 metres**); 7 kW.—Programme also for **Copenhagen** (337 metres).—**9.0 a.m.,** Divine Service relayed from **Copenhagen.** **10.30 a.m., to 10.40 a.m.** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **12.0 Noon to 12.25,** Lesson in German, arranged by the paper "Radiolytteren." **12.30 to 12.55,** French Lesson, arranged by "Radiolytteren." **5.50** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **6.0,** Press Review. **6.15,** Time Signal. **6.30,** Talk. **7.0,** Town Hall Chimes, relayed from **Copenhagen.** **7.5,** Concert by the Station Orchestra. **8.15,** "The Proposal," Comedy in One Act by Tchekov; Danish Translation by Emmanuel Hansen. **8.45,** Orchestral Concert. **9.45,** Dance Music, relayed from the Palace Hotel, **Copenhagen.** The Orchestra, conducted by Teddy Petersen. In the Interval at **11.0,** Chimes relayed from the Town Hall, **Copenhagen.** **11.30** (approx.), Close Down.

KATTOWITZ (**423 metres**); 10 kW.—**1.30 to 4.0,** Inter-relay Programme from **Cracow, Kattowitz, Posen** and **Vilna.** **9.30,** Concert of Light Music. **10.30** (approx.), Close Down.

KÖNIGSBERG (**303 metres**); 4 kW.—Programme relayed by **Danzig** (272.7 metres).—**8.0 a.m.,** Morning Recital and Address. **10.0 a.m.** (**Königsberg** only), Weather Report and Forecast. **10.15 a.m.,** Concert by the Station Orchestra. **11.55 a.m.,** Relay of Time Signal from **Nauen,** followed by Weather Report and Forecast. **1.30,** P. S. Leonhardt, Chess Talk, followed by Elementary Spanish Lesson, by Kurt Metze, Lecturer in Spanish at the Königsberg Technical Institute. **6.30,** Programme relayed from the Danzig Stadttheater. "Turandot," Lyrical Drama in Three Acts and Five Scenes, by Puccini. German Translation by Alfred Brüggemann. Musical Director: Cornelius Kun. In the Intervals, Late News Bulletin and Sports Notes. **9.30** (approx.), Dance Music relayed from **Berlin.** **11.30** (approx.), Close Down.

LAHTI (**1,522.8 metres**); 35 kW.—Programme also for **Helsingfors** (375 metres).—**7.0 a.m.** (approx.), Relay of Sacred Service. **9.50 a.m.,** Press Review. **10.5 a.m.,** Recital of Music. **10.50 a.m.,** Weather Report and Forecast, followed by Time Signal. **3.0,** Concert by the Wireless Orchestra. **4.0,** Talk. **4.25,** Concert by the Station Orchestra. **4.57,** Time Signal and Weather Report and Forecast. **5.10,** History Talk. **5.40,** Talk. **7.15,** Concert by the Wireless Orchestra, conducted by Erkki Linko; Violin Solos by Erik Cronvall. **7.45,** Late News Bulletin given in Finnish and Swedish. **9.0** (approx.), Close Down.

LANGENBERG (**468.8 metres**); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres), and **Münster** (250 metres).—**7.5 a.m.,** Weekly Programme Review by Alfred Dormanns (in Esperanto). **7.15 a.m.,** Instruction on the Lute and Guitar by Olly Wintz-Koort. **7.35 a.m. to 7.55 a.m.,** Esperanto Lessou by Alfred Dormanns. **8.0 a.m.,** Catholic Festival with Choral and Instrumental Selections, and Address in the Interval. **10.0 a.m.,** Talk on the German Language. **12.0 Noon,** Orchestral Concert, followed by Talks on Literature and Chess. **3.30,** Concert of Instrumental Music. **7.0,** Popular Concert relayed from the Grosse Messehalle, Cologne. The Westdeutscher Rundfunk Orchestra and the Cologne Concert Fellowship. The Orchestra conducted by Dr. Wilhelm Buschkötter. Choral Director: Herr Wilhelm Brouwers. Followed by Late News Bulletin, Sports Notes and Concert of Light Music. **11.0** (approx.), Close Down.

LEIPZIG (**365.8 metres**); 4 kW.—Programme relayed by **Dresden** (275.2 metres).—**7.30 a.m.,** Organ Recital, relayed from the Leipzig University Church. Organist: Professor Ernst Müller. **8.0 a.m.,** Choral and Instrumental Concert. **12.0 Noon** and **12.30,** Two Talks for Farmers. **1.0,** Events Abroad. **1.45,** Talk arranged by the German Speaking Union. **2.0,** Popular Gramophone Records. **3.0,** Concert or Play. **5.30,** Talk. **6.30,** Programme relayed from the New Theatre, Leipzig. "Martha," Opera in Four Acts by Flotow. Musical Director: Albert Conrad. **9.0,** Sports Notes. **9.30,** Dance Music, relayed from **Berlin.** **11.30** (approx.), Close Down.

LYONS (Radio Lyon), (**291 metres**); 1.5 kW.—**7.45,** "Le Journal Parlé de Radio-Lyon." **8.0,** Concert with Instrumental Solos by M. Camand (Violin); Madame Ducharne (Pianoforte); and M. Testanière (Cello). "The Pearl Fishers" (Bizet). **9.0** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (**375 metres**); 3 kW.—Programme relayed by **Salamanca** (EAJ22) (405 metres).—**11.30 a.m.,** Relay of Concert by the Municipal Band from "El Retiro" (weather permitting); The Band conducted by Señor Villa. **2.0,** Relay of Chimes and Time Signal. **2.5,** Concert by the Wireless Orchestra and selection by Luis Medina. **3.30 to 7.0,** No Transmission. **7.0,** Relay of Chimes followed by Concert of Sextet Music. **8.0,** Dance Music relayed from the Alkazar, The "Palermo" Orchestra. **8.30 to 10.0,** No Transmission. **10.0,** Chimes and Time Signal. **10.5,** Concert by the Band

t the Asturias Regiment under the direction of Don Francisco Eslei. **12.0 Midnight,** Dance Music by the Palermo Orchestra relayed from the Alkazar. **12.30 a.m.** (approx.) (Monday), Close Down.

MILAN, 1MI (**549 metres**) ; 7 kW.—**9.30 a.m. to 10.0 a.m.,** Morning Recital of Sacred Music with Soloists. **11.20 a.m.,** Time Signal and Quartet Selections. **12.30 to 3.0,** No Transmission. **3.0,** Opening Signal and Concert by the Milan Radio Quintet. **5.0 to 7.25,** No Transmission. **7.25,** Opening Signal and Notes on Current Events. **7.35,** Time Signal and Talk by Ulrico Tegani : Town and Country. **7.45,** Sports Notes. **7.50,** "The Girl of the Golden West," Opera, by Puccini ; Late News Bulletin and Sports News at the end of Act 2. **10.45** (approx.), Close Down.

MOTALA (**1,389 metres**) ; 30 kW.—Programme also for **Stockholm** (454.5 metres), **Boden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres) and **Sundsvall** (545.6 metres).—**10.0 a.m.,** Morning Service relayed from a Church in **Stockholm. 3.30** (approx.), Concert or Dramatic Programme. **5.0,** Relay of Divine Service from **Stockholm. 6.15,** Concert or Play. **8.15,** Late News Bulletin. **8.40,** Relay of Foreign Stations. **11.0** (approx.), Close Down.

MUNICH (**535.7 metres**) ; 4 kW.—Programme by **Augsberg** (566 metres), **Kaiserslautern** (277.8 metres), and **Nuremburg** (241.9 metres).—**10.0 a.m.,** Relay of Chimes from the Munich Town Hall. **2.0,** Concert. **6.30,** Time Signal and Local Sports News. **6.45,** Concert of Orchestral and Vocal Selections. **9.0,** Late News Bulletin. **9.30,** Relay of Concert. **10.30** (approx.), Close Down.

NAPLES, Call 1NA (**333.3 metres**) ; 1.5 kW.—**9.0 a.m.,** Concert of Sacred Compositions. **3.45,** Programme for Children. **4.0,** Popular Concert. **4.30,** Time Signal. **7.20,** Topical Notes. **7.40,** Time Signal. **7.48,** Harbour Notes. **7.50,** Concert of Operatic Selections by the Station Orchestra with Vocalists, Micaela's Aria from "Carmen" (Bizet), Soprano Solo by Signora E. Blandi with Orchestral accompaniment. **9.0,** Sports News. **9.55,** Calendar and Programme Announcements. **10.0** (approx.), Close Down.

OSLO (**461.5 metres**) : 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres), **Rujkan** (448 metres).—**6.15,** Weather Report and Forecast and News from the Press, followed by Literary or Musical Programme. **7.0,** Time Signal and Concert by the Station Orchestra. **8.30,** Weather Report and Press Notes. **8.45,** Talk on Current Topics. **9.30** (approx.), Dance Music relayed from the Hotel Bristol. **10.45** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (**458 metres**) ; 0.5 kW.—Programme relayed at Intervals by the following stations : **Bordeaux PTT** (275 metres), **Eiffel Tower** (2,650 metres), **Grenoble** (416 metres), **Lille PTT** (261 metres), **Limoges** (285 metres), **Lyons PTT** (480 metres), **Marseilles** (303 metres), **Rennes** (280 metres), **Toulouse PTT** (260 metres).—**8.0 a.m.,** General News Bulletin and Time Signal. **9.25 a.m.,** International Time Signal and Weather Report and Forecast. **12.0 Noon,** Concert under the direction of M. de Buxeuil and M. L. Raiter, and organised by "Les Editions Salabert." **1.0,** Industrial Notes. **1.30,** Concert organised by "L'Association Générale des Auditeurs de T.S.F.," Romance sans paroles by Fauré. **4.0,** Pasdeloup Concert relayed from the Théâtre des Champs Elysées ; Selections of Symphony Music. **6.30,** "Le Radio Journal de France." **8.0,** Talk under the auspices of the "Union des Grandes Associations." **8.15,** Sports News. **8.30,** Concert of Instrumental Music followed by Late News Bulletin, Time Signal and Weather Report. **10.30** (approx.), Dance Music relayed from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (**2,650 metres**) ; 5 kW.—**7.56 a.m.,** Time Signal on 32.5 m. **9.26 a.m.,** Time Signal on 2,650 metres. **7.10 to 7.20,** Weather Report and Forecast. **7.30** "Le Journal Parlé par T.S.F.," with Talks by its regular contributors, including Doctor Pierre Vachet, Detective Ashelbé, and M. René Casalis on Portez-vous bien ; Police Memoirs ; Events in the World of Sport, and Sports Notes from the paper "Paris-Sport." **7.56,** Time Signal on 32.5 metres. **8.0 to 9.0,** Concert. **10.26,** Time Signal on 2,650 metres. **11.15** (approx.), Close Down.

PARIS (Petit Parisien) (**340.9 metres**) ; 0.5 kW.—**8.45,** Gramophone Records. **8.50,** Talk. **8.55,** Press News. **9.0,** Concert by Artistes from the Opera House and the Opéra-Comique, Music to Shakespeare's "Tempest" by Chausson. **9.30,** Concert of well-known Symphony Compositions conducted by Professor Estyle, of the Paris Conservatoire. **10.0,** Late News Bulletin. **10.15,** Orchestral Selections. **11.0** (approx.), Close Down.

Sunday, November 11th.

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PARIS (Radio Paris), Call CFR (**1,750 ; metres**) 6 kW.—**8.0 a.m.,** General News Bulletin and News from the Press. **8.30 a.m.,** Daily Physical Culture conducted by Dr. Diffre. **12.0 Noon,** Religious Address followed by Sacred Recital arranged by "La Vie Catholique." **12.30,** News from the Press. **12.45,** Concert by the Albert Locatelli Orchestra with Interlude by Bilboquet. **4.30,** Programme arranged by "L'Industrie Musicale," The Latest Gramophone Records, In the Interval, News from the Press. **7.0,** Agricultural Talk and Press News. **7.45,** The Radio-Paris Guignol, (a) Cassandre et ses domestiques, (b) La Vertu recompensée, (c) Les Jacasseries de Polichinelle by Bilboquet. **8.30,** Orchestral Concert. Between the Acts, Press News and Late News Bulletin.

PITTSBURGH, Call KDKA (**63 and 27 metres**) ; 25 kW.—**4.0,** Sessions Chimes, followed by Church Service. **7.0,** Roxy's Stroll Programme relayed from WJZ, **New York. 9.45,** Service relayed from the Shadyside Presbyterian Church, with Sermon by the Pastor, the Rev. Hugh Thomson Kerr. **11.0,** Concert relayed from the William Penn Hotel, Pittsburgh. **11.30,** Concert by the Whittall Anglo-Persians relayed from WJZ, **New York. 1.0 a.m.** (Monday), Programme from the National Broadcasting Company, **New York. 1.15 a.m.,** Collier's Radio Hour. **2.15 a.m.,** The Utica Jubilee Singers. **2.45 a.m.,** Concert. **3.15 a.m.,** Longine Time. **3.30 a.m.** (approx.), Close Down.

POSEN (**344.8 metres**) ; 1.5 kW.—**11.15 a.m.,** Ceremony on the occasion of the Celebration of the Tenth Anniversary of Polish Independence, relayed from the Posen University Hall and followed by inter-relay programme from **Cracow, Kattowitz, Posen** and **Vilna. 9.0,** Time Signal. **9.40,** Concert of Light Music. **11.0** (approx.), Close Down.

PRAGUE (**348.9 metres**) ; 5 kW.—**8.0 a.m.,** Concert of Sacred Music. **12.05,** Industrial Notes. **12.20,** Social Announcements. **3.30,** Concert of Orchestral Selections. **5.0,** Programme for German Listeners. **9.0,** Time Signal and Late News Bulletin. **10.15,** Concert of Popular Music.

RABAT, Call PTT (**416 metres**) ; 2 kW.—**12.30,** Concert by the Station Orchestra. **4.0 to 5.0,** Military Music. **8.20,** Sports Talk by M. Barrier. **8.30,** Concert of Orchestral Music. **10.30,** Relay of Dance Music. **11.0** (approx.), Close Down.

RIGA (**526.3 metres**) ; 4 kW.—**9.15 a.m.,** Relay of Divine Service from the Mara Church. **12.0 Noon,** Programme of Music and Tales for Children. **3.0,** Concert by the Station Orchestra under the direction of Arved Parups. **4.0,** Talks. **6.0,** Concert with Soloists. **8.0,** Weather Report and Forecast and Late News Bulletin. **8.30,** Dance Music by the Orchestra at the Café de l'Opéra. **10.0** (approx.), Close Down.

ROME, Call 1RO (**447.8 metres**) ; 3 kW.—**9.0 a.m.,** Opening Signal. **9.5 a.m.,** Vocal and Instrumental Concert. **9.45 a.m. to 12.0 Noon,** No Transmission. **12.0 Noon,** Opening Signal. **12.5 to 1.0,** Concert by the Wireless Trio. **1.0 to 4.0,** No Transmission. **4.0,** Opening Signal. **4.5,** Selections of Dance Music by the Casinetta Orchestra. **5.0 to 6.40,** No Transmission. **6.40,** Opening Signal. **6.45,** Topical Talk. **7.0,** Agricultural Talk. **7.10,** Sports Results and News from the Stefani Agency. **7.39,** Time Signal. **7.45,** Concert devoted to the works of Schubert, on the occasion of the First Centenary of his Death (November 1828) ; Overture to "Alfonso and Estrella." **9.50,** Late News Bulletin. **10.15** (approx.), Close Down.

SAN SEBASTIAN (Union Radio), Call EAJ8 (**335 metres**) ; 0.5 kW.—**10.0,** A Programme of Light Music by the Orchestra at the Sans Sebastian Casino. **12.0 Midnight** (approx.), Close Down.

SCHENECTADY, Call 2XAD and 2XAF (**21.96 and 31.4 metres**) ; 30 kW.—**3.30,** Relay of Church Service from Schenectady, N.Y. **6.30 to 7.0,** The United Radio Corporation Programme. **8.30,** Organ Recital by Elmer A. Tidmarsh, relayed from the Union College Memorial Chapel, Schenectady. **9.0,** Talk for Men under the auspices of the Bedford Branch of the Y.M.C.A., relayed from **Brooklyn, N.Y.** Speaker : Dr. S. Parkes Cadman. **10.30,** Acousticon Programme relayed from **New York. 11.0,** Stetson Parade Half Hour, relayed from **Boston, Mass. 11.30,** Musical Selections relayed from **New York. 12.0 Midnight,** Reinald Werrenrath : Old Company's Programme, relayed from **New York. 12.30 a.m.** (Monday), Programme relayed from the Capitol Theatre, **New York. 2.0 a.m.,** Talk on "Our Government," relayed from **Washington, D.C. 2.15 a.m.,** Atwater Kent Hour relayed from **New York. 3.15 a.m.,** Time Signal. **3.17 a.m.,** Experimental Transmission of Television Signals. **3.30 a.m.** (approx.), Close Down.

SEVILLE (Union Radio), Call EAJ5 (**434.8 metres**) ; 1 kW.—**2.0 to 3.0,** Light Music by the Seville Wireless Orchestra. **9.30,** Orchestral Concert with Vocalists. **11.0,** Flamenco Songs and Selections of Dance Music by the Station Orchestra. **11.30** (approx.), Close Down.

STAMBOUL (**1,200 metres**) ; 5 kW.—**3.30,** Orchestral Concert. **4.30,** Stock Exchange Quotations. **5.15,** Turkish Music. **7.30,** Weather Report and Forecast and Time Signal. **7.40,** Talk. **7.55,** Orchestral Concert. **9.0,** Late News Bulletin. **9.30** (approx.), Close Down.

STETTIN (**238 metres**) 0.75 kW.—Relays **Berlin** (Voxhaus) programme at intervals from **8.9 a.m. to 11 p.m.**

STUTTGART (**379.7 metres**) ; 4 kW.—Programme relayed by **Freiburg** (577 metres).—**10.15 a.m.** (approx.), Morning Recital. **11.0 a.m.** (approx.), Orchestral Concert, followed by Gramophone Selections. **1.0,** Programme for Children, relayed from **Berlin. 7.15** (approx.), Concert or Play, followed by Programme of Light Music and Late News Bulletin and Sports Notes.

TALLINN (**408 metres**) ; 2.2 kW.—**7.30 a.m.** (approx.), Relay of Morning Service. **1.0,** Orchestral Concert. **6.0,** Concert of Orchestral and Vocal Items. **7.30,** Late News Bulletin.

TOULOUSE (Radiophonie du Midi), (**391 metres**) ; 3 kW.—**12.30,** Weather Report and Forecast and Stock Exchange Quotations. **12.45,** Concert. **1.0,** Time Signal (Carillon). **1.45,** News from the Press. **8.0,** Stock Exchange Quotations and News Bulletin. **8.15,** Communications from "La Dépêche" and "Le Petit Parisien." **8.30,** Concert. **8.48,** Concert arranged by "L'Association des Commerçants Radio-Electriciens du Midi." Selections from Pelleás and Mélisande, Lyrical Drama in Five Acts by Maeterlinck. **10.15,** Daily Bulletin of North African News, followed by Late News Bulletin. **10.30** (approx.), Close Down.

VIENNA (**577 and 517.2 metres**) ; 1.5 and 15 kW.—Programme relayed by **Graz** (357.1 metres), **Innsbruck** (294.1 metres), **Klagenfurt** (272.7 metres), and **Linz** (254.2 metres).—**9.20 a.m.,** Organ Recital. **10.0 a.m.,** Selections by the Vienna Symphony Orchestra. **2.15,** Experimental Transmission of Pictures. **3.0,** Orchestral Concert. **6.30,** Programme relayed from the, "Grosse Musikvereinsaal." Concert of "Labour" Symphony Music. "Peace on Earth" by Schönberg followed by Selections of Light Music. **10.0** (approx.) Close Down.

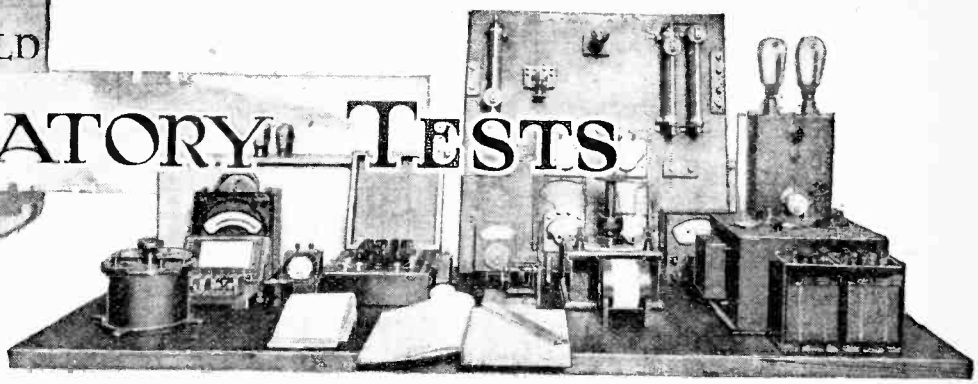
VILNA (**435 metres**) ; 1.5 kW.—**11.0 a.m.,** Relay **Warsaw. 1.30 to 4.0,** Inter-Relay programme from **Cracon, Kattowitz, Posen** and **Vilna** in celebration of Tenth Anniversary of Polish Independence. **9.30,** Concert of Light Music.

WARSAW (**1,111 metres**) ; 10 kW—**11.0 a.m.,** Concert by the "Philharmonic de Narsovie." **1.30 to 4.0,** Inter-Relay programme from **Cracow, Kattowitz, Posey** and **Vilna** in celebration of the Tenth Anniversary of Polish Independence. **9.30,** Concert of Light Music. **10.30** (approx.), Close Down.

ZAGREB (**309.2 metres**) ; 0.7 kW.—**10.30 a.m.,** Orchestral Concert. **4.0,** Dance Music, relayed from the "Club-Bar." **6.45,** Wireless Notes. **7.0,** Relay of an Opera from the Zagreb National Theatre.

ZÜRICH (**588 metres**) ; 1 kW.—**10.0 a.m.,** Light Music by the Orchestra at the Capitol Theatre. **11.0 a.m.,** Weather Report and Forecast. **11.30 a.m.,** Concert by the Zürich Wireless Orchestra. **3.0,** Concert relayed from the Carlton Elite Hotel. The Castellano Orchestra. **6.30,** Time Signal. **6.33,** Religious Address. **7.0,** Chamber Music by the Station Orchestra : Violin Solos by Erwin Gilbert and Max Scherbaum ; Viola Solos by Viktor Chmelik ; 'Cello Solos by Julius Bächi. **9.0,** Weather Report and Late News Bulletin of the "Neue Züricher Zeitung." **9.30** (approx.), Close Down.

WIRELESS WORLD LABORATORY TESTS



A Review of Manufacturers' Recent Products.

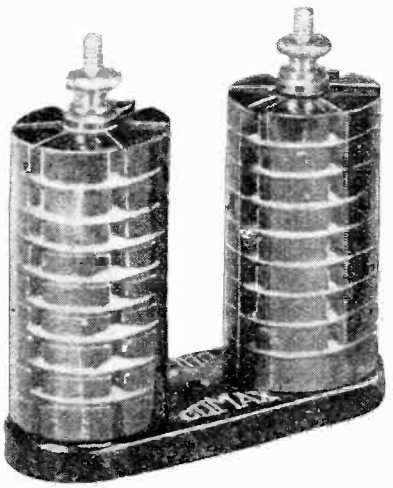
CLIMAX H.F CHOKE.

The "binocular" construction of this choke reduces the possibility of coupling with other circuits in the receiver, since the coupling between the two sections confines the field to the immediate vicinity of the choke. Each section is wound on a slotted cylindrical former from which much of the dielectric is removed by vertical milling. It is thus possible to examine the windings, which are exceptionally regular and uniform, through the transparent celluloid covering.

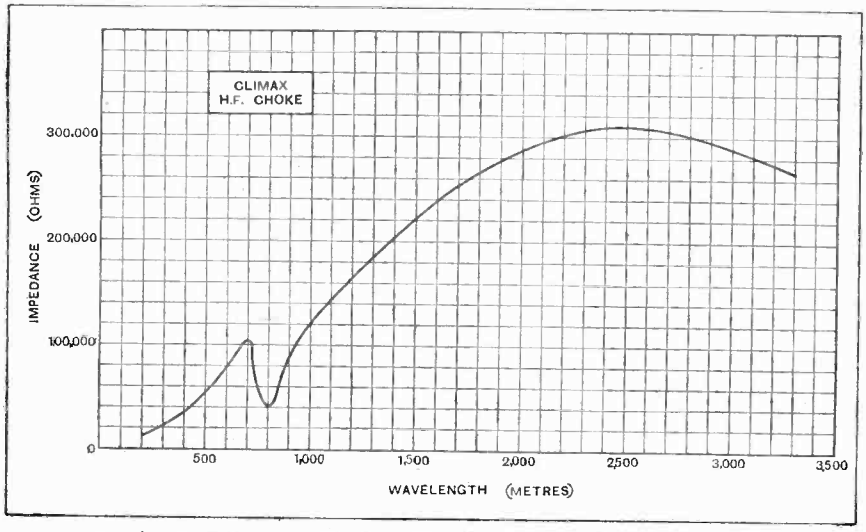
The impedance curve shows that the choke is suitable for wavelengths up to 2,500 metres. There is, however, a possibility of self-oscillation between 700 and 800 metres where the slope of the curve is negative. The choke was tested in circuit for oscillation over this waveband, but under the conditions of test the receiver remained stable; increased reaction in the vicinity of this waveband was, however, necessary. The kink in the curve is due to the fact that the coupling between the two halves of the choke is not so great as the coupling between the sub-sections in each unit. The self-inductance and self-capacity of each half, therefore, forms a closed circuit, and the overall performance is equivalent to that of two chokes in series. Fortunately the kink occurs on a waveband on which there are few important stations and the choke is quite efficient on the 200-500 and 1,000-2,000 metre bands. The impedance at various typical wavelengths is as follows :—

Wavelength (metres).	Impedance (ohms).
200	12,700
500	54,000
1,600	238,000

The price of the Climax choke, which is made by Messrs. Climax Radio Electric, Ltd., Quill Works, Putney, London, S.W.15, is 7s. 6d.



Climax binocular H.F. choke; D.C. resistance 1,320 ohms.



Impedance curve of Climax H.F. choke; external capacity 8 micro-mfd.

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"STELLA" CABINETS—A NEW FINISH.

In order to expedite the delivery of "Stella" aluminium cabinets, a new finish has been developed to replace the original machine-chased and lacquered surface. The new finish is described as "marble," and is a hard and durable enamel artistically mottled either in greyish white or dark brown. The prices remain the same as for the original chased finish, and readers requiring further particulars of the structural details of these cabinets are referred to page 140 of the issue for August 1st.

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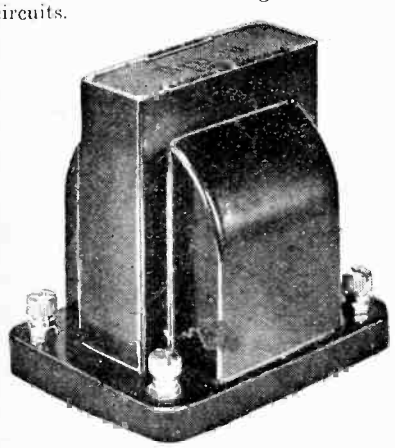
BROWN "L.F." TRANSFORMER.

The manufacture of intervalve transformers is a new departure for Messrs. S. G. Brown, Ltd., but the N.P.L. curve for their first model (Type A) shows that they are fully conversant with the principles of transformer design.

The N.P.L. report gives curves for three combinations of valves, and it is interesting to note that the loading effect of the power output valve on the secondary winding has been taken into account in plotting the curves. The best results would appear to be given with a D.E.L. 610 valve preceding the transformer, the output valve for this curve being a D.E.P. 610, with an inductance of 3 henrys in the anode cir-

cuit. Starting at 30 cycles, the voltage amplification rises from 35 to 52 at 80 cycles, after which it remains constant up to 1,000 cycles, and then starts to rise gradually to 60 at 5,000 cycles. This rising characteristic at the upper frequencies is useful in combating high-note loss due to selective tuning in the H.F. circuits.



Brown Type "A" intervalve transformer.

No condenser is connected across the primary winding, so that a by-pass condenser may slightly modify the characteristics as described above. The makers state, however, that a by-pass condenser up to 0.0003 mfd. can be used with advantage.

The transformer, which has a ratio of 3½ : 1, is hermetically sealed in a brown moulded case, and the price is 30s.

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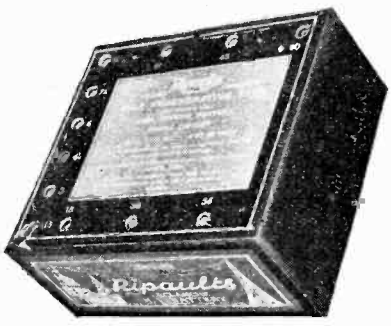
RIPAULT DOUBLE-CAPACITY H.T. BATTERY.

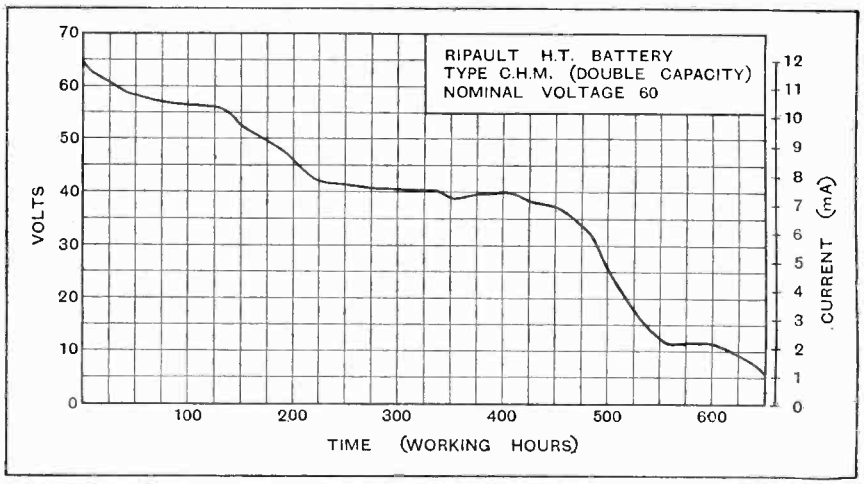
The following test relates to the type C.H.M. (Blue Label) battery with a rated E.M.F. of 60 volts. Reference to the maker's unique table of useful life for different rates of discharge shows that the battery is suitable for discharges up to 15 milliamperes. The following figures are abstracted from the table :—

Discharge Rate (mA).	Approx. Life (hrs.).
7	750
10	475
15	285

With the object of obtaining an average discharge of about 10mA, the fixed loading resistance was set to give an initial current of 12 mA. With this current flowing the terminal voltage was found to be 4.5 volts in excess of the maker's rating.



Ripault 60 volt double-capacity battery, Type C.H.M. (Blue Label).



Discharge curve of the Ripault type C.H.M. battery.

The general form of the discharge curve is exceptionally good, and the fall of voltage is small and progressive until the "cut-off" point is reached, when the drop to zero is rapid. In this respect the Ripault battery conforms to the text-book ideal of dry cell battery performance. It will be seen that the steep "cut-off" starts at about 475 hours, which confirms the figures given for the 10 mA rate.

Readers may find it of interest to compare the general shape of the curve with that of the smaller capacity battery reviewed on page 478 of the issue of May 2nd, 1928. In our opinion, the similarity is a striking testimony to the uniformity of the materials used in these batteries.

The price of the 60-volt C.H.M. battery is 15s. 6d., and the maker's address is 1, King's Road, London, N.W.1.

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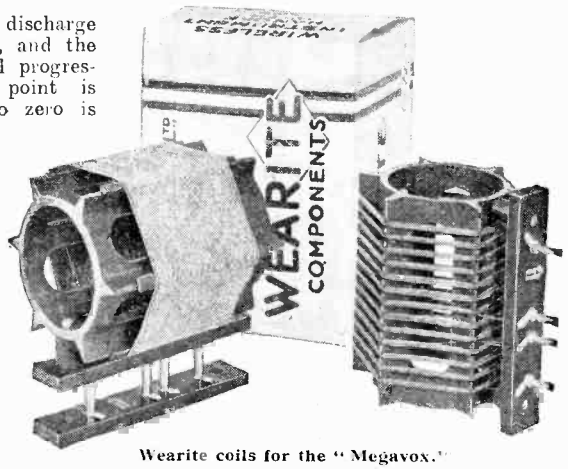
WEARITE "MEGAVOX" COILS.

Messrs. Wright & Weaire, Ltd., 740, High Road, Tottenham, London, N.17, have now put in production a set of aerial coils for *The Wireless World* "Megavox" receiver, described in the issue for September 19th.

The coils are mounted on ribbed ebonite formers and are wound exactly to specification. A special base is made to fit the coil pins, and the contact between pins and sockets is perfect.

The coils have been tested in the original "Megavox," and the performance is identical with that given by the original hand-made coils.

The price of the Litz-wound short-wave coil is 15s., and the long-wave coil costs 10s. 6d. The base is priced at 1s. 3d.



Wearite coils for the "Megavox."

PURE RUBBER SHEET.

A specimen of rubber sheet produced by the Britannia Rubber & Kamptulicon Co., Ltd., 7, Newgate Street, London, E.C.1, has been examined as to its suitability for moving-coil loud-speaker diaphragm support.

The manufacturers have apparently appreciated that it is an error to attempt to use extremely thin india rubber for this purpose, which becomes unduly stretched in the process of mounting the diaphragm, and is apt, moreover, to perish readily. The specimen sheet examined was of pure brown rubber, and will be found in use to give prolonged service and provide for centring the diaphragm without need for any auxiliary centring devices.

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TRADE NOTE.

Messrs. Read Radio, Ltd., have now moved to new premises at 32, Newman Street, London, W.1., the telephone number (Museum 2244) remains as before.

News from All Quarters: By Our Special Correspondent.

Television Tests in England?—Picture Transmission Success.—Visits to Nottingham.—Wales and the Regional Scheme.—A Shakespearean Venture.—Controversy in Earnest.—Bristol's Radio Week.

More About Television.

A number of people would not be at all surprised if the present *impasse* over television were to end abruptly in Humpty-Dumpty fashion. In a recent editorial *The Wireless World* suggested that the Baird Company might be given an opportunity of showing what they could achieve by means of tests outside broadcasting hours from, say, the stand-by transmitter at Marconi House. From what I can gather this suggestion has not gone unheeded in influential quarters.

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In the Wee Sma' Hours.

What will probably happen in the near future is that the B.B.C. will lend a station to the Baird Company for experiments in the early morning hours. An arrangement of this kind would permit of the use of a wide band of wavelengths without interference to stations on the Continent.

I understand that the possibility of conflicting with the Geneva wavelength scheme was one of the reasons which led the B.B.C. to reject the Baird Company's original proposals. Television at the present time needs to have more than one frequency to play with.

It is hardly likely that the proposed television experiments from Scheveningen, in Holland, will be conducted at times when European broadcasting stations are working.

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The Fultograph Tests.

With regard to the Fultograph transmissions, the B.B.C. is watching very carefully to discover what public demand exists for this service.

From a technical point of view the picture transmissions during the past week have amply justified the experiment, and it now remains to be seen to what extent John Citizen is intrigued by the notion of "pictures" from the ether.

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Trouble in Nottingham.

As was expected, the closing down of 5NG on Wednesday last has loaded the Savoy Hill postbag with complaints from the "stricken area." Nottingham folk who were getting 5NG's programme on aperiodic bits of chicken netting find that 5GB is appreciably weaker than the good old local station, and they want to know the reason why.

FUTURE FEATURES.

London and Daventry.

NOVEMBER 11TH.—Armistice Day Service from the Cenotaph and Remembrance Festival from the Royal Albert Hall.

NOVEMBER 13TH.—Danish National Programme.

NOVEMBER 14TH.—"The Pretenders," by Ibsen.

NOVEMBER 15TH.—Hallé Concert, relayed from the Free Trade Hall, Manchester.

NOVEMBER 16TH.—"Tom Jones" (Sir Edward German).

Daventry Exp. (5GB).

NOVEMBER 11TH.—Armistice Day Programme.

NOVEMBER 12TH.—Act 3 of "Lohengrin," relayed from Leeds.

NOVEMBER 13TH.—"The Pretenders," by Ibsen.

NOVEMBER 15TH.—"Tom Jones" (Sir Edward German).

Manchester.

NOVEMBER 12TH.—A Jewish Programme.

Newcastle.

NOVEMBER 12TH.—"My Programme," by Sir John Fitzgerald.

NOVEMBER 13TH.—"In the Cellar," a play by Gertrude Jennings.

Glasgow.

NOVEMBER 11TH.—Scottish "Remembrance" Programme.

NOVEMBER 13TH.—A Concert by the Glasgow Choral and Orchestral Union.

Aberdeen.

NOVEMBER 17TH.—"The Reed in the Wood," a romance by Edwin Lewis.

Belfast.

NOVEMBER 12TH.—"Le Cabaret de Lapin qui Saute."

NOVEMBER 15TH.—A Light Russian Programme.

NOVEMBER 16TH.—Belfast Philharmonic Society's Concert, "The Song of Songs," set to music by Granville Bantock."

A Round of Visits.

The B.B.C. engineers are now running through the correspondence, and in the next few days visits will be paid to the houses of certain picked complainants. In each case the resident's receiver will be checked against a standard set of the same type. I hear that the engineers are prepared to wager that the fault will lie with the receiver in nine houses out of ten. This was the proportion of defective sets found in a similar tour in Birmingham when 5IT closed down.

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And What of Wales?

While the B.B.C. is still uncertain where it will pitch the Northern regional station, acute interest is being aroused over the next station on the list, viz., the West Regional, not only in regard to its position on the map, but its ultimate functions on the programme side.

A strong persuasion exists in favour of "nationalising" the station, *i.e.*, making it the artistic and cultural mouthpiece of the Welsh people, many of whom have clamoured after this ideal ever since broadcasting started. It is fairly certain that they are doomed to disappointment.

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What Would Cornwall Say?

The West Regional station will cater for the needs of the whole of the West country, including Devon and Cornwall, and one can hardly imagine anything more irritating to the Cornishmen than spending long evenings in listening to Welsh.

Wales, however, is justified in asking for proper representation in the programmes, and it is certain that this desire will be met, probably by the inclusion of a preponderance of Welsh material in the transmissions on one of the twin wavelengths.

It is practically admitted at Savoy Hill that the West Regional station will occupy a site on the hills near Cardiff.

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Putting Shakespeare to the Test.

With all due respect to Mr. R. E. Jeffrey, the B.B.C. dramatic producer, I confess that his avowed intentions in regard to the forthcoming production of "Hamlet" *without declamation* makes me shudder.

Imagine the famous soliloquy without declamation! I would rather hear it in modern American! ("You're for it, or

you aint; d'you get me, guy?") However, it would be unfair to say more until we have heard the experiment for ourselves. The date will be November 22nd.

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"X."

Constant invocation of the Deity is a poor and outworn device for heightening the dramatic flavour of stage dialogue. There was too much of it in last week's radio thriller, "X," an unknown quantity which did not gain much on closer acquaintance.

The play would have been more acceptable if we had not so recently heard "Speed" and "The Greater Power," two efforts which at least tilled fresh soil. "X" did not; it sought to make capital out of the old superstition which would put ghosts into every machine.

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A Good Opening.

The opening passages were best, but soon after the machinery stronghold in the Sahara Desert had been discovered the affair became tedious in its absurdity. The dialogue could have been cut in chunks, likewise those irrelevant scenes dealing with odd, unplaceable people who were obviously about to die as "victims of the machine" in motor and aeroplane accidents. (This was done far better in "Speed.")

The effects were good, though I think some variation might have been tried in the "spook music." We are getting too accustomed to those dithering semitones.

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Cecil Lewis and Max Mohr.

As the result of further collaboration between Cecil Lewis and Max Mohr, a new radio play entitled "Caravan" will be broadcast from 2LO and 5XX on November 26th.

It is a play about Egypt and will be the fourth in which Mr. Lewis has collaborated wth the German author for broadcasting purposes, the three previous being "Improvisations in June," "Pimpus and Caxa" and "Rampa." The last-named was produced in London a few days ago at the Gate Theatre studio.

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A Chess Talk.

The game of chess has not hitherto found a niche in the broadcast programmes.

The first chess talk is to be broadcast on November 16th by Mr. Brian Harley, who will deal with that popular opening move, "the Queen's Gambit declined."

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Without a Manuscript!

The B.B.C. will permit Sir Thomas Hughes to come to the 2LO microphone on November 20th without a manuscript. Sir Thomas is a great Dickens enthusiast who, in spite of his public duties, finds time to learn by heart long passages from his favourite author. On this occasion he will recite a scene from "David Copperfield" entirely from memory.

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The Fun Begins.

Controversial broadcasting has hitherto been confined to isolated debates, but on Friday next, November 9th, at 7.25, we are to have the first of a series of talks revolving round the same vexed topic, viz., modern industry. Lord Melchett will be the speaker on Friday, and he will urge the case for Rationalisation. Other speakers on successive Friday evenings will be, respectively, Mr. Walter M. Citrine, on the attitude of organised labour; Mr. H. D. Henderson, on the New Industrial Revolution; Major

THE FIRST PICTURE. The portrait of H.M. the King as it was received on the demonstration "Fultograph" at the Savoy Hotel.

Walter Elliot, M.P., on World Trade; Miss Lynda Grier, on Women in Industry; and the Rt. Hon. Sir Herbert Samuel, on "What of the Future?"

Most shades of political opinion are represented in this list, so if nobody is offended it will not be the fault of the B.B.C.

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Radio Week in Bristol.

The week beginning November 18th is Bristol Radio Week, and the Cardiff programmes will be designed to show Bristol's fame and history. On November 18th evensong will be relayed from Bristol Cathedral.

On November 19th the Bristol Post Office Staff Concert will be relayed from the Central Hall, Bristol.

"The Apex," a comedy in one act by R. J. McGregor, will be given on November 23rd. This play is written by a Bristolian, and the three members of the cast are Bristol artists.

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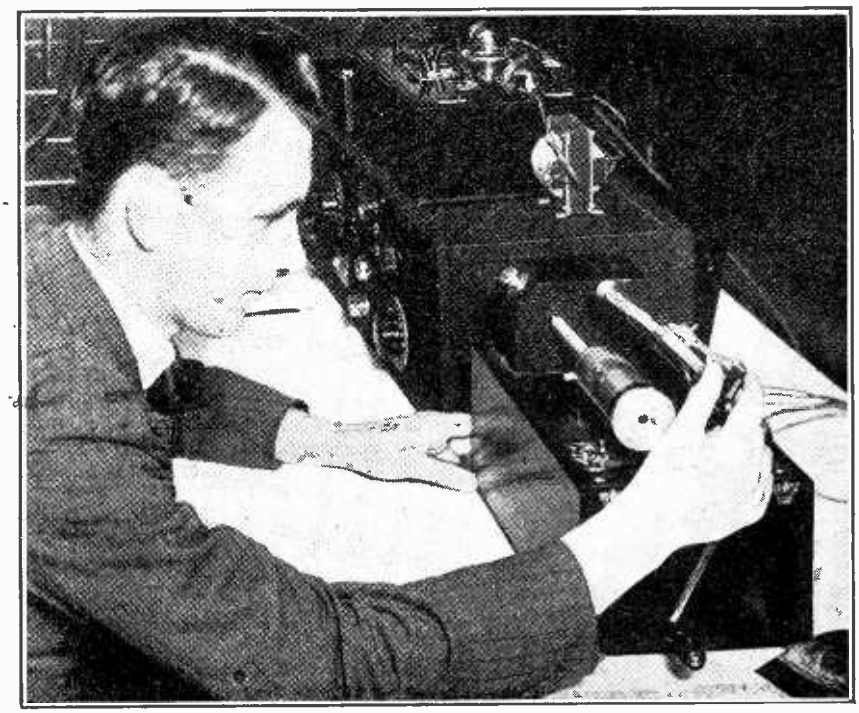
Keighley Annoyed.

I see that Keighley is indignant. Who's Keighley, anyway? "Keighley's not," as Mrs. 'Arris would say, "a 'oo, but a it." The Yorkshire town of Keighley is indignant with a poor, uneducated announcer who dropped a brick in giving the result of a football match between Hull Kingston Rovers and "Keeley"; he ought to have said "Keethly."

Why Keighley makes such a fuss about it puzzles me, but then I didn't hear who won the match.



PICTURE BROADCASTING BEGINS. The "Fultograph" transmitting apparatus photographed just before sending the first picture from Daventry, 5XX, on Tuesday, October 30th. The image was transmitted from Savoy Hill by landline to 5XX, whence it was broadcast and picked up on a demonstration set at the Savoy Hotel.

SALON de T.S.F.

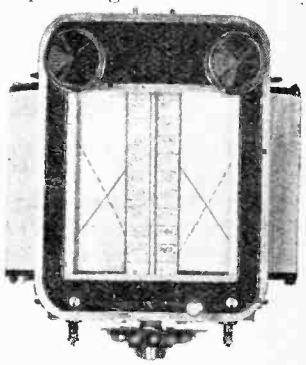
The Radio Situation in France To-day.

Review of the Paris Show.

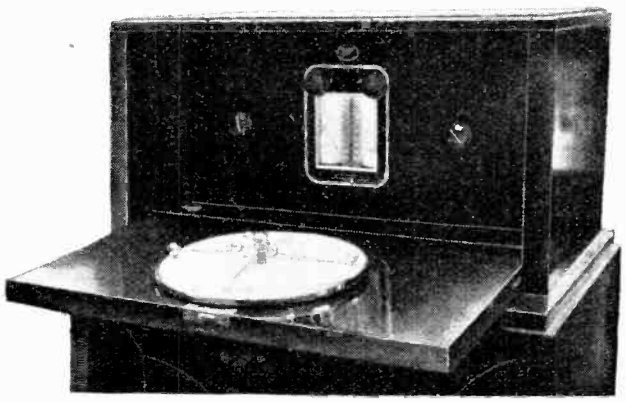
FRANCE seems to know but one type of receiver—the superheterodyne. To the enthusiast in this country such an observation is almost unbelievable, as that form of receiver passed out of vogue here, for both commercial and home constructed sets, more than two years ago. It is hard to find a reason, not only for the survival of the superheterodyne but for its development and elaboration in the hands of the French, to the exclusion, almost, of the highly efficient form of receiver of not more than four valves. Its longevity is governing the entire technique of radio reception in France calling for the standardising of special valves, the suppression of battery eliminators as their failing are evident with seven- and eight-valve receivers, and the exclusion of the moving-coil loud speaker. This is the predominant note that strikes one on visiting the fifth Salon de T.S.F., which opened in Paris at the Grand Palais on October 25th.

Bigger than Olympia.

No fewer than 280 exhibitors have taken stands occupying a floor space of some 60,000 square feet. To compare with the Olympia Radio Show, that exhibition included 266 exhibitors with a stand area of 40,000 square feet. An analysis of the types of receivers exhibited showed that of 250 sets, some 200 embodied the superheterodyne principle and about one-third of this number were portable superheterodynes. Both in the town and country districts the almost entire absence of aerials is a fact one cannot help noting, and it can only be assumed that the majority of French listeners find satisfaction in the use of frame aerial and superheterodyne. Judging by results quality of reproduction is a second consideration to the making of a set with calibration chart showing all the broadcasting stations of Europe. The seclusion provided by the tariff on imported sets, combined with the exclusion of other than French receivers from their exhibition, completely eliminates foreign rivalry which would undoubtedly have a beneficial effect on the design of French productions. Casual inspection of many of the sets suggested the incorporation of both screened grid valves and pentodes, valves which are even better known in certain of the Continental countries than they are here. Closer observation, however, showed that what at first sight might have been a screened grid H.F. amplifier, was, in reality, an arrangement for combining the received and interfering frequencies in the superheterodyne circuit, while in the output stages an additional valve connection resembling a pentode was nothing more than the introduction of an additional grid for neutralising the space charge around the filament.



Drum-enclosed tuning condensers of the Berrens set. The wavelength indicating scale is changed by the switch.



The Berren superheterodyne with calibrated tuning drums and frame-aerial indicator.

Station Indicators.

Turning now to the actual details of the sets, one might quote the Elgédine of Gaumont as representing

Salon de T.S.F.—

a highly developed superheterodyne. One large engraved dial, perhaps a foot in diameter, is marked off with the degrees setting for the frame as well as the tuning positions of a large number of stations. No technical skill is required to operate the set, which is built as a tall piece of furniture complete with batteries and battery charger, enclosed frame aerials, and pleated diaphragm loud speaker. This form of construction, as with many other elaborate sets having semi-automatic tuning controls, calls for the rigid assembly of the components on a metal frame, and in this respect introduces a good feature into receiver construction. Of the six valves used in the Elgédine, the first is a four-electrode valve serving as a combined detector oscillator, followed by two intermediate amplifiers, second detector, and two low-frequency stages.

A pair of intersecting cross wires give the tuning positions of the Péricand receiver.

Ingenious Tuning Devices.

The Synchrodyne is another chassis-built receiver and a product of Radio L.L., a well-known French concern, whose activities include the construction of high-power broadcast stations. It is built on an all-metal frame of heavy aluminium with a front panel nearly three feet in length. Great ingenuity is shown in its tuning system, and as it is calibrated the wave change switch is arranged to expose the appropriate scale on a drum carrying the tuning scale. Its three tuning condensers have their rotating plates linked together on a common shaft, while the stators of two of them are likewise ganged and operated from a separate control.

Accuracy of calibration or the ability to tune a set to any given station being one of the principle merits of the superheterodyne, every care has been taken, in many of the sets, to preserve this property and present it in a form usable by the non-technical listener. At the stand of Etablissements J. H. Berrens was to be found a particularly ingenious calibrated tuning unit. Two small tuning knobs actually operated drums carrying the tuning scales as well as revolving what would normally be the fixed plates of tuning condensers enclosed within the drums. Curves set out on graph paper wrapped around these condenser tuning drums gave the wavelength settings against vertical tuning scales, as can be seen in an accompanying illustration. Wave change switching being arranged by a lever situated between the two drums provided, also, for the turning over of a vertical metal flap, in a like manner to turning over a leaf in a book, so as to expose the appropriate scales against the drums. This system, it is understood, is adopted in a number of French receivers, and is described to evidence the great difference which exists between French and British radio receiver design. In the Berrens' receivers, also, is to be found a beautifully finished dial exposed horizontally on dropping the front of the receiver and used to rotate the two-section frame. Close examination revealed that the mechanical connection to the frame was by cord and pulley concealed within the thickness of the woodwork. In the matter of cabinet work, the Berrens receivers are superb, although this remark applies to many of the receiving sets exhibited at this year's Salon.

Artistic Cabinet Designs.

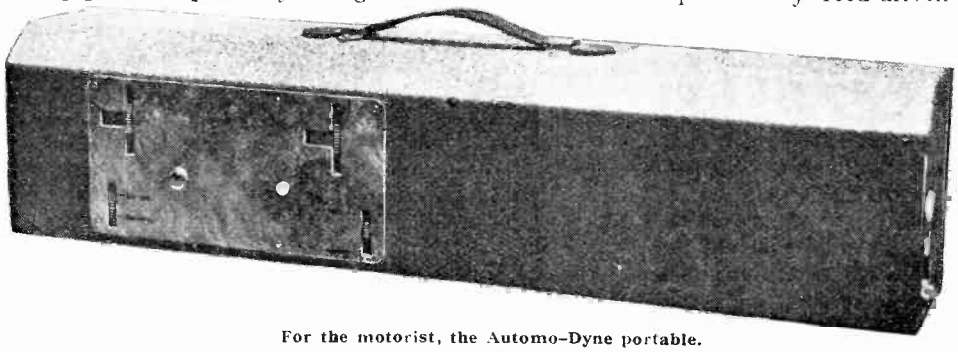
As to external finish and workmanship, artistic design and colouring, there is no equivalent to the French sets on the British market, and these sets, some half as large as an upright piano, sell for prices averaging about £25, to which the cost of accessories must be added, by way of valves, batteries, and, in some cases, the loud speaker.

Probably the most ornate of receivers was the Super-

The Super-Toroïd, a combined superheterodyne and electrically reproducing gramophone.

Salon de T.S.F.—

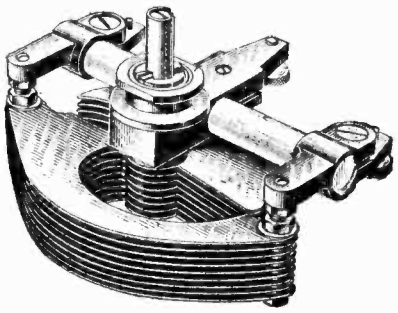
Toroid of Etablissements P. Hugla. Its cabinet resembled an exceedingly well-finished sideboard and the top panel, exposed by lifting the lid, was of a white



For the motorist, the Automo-Dyne portable.

irredescent substance resembling pearl. All controls and fittings, and there were many of them, were highly nickel-plated and harmonised with the "gettering" on the valves, which were recessed into the panel. A turntable was provided so that the outfit served as an electrical reproducing gramophone, while side compartments housed batteries and records.

On the receiver by Etablissements Péricaud was to be found another clever form of tuning indicator. Its two tuning knobs were linked by strings and pulleys so as to propel a pair of cross wires behind a glass panel. A vertical wire moved horizontally and was intersected by a horizontal wire moving vertically. Behind the wires was a wavelength and station calibrated curve, and it was only necessary to turn the tuning knobs so that the wires intersected on the required station.



An interesting variable condenser, assembled about a quartz rod (Gravillon).

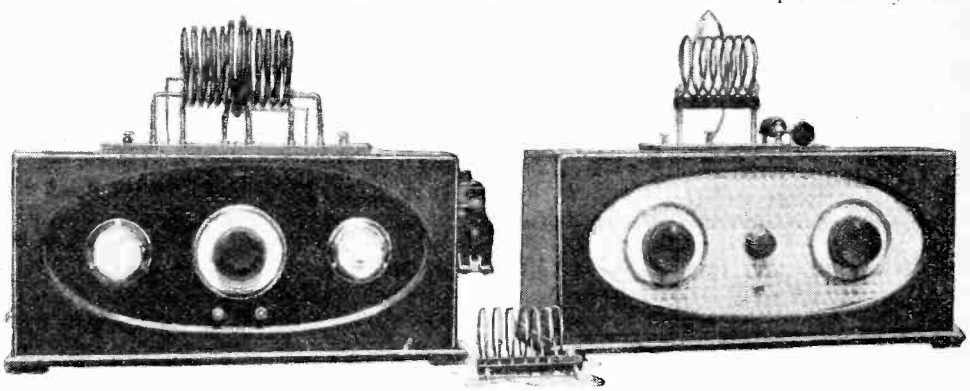
For radio reception in the car a special receiver, the Automo-Dyne, has been designed, and was exhibited by Intégra. As the name suggests, it is a superheterodyne with six valves, and it can be mentioned here that the names of practically all French receivers terminate with "dyne." The Automo-Dyne is all-metal enclosed and suitably shaped for accommodating either beneath the dashboard or out of the way, on the floor of the car in front of the seat. It is robustly built, has no projecting parts or dials, and will maintain its tuning adjustments. A second unit is supplied carrying batteries and frame aerial.

Among the accessories those which predominated were loud speakers and frame aerials, neither of which greatly interest listeners in this country. Practically all the loud speakers were of the cone type, and quite a large number had stretched celluloid diaphragms, invariably operated by reed-driven movements. Cabinet work, as with the complete receiving sets, was particularly attractive, differing from the simple rectangular boxes commonly met with here. An interesting four-pole differential movement selling for just over £2 and known as the Royal Duplex, was shown on the stand of Omnium Radio Electrique. The necessary requirement of liberal armature movement in an almost constant magnetic field is obtained by the use of two horse-shoe magnet systems and four coils. This unit is likely to prove popular in France.

No Moving-coil Loud Speakers.

With the Olympia and Manchester Shows still fresh in one's mind and the conspicuous part taken by moving-coil loud speakers at these exhibitions, the Salon appeared to lose its identity as a wireless exhibition owing to the almost total exclusion of loud speakers of this type. Hidden away on two of the stands, however, specimens were to be found, one incorporated as a matter of routine in a Panatrope, while the other was on the stand of Radio L.L., though not in a position where it could be readily seen or inspected. It is doubtful if the moving-coil loud speaker will gain prominence in France until the receiving systems and low-frequency amplifiers are completely modified.

Components formed only a small part of the total exhibits, and in this field variable condensers predominated. Although the general instrument work inside of quite a number of the sets was poor, many of the variable condensers, and particularly their



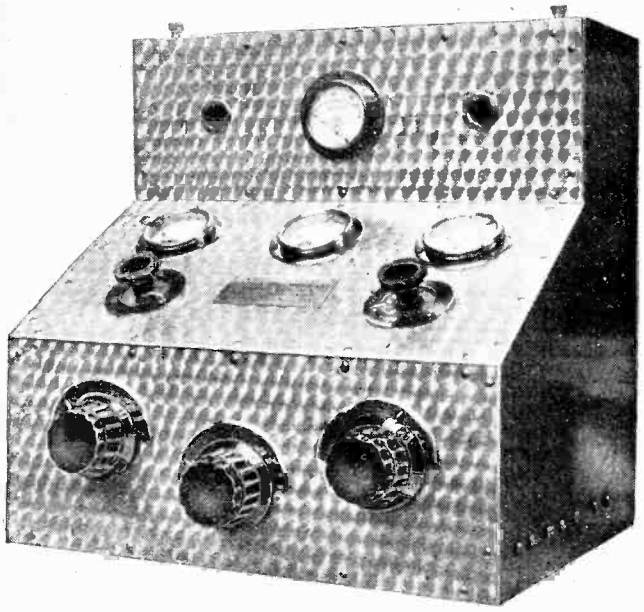
The Creo short-wave transmitter and receiver.

Salon de T.S.F.—

reduction gearing and dials, were exceedingly interesting. Revolving dials are not fashionable, and most attractive was the large knob with vernier window moving over a scale on a well-finished circular aluminium plate, a typical example being the Le Vernier condenser of Les. C. V. Travernier. The aluminium scales look exceedingly well, the effect in some instances being produced by actually grinding the face of the aluminium prior to lacquering. Quartz glass bars are largely used for insulation in variable condensers, two examples being the condensers of Pival and Gravillon. In the first case two short circular rods support the stator, while in the latter the condenser assembly is built up around a straight quartz rod with a centre clamp giving support to the bearing of the moving plates, and a pair of end clamps supporting the fixed plates. The average price of a good quality variable condenser in France is 9s. without dial.

L.F. Transformers and Fixed Condensers.

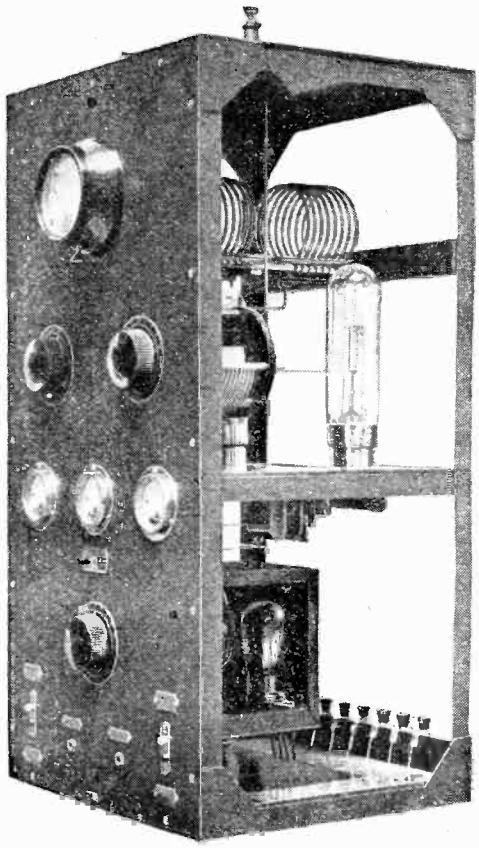
Fixed-capacity condensers are invariably of the air dielectric type. They are compact, of low loss, and cannot be broken down. Typical examples are the Riga of Constructions Radio-Eléctrique and the Le Capac of Etablissements Gilson. Edgewise and drum dials were not greatly in evidence, though one exemplifying attractiveness of design is the Electron condenser made by a company whose wide activities extend to the construction of piezo electric oscillators. Low-frequency intervalve couplings by way of transformers and resist-



The combined transmitter-receiver by Merland and Poitrat.

ances were few, and there appeared little competition among manufacturers in this direction. Transformer curves were not displayed to the same extent as they are in connection with L.F. transformers in this country. Brunet and Pival transformers were most in evidence, selling at a range of prices up to 10s.

Battery eliminators practically do not exist on the French radio market, although there were a few A.C. rectifiers of the buzzer and arc types for battery charging. The Westinghouse form of rectifier so common



A telephony transmitter with master oscillator drive (Radio Provence).

in this country is almost unknown, though a single specimen was actually in the exhibition. For H.T. supply dry cells and H.T. accumulators, and particularly the latter, are in universal use.

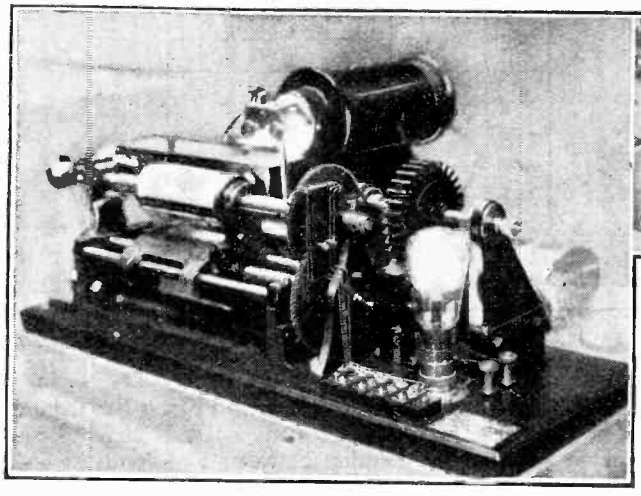
Short-wave Transmitters.

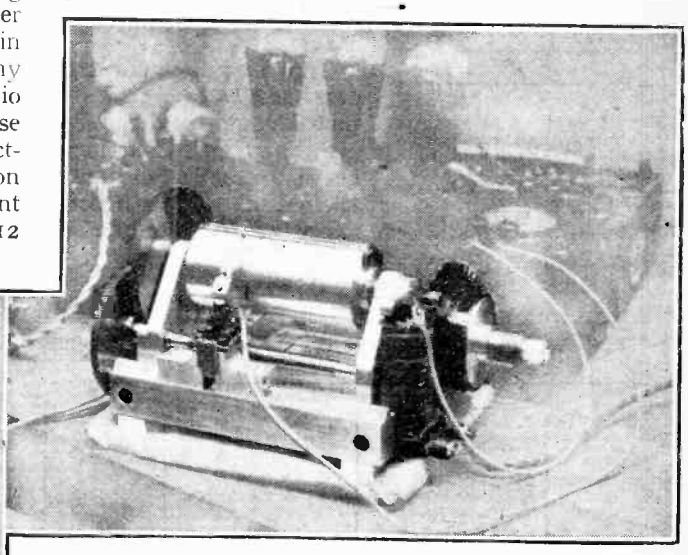
On many of the stands was to be found transmitting equipment and in particular short-wave apparatus for amateur use. The more simple sets used a symmetrical two-valve Meissner circuit, an interesting example being the Creo, a product of Etablissements Cie Radio Eléctrique de L'Opera. A selection from the many attractive short-wave transmitting sets is given in the accompanying illustrations, including one by Merland and Poitrat, which is a beautifully built combined transmitter and receiver, covering a wave range 10 to 100 metres, and the tall all-metal frame-built unit with totally-enclosed master oscillator drive by Radio Provence. There must be a lively demand for transmitting equipment judging by the number of stands on which sets were to be found, and as compared with our own exhibitions where no single example existed.

Not many years ago the most commonly used valve in this country was the "French valve," in particular the Métal and the Fotos, and it is interesting to con-

Salon de T.S.F.—

sider these products of to-day. The range of Métal valves of the Compagnie des Lampes includes those with tungsten, thoriated and oxide-coated filaments. A typical valve is the Micro-Métal D.Y.604. At a filament voltage of 4 it passes 0.1 amperes, has an impedance of 4,500 ohms and a magnification of 6, giving a mutual conductance as high at 1.4. It sells for a little more than 8s. Valves of the " bigrille " type are common in France, and are two-grid valves specially introduced for use in the detector oscillator stage of superheterodynes and have practically no parallel in England. In the Fotos-Gramont series one of the best popular valves is the B.F.1, which is rated at 4 volts 0.12 amperes, with a magnification of 6 to 7 and an impedance of 6,000 ohms, giving a mutual conductance of about 1, and selling at less than 7s. In the Fotos " bigrille " series are two L.F. amplifiers in which the extra grid is used as a means of reducing the working anode voltage down to between 10 and 25. Two other valves of this type are specially designed for use in superheterodynes. Dario and Crynos valves are worthy of mention, manufactured respectively by La Radio Technique and Etablissements M.C.B. Each of these concerns has a popular valve with a mutual conductance in excess of 1, the Dario R.56 has an amplification of 9, with an impedance of 6,000 for a filament current of 0.1 amperes at 3.8 volts, while the Crynos B.712 has a magnification of 7 with an impedance of 6,000 ohms for a filament current of 0.16 amperes at 4 volts. Practically all French valves are made for use on a 4-volt supply. Screened grid and pentode valves of French manufacture would appear to be, as yet, non-existant.





THE BELINOGRAPHE. On the left is the transmitter. A negative paper image is traversed by a point of light, the reflected light falling upon a photoelectric cell. Synchronising is checked by a flashing neon lamp illuminating a toothed wheel. The simple picture receiver is driven by an A.C. motor and runs at a constant speed related to the frequency of supply. A blue image is recorded by the application of the rectified current to a chemically moistened paper.

Picture Transmission Popular.

By far the biggest gatherings were to be found around the stands where demonstrations of picture reception were in progress. Two systems are now in use in France, the Sferographe, which is the name applied to the Fultograph of this country, and the Belinographe. Transmissions with the former system are being conducted from Radio Paris, and with the latter from the stations PTT, Radio-Toulouse, and Radio LL. Like the demonstrations given at the Manchester Exhibition, the Sferographe (Fultograph) was seen in operation recording a perfectly good picture. Nothing need be said concerning its technical details, which have been given at length in these pages. The Belinographe is synchronised by being driven with an A.C. synchoneous motor arranged to produce a given speed of rotation depending upon the frequency of the A.C. supply. The illustration shows the double-ended magnet which is energised from the A.C. mains and propels a toothed wheel, different frequencies being accommodated by the substitution of wheels with an appropriate number of teeth. Unlike the Sferographe, the rotation of the cylinder is not momentarily tripped for synchronising and construction is therefore greatly simplified, though it calls for the frequency of the supply being correct within narrow limits. The machine is all-aluminium built and well finished, and makes use of the electrolytic method of recording. Here, again, it differs from the Fultograph in that the solution is a ferricyanide, producing a permanent blue image, although this solution is perhaps less sensitive than the starch iodide of the Fultograph. The picture is 10 × 13 cm., and the pitch of the traverse is six revolutions to the millimetre. Transmission is carried out by dispersion from a point of light falling upon a photoelectric cell.

The English visitor to this year's Salon cannot help being surprised, first with its magnitude and next with the vast technical differences which exist in radio practice in France and our own country.

USEFUL DATA CHARTS. (No. 15.)

Efficiency of Coupling by Grid Leak and Condenser.

WHEN, in an amplifier, the signal from the plate of a valve is handed on to the grid of the following valve by means of a grid leak and condenser, it is important to know what fraction of the signal is handed on—in other words, what is the efficiency of the coupling.

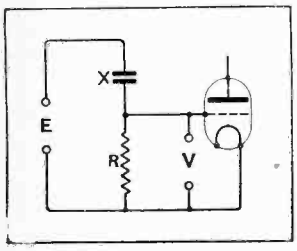


Fig. 1. — In an amplifier when leak and condenser coupling is employed the coupling efficiency is represented by V/E.

This fraction is V/E, as is evident from the figure, and is equal to $\frac{R}{\sqrt{R^2+X^2}}$; if we put $\frac{X}{R}$ = tan A, then $\frac{R}{\sqrt{R^2+X^2}}$ is equal to cos A.

The abac is accordingly constructed by arranging that the right-hand line shall give the ratio X/R. Then a curve is drawn so that a tangent drawn to it from tan A on the right will give cos A (i.e. V/E) on the left.

An Example.

A grid leak of 100,000 ohms is used with a grid condenser of 0.0095 microfarads: What fraction of the signal will reach the grid of the following valve at 50 cycles/sec.?

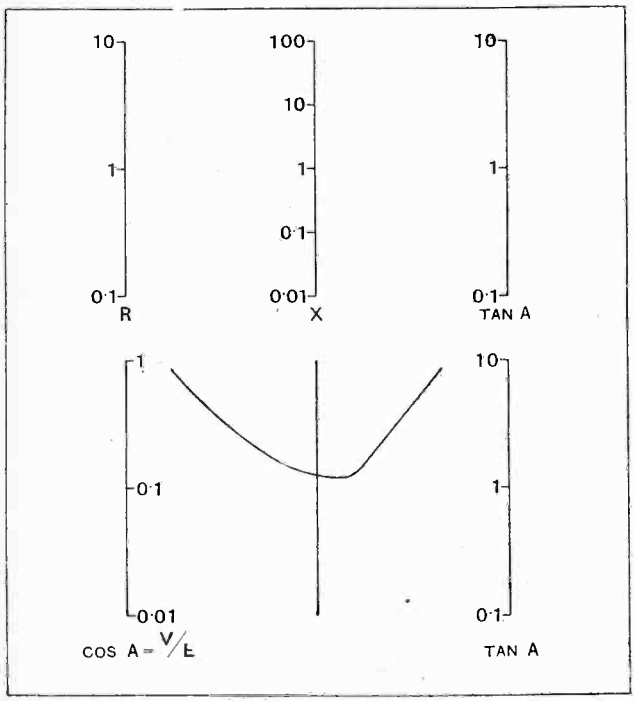


Fig. 2.—The abac given this week is constructed by arranging that the right-hand side shall give the ratio X/R. A curve is then drawn so that a tangent drawn to it from tan A on the right will give cos A (i.e. V/E) on the left.

Low Note Loss.

From abac No. 7 we see that the impedance of this condenser at 50 cycles/sec. is 167,000 ohms. Hence X = 167,000, R = 100,000, and on joining these two and drawing a tangent to the curve from the point where this line meets the reference line, we get V/E = 0.513. Evidently the low notes would suffer considerable loss: either R or C, or both, should be larger.

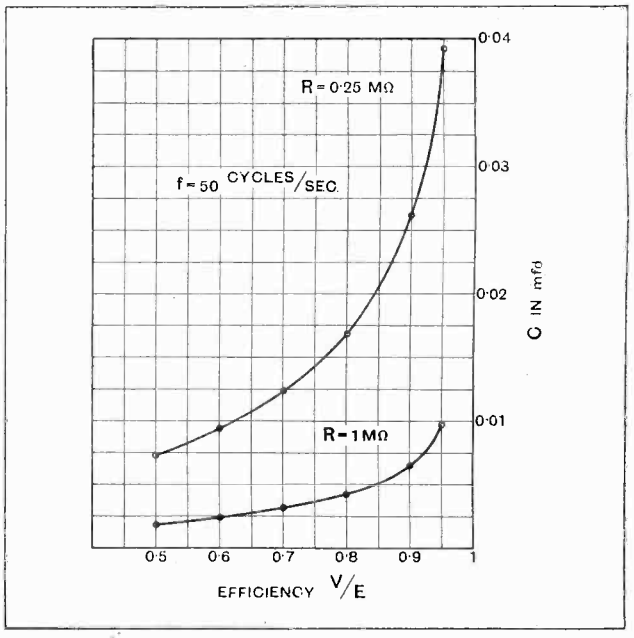
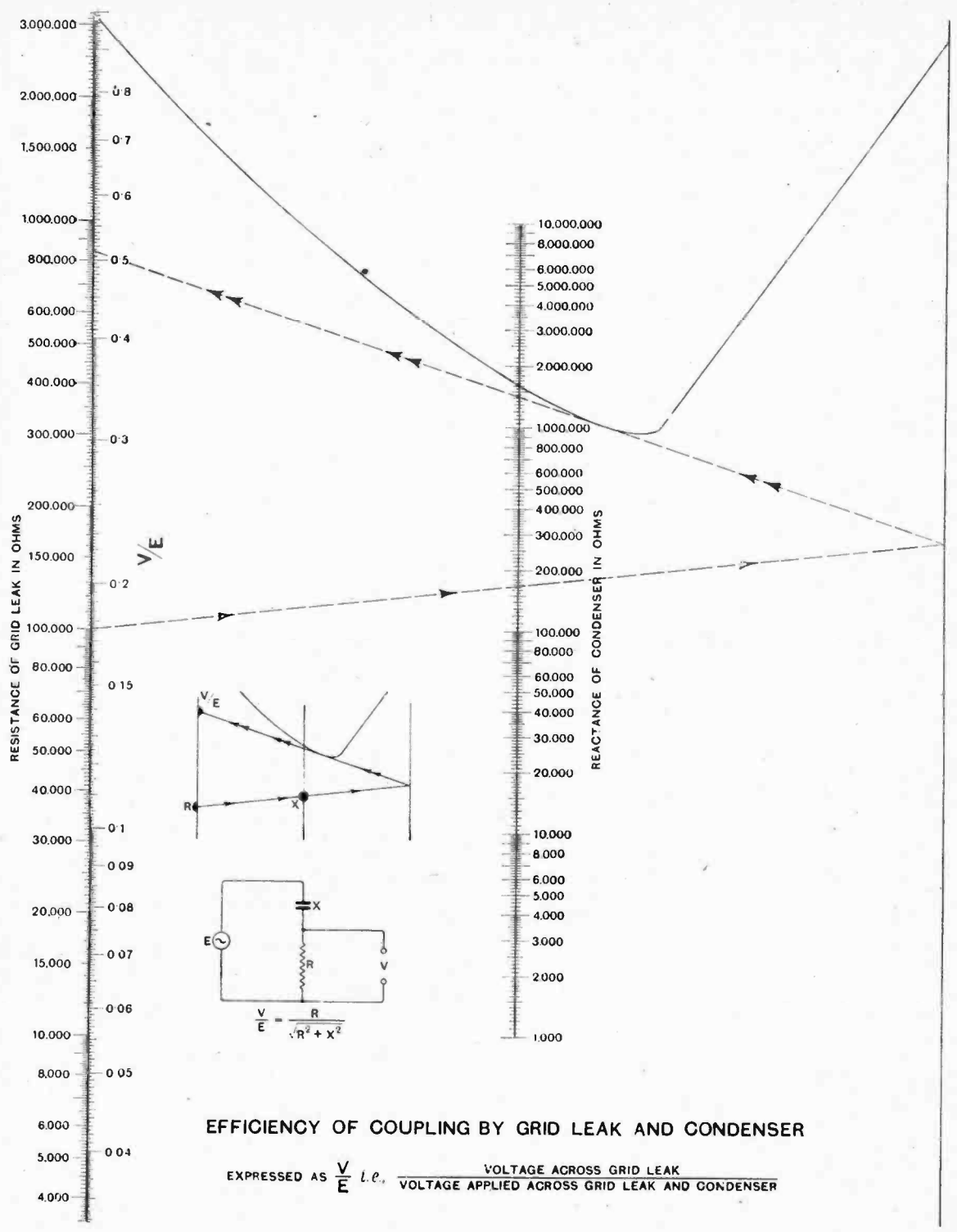


Fig. 3.—Curves showing how the efficiency of a coupling circuit changes as the grid capacity is varied.

From this abac, in conjunction with No. 7 (impedance of a condenser at audio-frequencies) it is easy to plot curves showing the relation between V/E and the grid capacity for different values of the grid leak: the frequency is taken as 50 cycles/sec. The curves show that 90 per cent. of the signal gets through to the grid for R = 1 megohm, C = 0.0065 mfd., or for R = 0.25 megohm, C = 0.026 mfd.

It is unwise to try for greater efficiency than this, for the use of larger leaks or condensers may give rise to blocking effects, of which details will be given in the next abac.—R. T. B.

At the end of the text associated with abac No. 14 in last week's issue a list was given of the useful data charts that have already appeared, together with the dates on which they were published.



EFFICIENCY OF COUPLING BY GRID LEAK AND CONDENSER

EXPRESSED AS $\frac{V}{E}$ *i.e.*, $\frac{\text{VOLTAGE ACROSS GRID LEAK}}{\text{VOLTAGE APPLIED ACROSS GRID LEAK AND CONDENSER}}$

W. W. ABAC

Nº 15

LETTERS TO THE EDITOR.

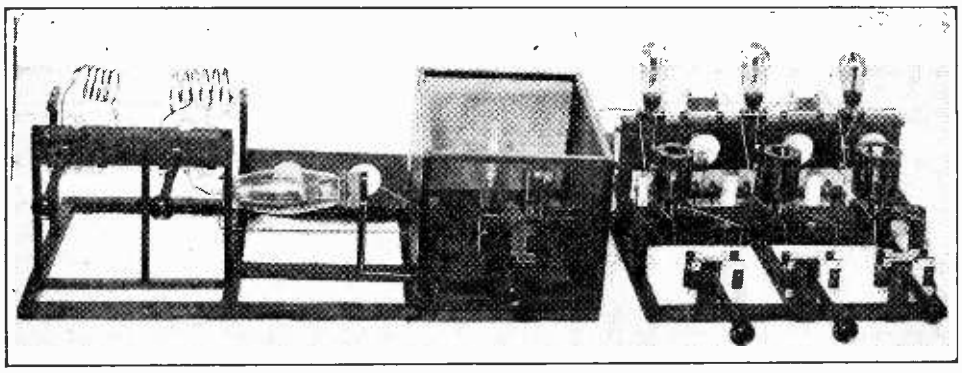
The Editor does not hold himself responsible for the opinions of his correspondents.

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.

LOUD SPEAKER ATTACK.

Sir,—According to recent correspondence in *The Wireless World*, it appears that at last the experts have realised the existence of "transients." It is to be hoped that microphones, amplifiers, transmitters and land lines will receive attention as well as the loud speaker. We have always understood that, so long as any piece of apparatus dealt uniformly with all frequencies the resulting output would be distortionless. It would be nice if the authorities concerned would state what happens in the case of shock excitation by sudden noises, such as drums, cymbals, and hand-clapping. Judging from general loud-speaker performance, the results are far from perfect.

Distortion is particularly noticeable with transients on any type of loud speaker, and seems to be caused by the natural resonances of the speaker being superposed on the sound to be reproduced. It is only necessary to tap a diaphragm to realise what a horrible noise is emitted whenever a really sudden whack comes along. Under working conditions transients of this nature must cause the speaker to make the output "diaphragmy," and this would appear to be the general effect in practice. It is likely that this accounts for the indistinctness in the bass in coil drives, where the reproduction of low-frequency transients is particularly bad. In the case of the reed drive, low-frequency transients have no chance at all, because there is no bass. From recent articles in *The Wireless World*, by Dr. McLachlan, we know that an improperly designed coil drive has serious low-frequency resonances which will be operative with every low-frequency transient, causing indistinctness and discordant notes.



The transmitting apparatus of Mr. J. W. Mathews (G6LL) who was successful in conducting the first British two-way communication on 10 metres with an American amateur station.

Surely it is absurd to utilise mechanical ingenuity to hustle a diaphragm having reconances whenever a transient is coming through. The suppression of resonances is the primary problem. An antidote for inertia is a secondary consideration and may be unnecessary. CURIOUS.

London.

BRITISH AMATEURS BRIDGE ATLANTIC ON 10 METRES

Sir,—I am pleased to be able to advise you that yesterday afternoon my station effected two-way communication with American stations 1AQD and 2BJD, using a wavelength of 10 metres. My test calls on 10 metres (my actual wave was 10.5 metres) at 1815 G.M.T. were answered by 1AQD, who reported my signals steady R5, and consistent two-way communication was maintained until 1940 G.M.T., when I connected with 2BJD.

The signals of 1AQD varied between R2 and R6, but were steady and readily copied on two valves throughout the test.

My transmitter is quartz controlled from a 84.5-metre crystal through the usual frequency doubling stages, and the aerial used being double-wave horizontal voltage-fed supplied by short R.F. lines.

A message of greeting from RSGB to ARRL was passed and acknowledged.

I believe this is the first two-way 10-metre work between this country and U.S.A., and it is of interest to note that the G.P.O. has only this month issued permits to experimenters to use the 10-metre wave. E. J. SIMMONDS.

West Drayton.
October 22nd, 1928.

Sir,—With further reference to my letter of 22nd inst. regarding 10-metre work, G6LL rang me up last night and informed me that he was in communication with an American station on 10 metres at approximately 1430 G.M.T. on the 21st, and he would thus antedate my 10-metre QSO by a few hours.

I am asking him to send you particulars. I understand he worked one U.S.A. station. E. J. SIMMONDS.

West Drayton.
October 23rd, 1928.

Sir,—You will be interested to learn that 10-metre two-way contact with the U.S.A. was established on Sunday last at 1400 G.M.T., or soon after. The British station who was successful in hooking up with the States was G6LL, who has in all probability notified you direct.

There were at least three American stations audible on 10 metres on Sunday afternoon, and were received at my station at good strength. They were W2JN, who was in touch with G6LL and W2AYR, who came in at strength R4-5, whilst the other, W2BDA, was even stronger.

I tried hard to effect contact with one of these three, but was unsuccessful, although my signals may have been heard on the other side by some other station.

The signals from the American stations were all of the R.A.C. type, whilst those of G6LL were pure D.C. with crystal control note.

Colliers Wood, S.W.19. J. A. PARTRIDGE (G2KF).
October 24th, 1928.

Sir,—At 1430 G.M.T. on Sunday last W2JN was heard on 9.9 metres, calling CQ, at strength R5. On being called he replied, reporting signals from G6LL as being received at R6, and the following message was received :—"Congratulations on first 10-metre QSO between W and G."

Communication was maintained for an hour and three-quarters.

Signals were reported as fading from R6 to R3, and a reduction of power from 50 watts to 20 watts caused the signal strength to drop to R5.

The transmitter is shown in the accompanying photograph.

Clapton, E.5. J. W. MATTHEWS (G6LL).
October 24th, 1928.

READERS' PROBLEMS

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

The Service is subject to the rules of the Department, which are printed 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.

Changing a Resistance.

I understand that the anode resistance included in my R.C. coupling unit (which was obtained some time ago) has a value rather too high for good reproduction of the upper audible frequencies, and I should like to change it. Unfortunately, however, the various components of the unit are sealed with insulating compound in a moulded case, and it would seem to be impossible to obtain access to the interior. Is it practicable to connect another resistance externally?
F. T. T.

Yes, there should be no difficulty in using an external resistance. The H.T.+ lead should be removed from the unit and connected to one end of the new resistance, the other end of which must be joined to the "plate" terminal of the unit, which will still be joined to the anode of the preceding valve. No other alterations are necessary.

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Records and Radio.

I have so far been unable to obtain good results with a pick-up when the gramophone and wireless set are at opposite sides of the room, and presume that this trouble is due to the use of an extension lead about 18ft. in length. Can you suggest how the difficulty may be overcome?
T. E. M.

It is always unsatisfactory to connect a pick-up to an amplifier by means of a long lead; if you do not wish to install the wireless set and gramophone side-by-side, we think that your best course is to use a pick-up transformer, which should be located near the receiver. This transformer should be of a design suitable for working in conjunction with the pick-up. As regards the choice of a suitable component, you should consult the makers of the latter instrument.

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Bias for Screened Valves.

It seems that a slightly increased amplification is obtained from a screened grid H.F. valve if the bias applied to it is somewhat less than that of a single dry cell (1.5 volts). In the set I am building I should like to apply a bias of ¾ volt, if it is possible to do so without fitting a potentiometer. Can you suggest a plan?
C. E. G.

Assuming that you are using valves with a filament voltage rating equal to that of the L.T. battery, we cannot think of any more convenient method of obtaining a bias of less than 1½ volts than by the use of a potentiometer. It may be pointed out, however, that there is no need for continuous adjustment, and we think your needs would be adequately met by using a fixed resistance of some 200 ohms or more, with a few tappings. This could be made in compact form, and would be connected across the L.T. leads in the manner shown in Fig. 1.

In order to obtain the voltage you desire, it will be necessary to oppose the pressure of the bias battery by a suitable positive voltage picked up from the resistance. The potential drop along this resistance will be proportional to the length of wire in circuit, and, assuming that you are using a 4-volt L.T. battery, and wish to introduce a counter-E.M.F. of 0.75 volt, the tapping at Y (referring to the diagram) must be at a point which will include between X and Y slightly less than one-fifth of the total resistance between X and Z.

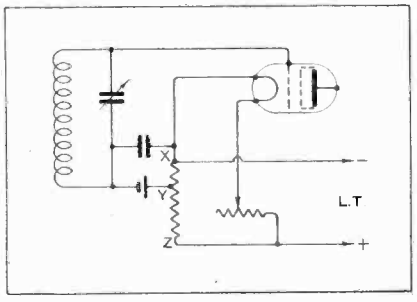

Fig. 1. — Obtaining intermediate grid bias voltages by means of a semi-fixed potentiometer.

It is well to include a by-pass condenser of about 0.1 mfd. in the position shown.

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H.F. in the L.F. Amplifier.

My set is a modification of the "All-Wave Four," and works well on the normal broadcast waveband. On the long waves, however, I have as yet been unable to obtain really satisfactory results; although the neutralising system seems to work properly, a "howl" is produced when the circuits are brought into tune, particularly if signals are coming in on this setting. Can you diagnose my trouble?
H. T. B.

We expect that the apparent instability on the long waves is due to the fact that H.F. voltages are being applied to the grid circuit of the first L.F. valve, and you should test the stopping resistance which was included in the original design in order to prevent this trouble. It seems quite likely that you will find it has a resistance value considerably lower than that at which it is rated. You might try the effect of connecting an H.F. choke in series with the resistance, but you should take care that it does not couple magnetically with the H.F. transformer.

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Complicated Switching.

Now that switches seem to be widely used for changing wave ranges, I am wondering whether it would be possible to design a receiver to cover ultra-short, medium, and long waves without the need for changing coils. If you favour this plan, perhaps you would be good enough to give me a few suggestions.
W. G. S.

Although it is now a fairly easy matter to design a satisfactory receiver to cover two bands of wavelengths by means of a switch change-over, we think that there would be great difficulties in the way of devising a method of covering three bands, particularly when very high frequencies are included. In any case, we fear that the matter could not be discussed helpfully in the course of a letter.

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.

Buzzer or Heterodyne?

I am thinking of making a buzzer wavemeter, but cannot decide whether this would be the most suitable kind for general use. Do you consider it preferable to the heterodyne type?
L. B. K.

It is rather difficult to give a definite answer to your query, as a good deal depends on the purpose to which a wavemeter is to be applied. If it is used as an aid to tuning, the buzzer type is almost certainly the better of the two, as its radiation can be picked up when the set is in a non-oscillating condition. Against this is the disadvantage that many buzzer wavemeters tune flatly, but this difficulty can be overcome; we think you would be well advised to read a description of an instrument of this type which appeared in our issue of August 3rd, 1927.

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Distortionless Detection.

Some time ago you published some circuit diagrams showing how a three-electrode valve could be used as a diode detector. Would it be possible to use this form of rectifier after a stage of transformer-coupled H.F. amplification, following it by a choke coupling to the L.F. amplifier?
R. S.

We assume that you are referring to the system of rectification in which the grid of an ordinary three-electrode valve is given a positive potential in order to neutralise the space charge, signal voltages being applied to the anode. This method can certainly be applied to an arrangement such as you describe; the connections are as shown in Fig. 2.

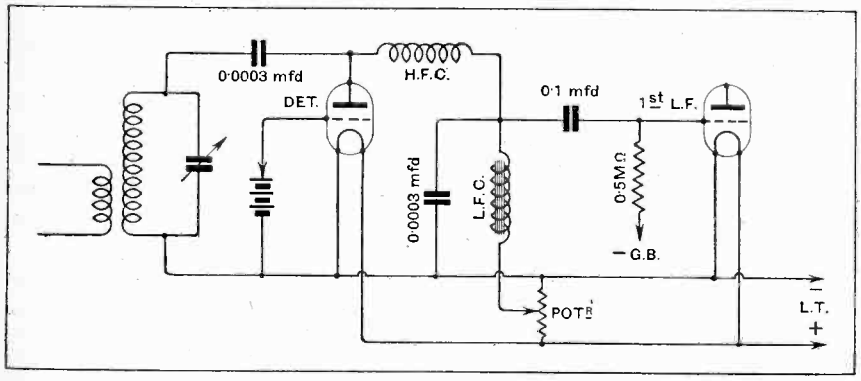

Fig. 2.—A diode detector with space charge neutralised by the application of a positive voltage to the grid.

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Short-circuited Mains.

My receiver is fed with H.T. through a D.C. eliminator, and I find that the house-lighting fuses blow when the earth lead is joined to the apparatus. The set seems to work quite well without this connection, but I feel certain that something is wrong, and would welcome your advice.
W. S. J.

It seems that the positive side of your mains supply is earthed, and that the common H.T. and L.T. negative lead of the receiver is in metallic connection with the earth terminal, with the result that the addition of an earth connection introduces a short-circuit across the mains.

It is quite possible that the set will work well with no other earth connection than that provided by the mains themselves, but if you are not satisfied with the results you can adopt one of two alternatives. The first is to connect a large condenser in the earth lead, and the second is to use an aerial-grid transformer with separate windings. In this latter case the low-potential end of the aerial coil must be connected only to the earth terminal and not to the filament circuit of the valve.

○○○○

A Fallible Rule.

I have in the past obtained a good deal of help from the simple rule with regard to grid bias values for amplifying valves (that the appropriate voltage is ascertained by dividing the H.T. voltage applied by twice the amplification factor of the valve). As far as some of the new valves are concerned, however, it does not seem to work out quite as well as before; am I correct in assuming that it no longer holds good? F. E.

It must be remembered that the formula you quote is, after all, no more than a rule of thumb, and that it is not scientifically accurate. It is safe to say, however, that it is still helpful, even with modern valves having a high mutual conductance. When it was first devised the values given tended to err towards an excessively high figure; nowadays, the contrary is the case.

It should be added that the rule cannot be used for ascertaining the bias to be applied to pentode valves.

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Pentode or Triode.

Would it be permissible to use an ordinary super-power valve (which I already possess) in the "Megavox Three" receiver in place of a pentode? I have an ample H.T. supply, and the valve gives sufficient volume for my requirements when used in my present set. D. M. V.

Yes, you could certainly use an ordinary triode as an output valve with good results, provided that signals are sufficiently strong. Of course, magnification will be much less than that obtainable from a pentode.

As your super-power valve is apparently capable of dealing with large inputs, we expect you will get best results (particularly from near-by stations) from anode-bend rectification, which is included as an alternative to the grid circuit method in the "Megavox" receiver.

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Another Use for the Crystal.

As it seems that the new directly heated A.C. valves do not work well as rectifiers, I am wondering whether it would be a good plan to use a crystal detector in conjunction with them. The set I have in mind would have an H.F. amplifying stage coupled to the crystal by means of a step-down tuned transformer (this was suggested in "The Wireless World" some time ago) and two L.F. amplifiers. Your comments on this circuit arrangement would be appreciated. M. G. F.

Subject to the proviso that you use a really stable and reasonably sensitive crystal detector, we think that your proposed scheme has a good deal in its favour, but we should point out that selectivity, as far as the H.F. coupling is concerned, will not be of a very high order. In your locality this is not likely to be a serious disadvantage, and in any case matters can be improved in this respect by using, as an H.F. amplifier, a valve with a high impedance and a high amplification factor.

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A Way Out.

On account of interference from power circuits and electrical apparatus, I find it almost impossible at my present address to receive good signals except from my local station and the two Daventry transmitters; even these latter stations are heard through a background which is at times loud enough to be annoying. All the usual "cures" have been tried, but with no real success. Must I abandon all hopes of reasonably good distant reception, or can you suggest anything? Nothing very complicated or expensive, please.
H. L. P.

We sympathise with you in your difficulties, but fear that there is little we can do to help you, except to advise you to try a loosely coupled and separately tuned aerial circuit—if you have not already done so. This comparatively simple addition is often most beneficial.

Perhaps you would be well advised to concentrate on short-wave reception, and we would certainly suggest that you should give it a trial, particularly as this form of broadcasting now seems to be firmly established. Signals of these wavelengths are generally found to be less susceptible to interference from "man-made static" than are those in the normal bands.

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

CONTENTS OF THIS ISSUE.

PATENT-LAW REFORM.

THE Report of a special Committee appointed by the British Science Guild with Dr. W. H. Eccles in the Chair "to consider what changes could advantageously be made in the British Patent Law" has just been issued from the offices of the Guild, John St., Adelphi. The Report contains recommendations of far-reaching importance both to the inventor and the public.

In our opinion some at least of the suggested reforms are long overdue. Amongst these is a proposal to empower the Comptroller of the Patent Office to hear actions relating to infringement, and to decide petitions and counter claims for the revocation of patents on all the usual grounds of invalidity.

A Confirmation of our Attitude.

Our readers will recollect that we have more than once suggested that a move in this direction would go far to clear away the existing uncertainty of the patent position in the wireless industry. At present the scope and validity of a patent can only be effectively tested by an action in the High Courts. The expense and time involved in High Court litigation can not lightly be faced by the ordinary manufacturer.

As a result he is frequently compelled either to pay an unjustifiable royalty—or else lose good trade—because of patent claims which could not be substantiated in Court. On the other hand, an inventor of moderate means, who may have secured the grant of substantial letters patent will find his rights ignored because he cannot afford to institute expensive litigation against infringers.

Special Qualifications of Patent Office Staff.

In their recommendation on this point the Committee argue that the County Courts though relatively inexpensive are not equipped to decide patent actions, whilst the technical knowledge and experience of the Patent Office staff render it peculiarly suitable to undertake the additional duties suggested.

Infringement and similar actions would in general only be dealt with by the Patent Office by mutual consent of the parties concerned, and on an agreed understanding as to whether the decision of the Comptroller should be final or subject to an appeal to the Courts. At the same time, provision could be made to enable the poor inventor to cite a powerful infringer before the Patent Office, and to have his claims adjudicated on, in bona fide cases, by this tribunal.

"Short Term Patents."

Another interesting suggestion advanced by the Committee is the institution of a special type of patent to cover minor improvements which, although more in the nature of ingenious design than actual invention, may yet find a wide market in practice. Such "Short term patents" would be issued with little delay and at considerably less cost than the normal patent. Their term, it is suggested, would be limited to a maximum of seven years.

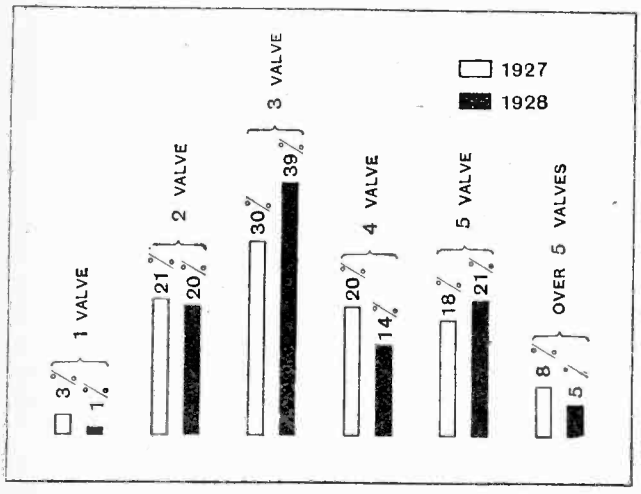
Among other points dealt with are: a stiffening-up of the penalties for making unwarranted threats in connection with patent rights; the possibility of affording some degree of Official assistance at the Patent Office to an inventor when making a search prior to his filing his application; and the extension of the Official search on the Patent Specification to cover all available text-books, periodicals, and other technical publications generally.

The Report bears ample evidence that the Committee have given long and careful consideration to a peculiarly difficult problem. It is to be hoped that their recommendations will in due course bear fruit in legislative action.

SETS of the SEASON

A Comparative Analysis of This Year's Designs.

THERE are several very real difficulties in the way of visualising in true perspective to-day's tendencies in design as compared with those of last year; the recent introduction and wide adoption of screened grid and pentode valves is likely, in certain cases, to discount the value of the lessons to be learnt from the percentage figures given in the accompanying graphs. For instance, the predominance of three-valve sets and the marked increase in their number might well give rise to the impression that experience has shown that this type of set is the most generally suitable for average needs. It probably is, but it must not be forgotten that this class comprises the particularly happy and popular combination of screened grid H.F. amplifier, triode detector, and pentode L.F. amplifier; this specialised arrangement cannot properly be compared with more conventional three-valve circuits, although it automatically falls into the same category.



TYPES OF SETS. 1927 and 1928 compared: the three-valve set is more popular than ever.

Advice is cheap, and in no direction is it more likely to be exactly worth its cost than with regard to the choice of a wireless set. This unfortunate state of affairs is due to the profound influence of local conditions and to wide differences in the efficiencies of aerials; without knowledge and even actual experience of these conditions it is fatally easy to offer advice which is, at the best, misleading. One is, indeed, tempted to evade the task of making suggestions to prospective buyers, but there is now such a bewildering array of types, let alone makes, of receivers that it is considered essential, before analysing present practice, to touch briefly on some of the points which should not be overlooked in coming to a decision.

Portable Sets: Advantages and Disadvantages.

Self-contained and portable sets are now offered in such quantities that they may soon outnumber the rival type of equipment which is fitted with an external aerial and (generally) with external batteries (or eliminator) and loud speaker. It would, therefore, seem necessary to decide first whether the advantages of the former type of receiver, such as portability, the avoidance of an external aerial, and general compactness and neatness, are sufficiently attractive to turn the scale against its increased cost. It is a fact that any frame-aerial set must, for equal performance, have a greater number of valves than the other type; its price will therefore be higher, and upkeep expenditure will be heavier.

As to whether the chosen set should include high-frequency amplification is a matter of both geographical situation and requirements. For real long-distance re-

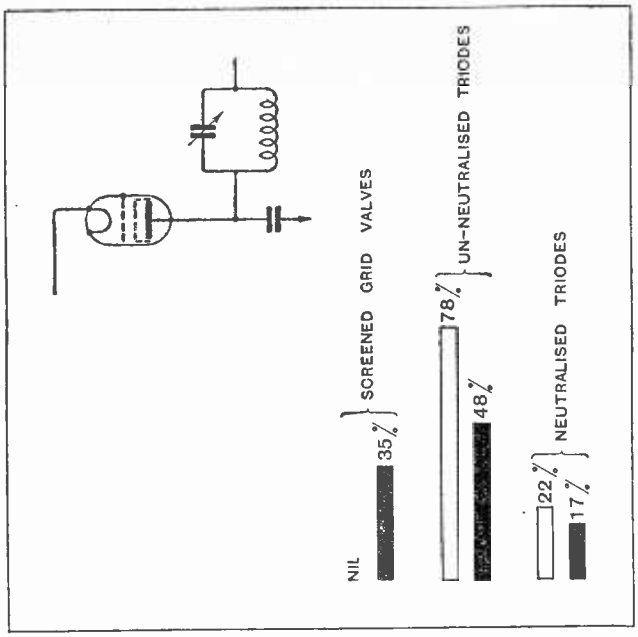
Sets of the Season.—

ception it may be considered as essential, for no set is really satisfactory for this purpose when it depends entirely for its sensitivity on critical adjustment of reaction. Apart from the question of range, it should be pointed out that a tuned H.F. stage confers another benefit, in the shape of selectivity, which cannot so satisfactorily be attained in any other way; those living in the vicinity of a transmitter and wishing to receive an alternative programme are often forced to use it for this reason, although it may not be strictly necessary from the point of view of sensitivity.

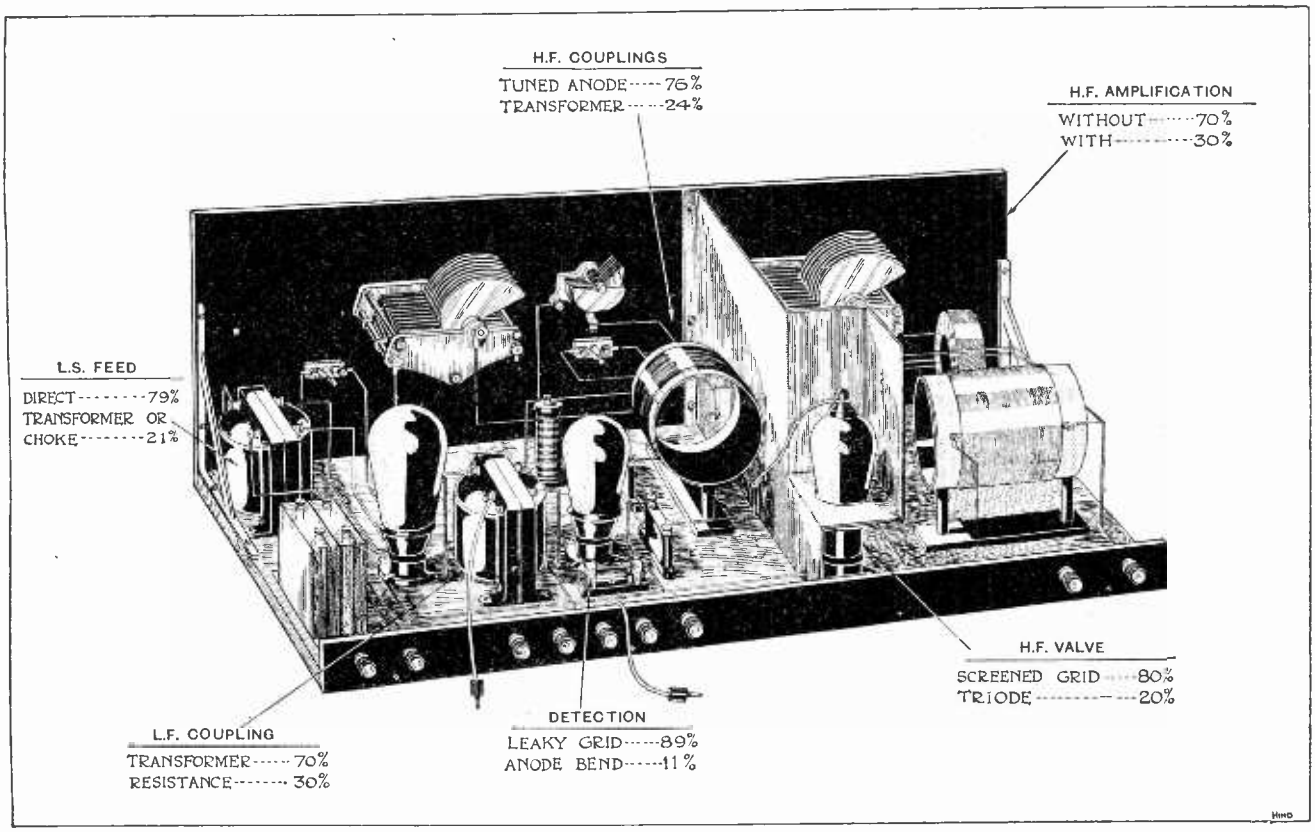
Three-valve Sets Gain Ground.

Pentode valves have done much to solve our problems with regard to volume of reproduction, but the fact remains that to achieve an intensity generally described as "realistic" the listener has to budget for an expenditure of energy greater than can economically be drawn from dry batteries or even from H.T. accumulators unless means for recharging them are readily available. Many of us must perforce content ourselves with the output of an ordinary super-power valve with normal H.T. voltage, and, after all, we are likely to be more popular with our neighbours by doing so.

In making an analysis of receivers as a whole, the most striking fact revealed by the first graph is, as already stated, the increased preponderance of the three-valve set, due very largely to the introduction of the shielded valve-triode-pentode receiver, which, in its best form, has capabilities with regard to sensitivity, selectivity, and volume sufficient to satisfy even the more ambitious requirements. As was to be expected, the gains of this classification are largely at the expense



H.F. AMPLIFICATION. The advance of the screened grid valve; last year its application was negligible.



THREE-VALVE RECEIVERS. Resistance-coupled L.F. stages are almost exclusively confined to sets without H.F. amplification.

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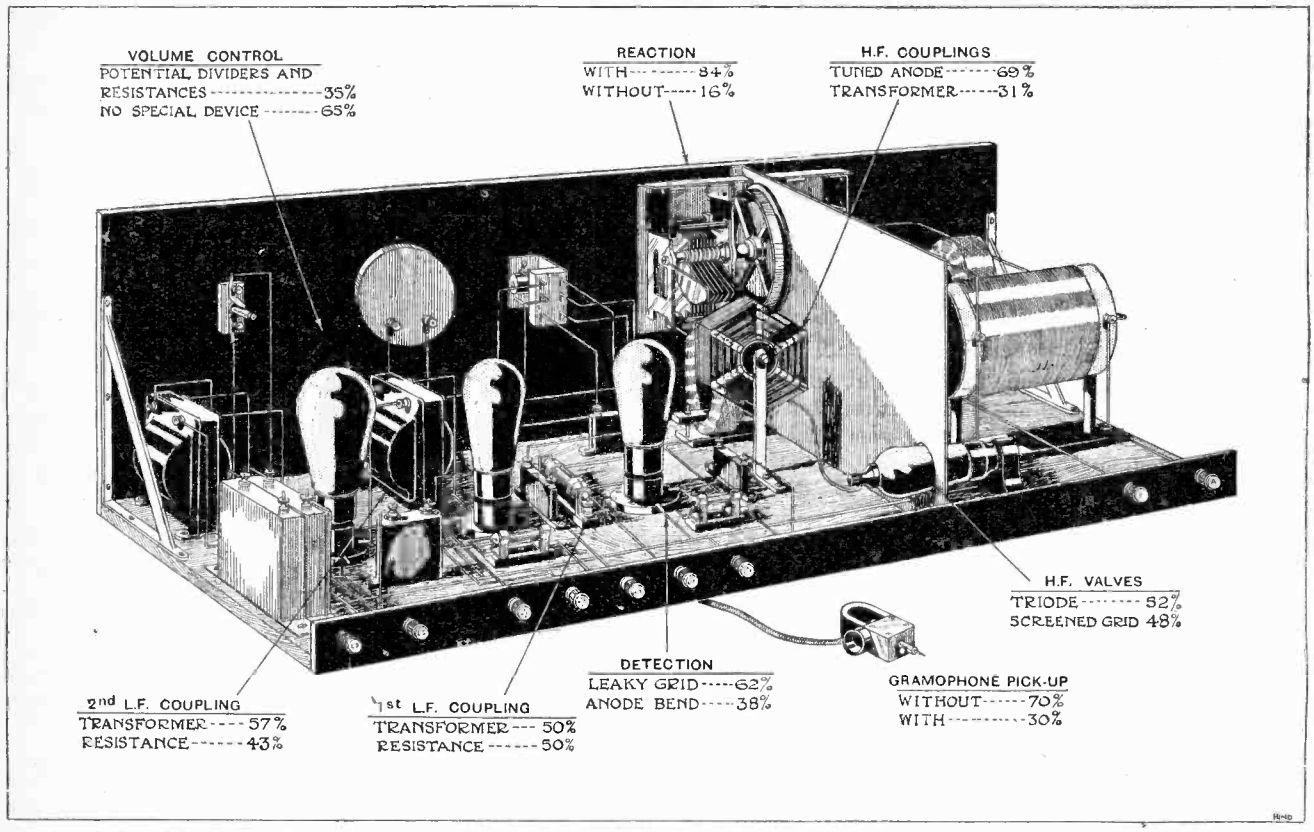
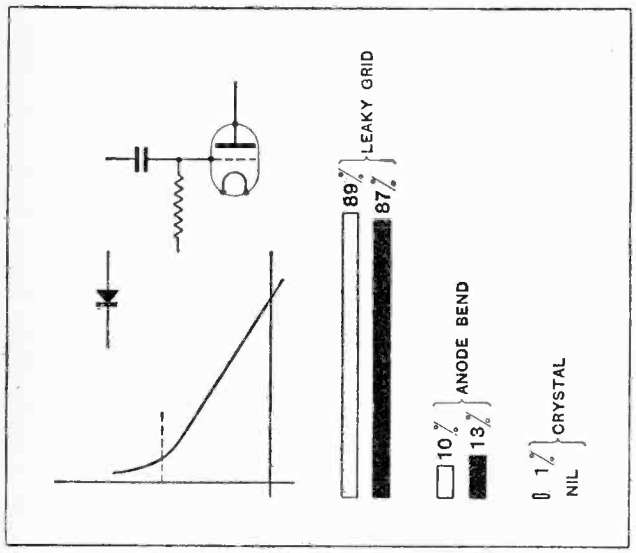


FOUR-VALVE SETS. Favours are almost equally distributed between three-electrode and screened grid H.F. amplifying valves.

of four- and multi-valve sets. Headphone reception seems to be even less popular, as will be seen from the diminished number of one-valve sets. The comparatively high proportion of five-valve sets is traceable to the wide appeal of this circuit arrangement in the " portable " class; it has not been adopted to any great extent in fixed receivers with outside aerials.



DETECTION. The leaky grid rectifier maintains its predominance.

It is on the H.F. side of the receiver that the greatest changes—and the greatest improvements—are seen, as will be evident from the fact that more than half of the amplifying stages included in this year's models make use of screened grid valves or neutralised triodes. The majority of the un-neutralised three-electroded valves are used in conjunction with " aperiodic " couplings in portable receivers.

Anode Rectification Unpopular.

With regard to detection, the apparently negligible gain of the anode-bend system is attributable to the pentode valve; a closer analysis reveals the fact that this method has made some progress in receivers where the new output valve is *not* used. One doubts, however, if it will ever seriously rival the leaky grid condenser method, which requires no periodical adjustment of bias in sets intended for those who demand apparatus calling for the minimum of attention.

The expressed opinion that crystal detection would have a new lease of life in receivers drawing all their energy from the mains seems to have been without foundation, as this form of rectifier, in conjunction with amplifying valves, has not met with favour.

Although less reliance is now placed on reaction as an aid to sensitivity, it will be seen that there is no appreciable tendency to abandon it altogether, in spite of widespread improvements in pure H.F. amplification. The popularity of the capacity control method has increased.

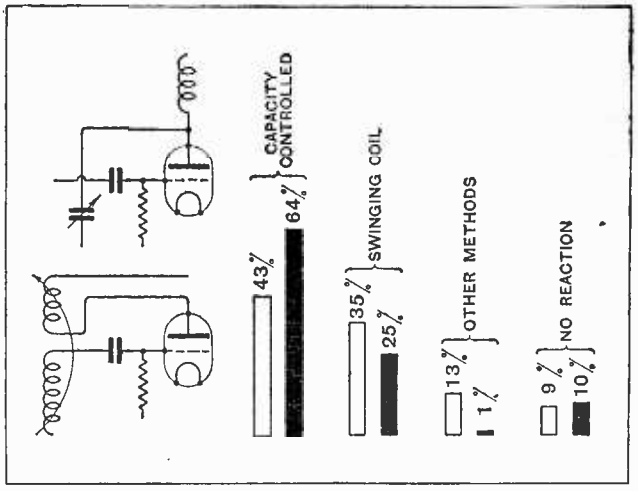
Sets of the Season.—

L.F. transformers retain their lead, helped by the fact that they are particularly suitable for coupling the detector to a pentode output valve. There is a distinct tendency towards the use of "mixed" amplifiers, with a resistance in the first stage, followed by a transformer.

Due largely to an increase in the number of sets which derive at least a part of their energy from the electric light mains, there are more output filters and transformers; it is rather surprising, in view of the publication of the I.E.E. recommendations, that there are still so many directly coupled loud speakers.

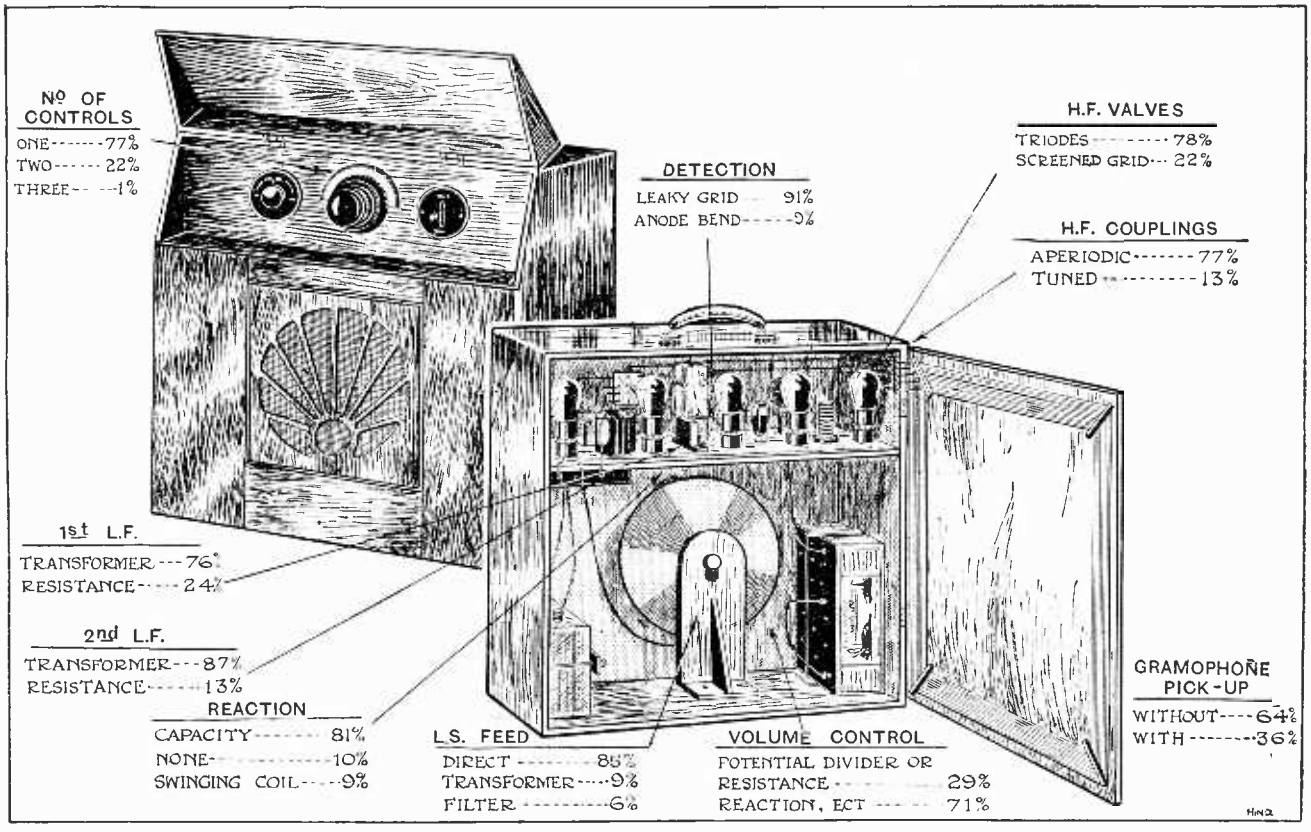
Typical Three-valve Receivers.

Dealing with three-valve sets in particular, we find that detector-L.F. combinations are in the majority, although H.F. amplification is gaining ground, in spite of the fact that its use is almost invariably followed by the addition of a second tuning control. In the "1-V.1" class of set we find that transformer L.F. coupling is almost universal. On the H.F. side it will be observed with interest that the percentage of transformer couplings is much higher than might be anticipated, in view of the increased cost and complexity of this device as compared with the tuned anode method. As for the system of detection used in this class of set, the predominance of the leaky grid method may be attributed to some small extent to the wide use of pentode output valves.



REACTION. Capacity control increases in popularity; the majority of receivers include reaction, in some form.

Turning to the representative four-valve receiver, it is found that the popular H.F.-det.-2 L.F. combination has swept the board; in the H.F. position screened grid and three-electrode valves are fairly evenly balanced, with a slight bias in favour of the latter. In this class there is an increased use of the anode-bend detector. In computing the percentages of H.F. couplings, several sets of American origin which are on the British market

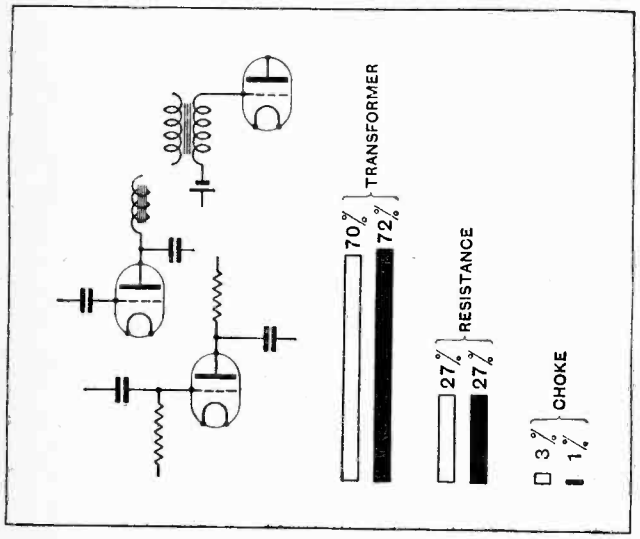


SELF-CONTAINED AND PORTABLE RECEIVERS. H.F. amplifiers with 2 aperiodic stages are still popular, in spite of competition from the screened grid valve.

Sets of the Season.—

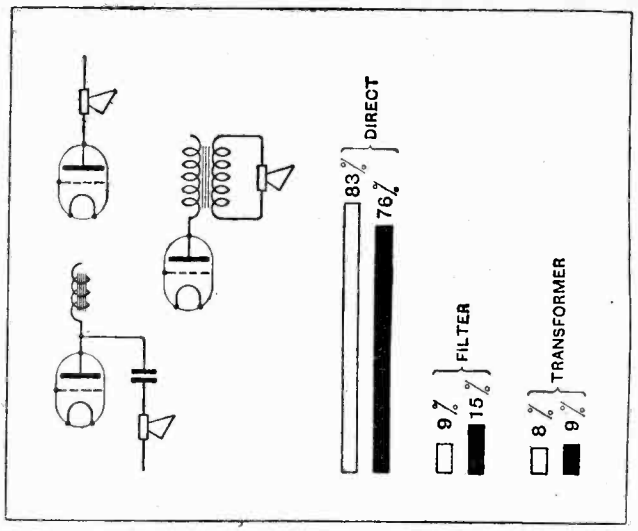
have been taken into account; their inclusion tends perceptibly to increase the proportion of tuned transformer couplings.

With but few exceptions, last year's portable and transportable sets included heavily damped tuned H.F. couplings, or, more often, aperiodic amplification. The former have almost disappeared, but it seems probable that "one knob" tuning, made possible by the adoption of the "untuned" system, is sufficiently



L.F. COUPLING. The relationship between the two principal methods remains practically unchanged.

popular to account for its retention in a large number of receivers. Of course, there are two or three sets with tuned H.F. amplification and a single "ganged" control, but their number is insufficient appreciably to influence the totals. In spite of a perhaps exaggerated and illogical public antipathy to more than one control, manufacturers have not been behindhand in taking ad-



LOUD SPEAKER FEED. Mains operation is responsible for a slightly increased tendency to use coupling devices.

vantage of the high amplification made possible by the use of screened valves with tuned circuits, and have in many cases introduced devices—such as direct calibration—to overcome the possible drawbacks of two adjustments.

There has been a very marked increase in the number of sets in this classification with provision for gramophone reproduction, but no corresponding addition of volume-control devices as compared with last year. The intensity delivered by a loop aerial set when receiving radio signals can almost always be adjusted by swinging the frame towards the position of minimum response, so special controls are hardly essential; this does not hold good when a pick-up is in use. It will often be found, however, that in cases where a control is not provided in the set an external resistance is connected across the pick-up.

BOOKS AND CATALOGUES RECEIVED.

Television, by Alfred Dinsdale, with a foreword by Dr. J. A. Fleming, M.A., D.Sc., F.R.S. Pp. 180 with 38 diagrams and 33 half-tone plates. Published by Television Press, Ltd., London. Price 5s. net.

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Kurzwellen-Verkehr, by Hans W. Priwin. A handbook for amateur transmitters, including the Morse code, use of abbreviations, and list of German amateur transmitters. Pp. 78. Published by Rothgiesser and Diesing A.G., Berlin. Price RM.1.30.

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Empfang auf Kurzen Wellen, by Manfred von Ardenne. A text-book on short-wave transmitters and receivers. Pp. 83, with 79 illustrations and diagrams. Published by Rothgiesser and Diesing A.G., Berlin. Price RM.3.50.

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The Motor Cycle Diary, including useful formulæ and tables, cubic capacity tables, monthly summary of running expenses, localities and gradients of the principal test hills, and winners of the Tourist Trophy races since 1907. Pp. 188. Published by Iliffe and Sons Ltd., London. Price, in leather binding with pencil, 1s. 6d. net.

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Ferranti, Ltd., Hollinwood, Lancashire. "True Radio Reproduction," an 88-page art booklet dealing with the theory of L.F. amplification and battery eliminators with special reference to Ferranti products. Also revised leaflets Nos. Wb405, Wb406/2, Wc409, Wc410, Wb411/2, Wb412, Wa416 and Wb404 for inclusion in the "Home Radio Catalogue."

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The Radielle Co., Ltd., 18a, Haverstock Hill, Chalk Farm, London, N.W.3. Illustrated catalogue with output curves of "Radielle" battery eliminators for A.C. and D.C. mains.

Electradix Radios, 218, Upper Thames Street, London, E.C.4. Complete 72-page illustrated catalogue of Electradix radio components and ex-Govt. apparatus.

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The Engineering Accessories Co., Ripple Works, Trafalgar Street, Burnley, Lancs. Two leaflets describing "Superfine" H.T. eliminators.

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The British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2. Illustrated catalogues of B.T.H. radio receivers and the new nickel filament Mazda valves, the latter illustrated with characteristic valves.

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Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. List No. 928 of Dubilier condensers and radio products.

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Metro-Vick Supplies, Ltd., Trafford Park, Manchester. Complete illustrated catalogue of Met-Vick (Cosmos) wireless equipment.

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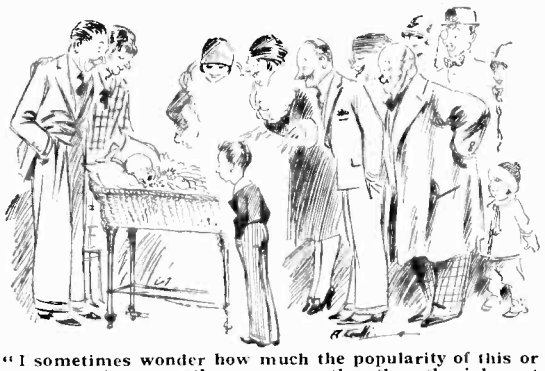
Garnett, Whiteley & Co., Lotus Works, Broadgreen Road, Liverpool. Illustrated catalogue of "Lotus" portable sets.

Directive Broadcast Reception

A Fantasia on Headphones.

I SOMETIMES wonder how much of the popularity of this or that new method or new equipment is due to the newness rather than to the inherent merits of the thing concerned; how much, in fact, we share that amiable weakness of the old Athenians for which they have been so unkindly pilloried in a prominent place. Suppose, for example, that by some strange but by no means unthinkable combination of circumstances, wire telegraphy had been discovered shortly after, instead of a long while before, wireless telegraphy. It is not difficult to imagine how enthusiastically it would have been received. "Here we have a great advance in the technique of communication which is obviously destined to displace wireless telegraphy in all except certain special circumstances where the peculiar advantages of the wireless system outweigh its numerous attendant drawbacks and disabilities. The complete freedom of the new wire telegraphy from atmospheric disturbances, the engaging simplicity and cheapness of the apparatus employed, its ease of control and manipulation, and its unfailing reliability, all combine to mark the new system as the darling of the future . . . etc., etc."



"I sometimes wonder how much the popularity of this or that . . . is due to the newness rather than the inherent merits of the thing concerned."

At the present moment the attention of the listening public is focused on the loud speaker, and the efforts of a considerable number of those designers and manufacturers who cater for that public is concentrated on the perfecting and further perfecting of such equipment. (The phrase "further perfecting" is quite legitimate in this connection, for it is well understood by the manufacturers of wireless apparatus that their progress is from perfection to perfection, as distinct from all other kinds of evolution.)

Already a kind of loud speaker aristocracy has been established, so that the owner of the latest "Thumplion Tiger" feels entitled to patronise even those of his acquaintances who affect a "Klaxton" coil drive, and neither of these privileged classes will care to be seen with persons who are known to harbour in their homes one of those vulgar things with a magnet drive and a horn. As for the man who still clandestinely listens with headphones—he is the "untouchable" of the wireless community.

Jealously Guarded Secret.

But now imagine for a moment that head phones had come at the head of this procession instead of at its tail. Suppose that at the recent Wireless Exhibition at Olympia this neat and ingenious listening device had been for the first time introduced to a public already sated with the blare of trumpets and the rattling of cones. I will presume on the tolerance of the Editor of this journal to the extent of writing for him the notice that would have appeared in the special Exhibition number.

"Stand No. 17, Phonette Manufacturing Co.

"The jealously guarded secret of the Phonette Manufacturing Company has been revealed at last, and this firm is to be sincerely congratulated on having produced the sensation of the year at Olympia. Also on having, performed a real social service, for it is not too much to say that their new listening device, to which they have given the name 'Headphones,' removes most of the annoying features that have hitherto been inseparable from broadcast reception.

"The apparatus has a simplicity of conception that leaves one wondering that it has not been thought of before. A 'headphone' consists, in fact, of two miniature and neatly constructed loud speakers of the magnet drive type secured to a band which is worn across the head and so locates the two separate small

Directive Broadcast Reception.—

loud speakers immediately over the ears of the listener.

"The first and most obvious result of this arrangement is that the reception is entirely confined to the wearer of the apparatus. Think of the inestimable advantage of this from the family and social point of view. Hitherto the intellectual and æsthetic susceptibilities of the family have been at the mercy of the strongest-minded or least considerate member of it.

"A real social service."

Alternatively, persons have constantly found themselves compelled to choose, in the absence of sufficient sound-proof accommodation, between foregoing the desire to hear some particular item in which they are specially interested, on the one hand, and constraining their reluctant associates to have their attention monopolised by a noise which affords them no satisfaction, on the other. We have personal knowledge of at least one family, the members of which are of widely divergent tastes and interests, having little more than a highly developed social conscience in common. Their elaborate and expensive wireless set is, in consequence, scarcely ever in operation.

Solution of Loud Speaker Problem?

"We may be thought to exaggerate in describing the matter as one of great social significance, but we assure our readers that we do not exaggerate. Who can say how many of the growing number of divorce cases which pass through our courts are due to what has hitherto been the impossibility of finding an equitable and mutually satisfactory solution of the loud speaker problem? The phrase "incompatibility of wireless temperament" has, in fact, become disastrously familiar.

"In future each individual listener will be able, so to speak, to consume his own smoke, without making himself a nuisance to his neighbour. No longer need the peace and quietness of our summer gardens be spoiled by the spill-over from Mr. Dogbody's loud speaker next door, nor need our highways any more be punctuated by obtrusive little bursts of wireless noise. This feature of broadcast reception has long been a standing reproach, all the more noticeable in these days when, as a result of, or, some may think, in spite of, the agitation instituted by the *Daily Wail*, unnecessary noise has been so largely eliminated from our daily life.

"On the æsthetic and technical side the innovation has advantages no less striking. We were given a demonstration of headphone reception, and as far as our ears could judge (and the ear, after all, is the final court of appeal in this matter) the new system has nothing to fear in a comparison with our best loud speakers in respect of acoustic fidelity. There was, indeed, a convincing air of reality about the reproduction. We were astonished to learn that this result can be accomplished without power valves or any of the recently developed poly-odes, and with a modest high-tension of no more than fifty volts. This, of course, is due to the relatively enormous efficiency of the new system. It is no longer necessary to agitate all the surrounding atmosphere, an extravagant process which has, moreover, attendant disadvantages in the matter of distortion arising from local resonances and standing waves. All that is required is the driving of a small, light, and virtually aperiodic connecting rod, joining the diaphragm of the ear-piece to the ear-drum of the listener. Thus an economy of means is effected which can only be compared with the epoch-making advance in wireless telegraphy constituted by the introduction of the beam system.

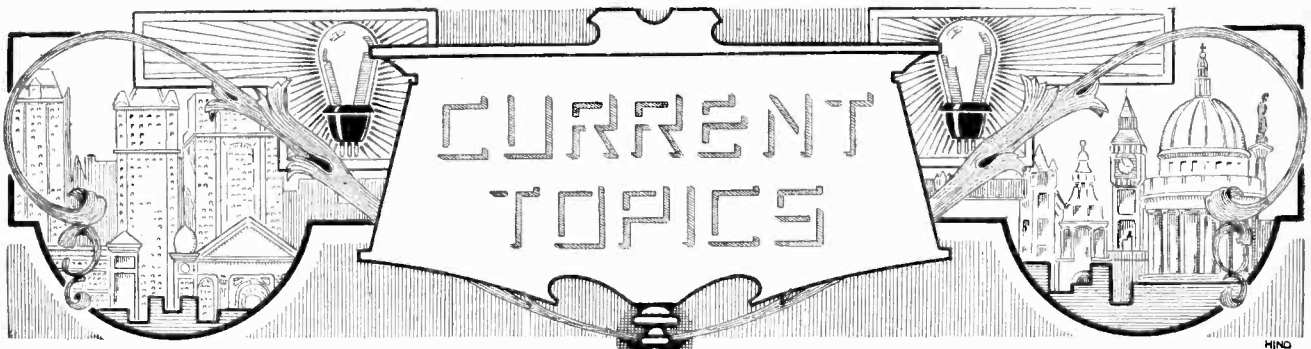
Definite Advantages.

"In addition to this local concentration of the sound energy, the headphone listener has the further advantage of effective acoustic shielding from local disturbances, a feature which is not without its due significance in the domestic scheme. (Think what a blessing it would have been to the unfortunate man in the old story, who married a dumb wife and then rashly caused her to be cured.) To those who would criticise this deliberate isolation as unsociable it can be replied that

"Incompatibility of wireless temperament."

by the simple expedient of slightly displacing one ear-piece it is possible to maintain sufficient contact with the external world for ordinary social purposes.

"It is always rash to prophesy, but we feel that we run little risk in affirming that the new headphone reception is destined to displace loud speakers in all except certain special circumstances, dances, public addresses, and so on, where those very characteristics which are in the ordinary way a menace to social and domestic sanity, become temporarily advantageous." F. M. C.



Events of the Week in Brief Review.

DEUTSCHES RUNDFUNK.

German broadcasting is celebrating its fifth birthday. There are now 2,334,253 licensed listeners.

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BELGIAN WIRELESS SHOW.

A wireless section is to be included in the twenty-second annual Belgian Motor Show in Brussels, to be held from December 8th to 19th next.

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UP-TO-DATE JAPAN.

Western innovations marked the enthronement of the Japanese Emperor at Kyoto last week. Descriptions of the ceremony were broadcast through Tokyo and Osaka, and pictures were transmitted for inclusion in the newspapers.

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AUSTRIA 'PHONES AMERICA.

The first wireless telephone service between Austria and America was inaugurated on November 3rd by an exchange of messages between Dr. Seipel, the Austrian Chancellor, and Mr. Kellogg, the U.S. Secretary of State.

The service makes use of the Trans-Atlantic telephone link between Rugby and New York.

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AN EMPIRE TELEPHONE SERVICE ?

A plan to bring the whole of the Empire into wireless telephonic communication with Great Britain is now being considered by the General Post Office. The Governments of the Australian Commonwealth, South Africa, and India have been communicated with and are understood to be giving the question sympathetic consideration.

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BRANDES BROADCASTING FROM HOLLAND.

The Sunday evening broadcasts from Hilversum on 1,071 metres, by arrangement with Messrs. Brandes, Ltd., the well-known wireless manufacturers, have been greeted with great enthusiasm by numbers of British listeners who welcome an orchestral concert which bridges the gap in the Sunday transmissions of the B.B.C. The concerts are given fortnightly between 5.40 and 7.10 p.m., the next being arranged for November 18th.

WANTED: ALL-NIGHT PROGRAMMES!

A South London resident puts in a plea for an all-night broadcasting service from 2LO. He is a night watchman and owns a portable set.

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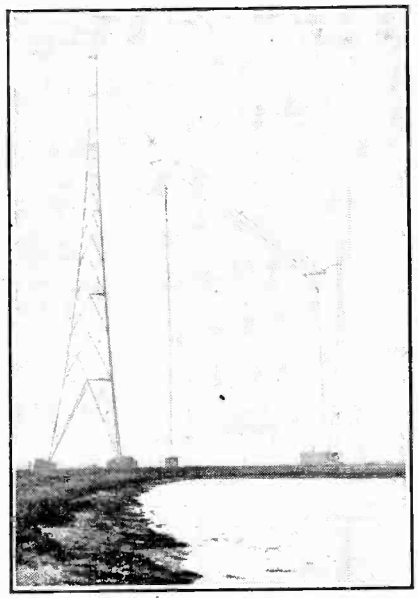
ELIMINATING "BACK ANSWERS."

An Edgbaston architect has installed microphones in his house so that orders can be given to the cook through a loud speaker in the kitchen.



A STATION WITHOUT A WAVE-LENGTH. Unkind things have been said about Kalundborg, the masts of which are seen above. Designed to work on 1,153 metres, a wavelength banned by the Washington Conference, Kalundborg has at present no official wavelength. It works on 1,680 metres and recently heterodyned 5XX.

MOUNTAIN WIRELESS TESTS.

Experiments in wireless transmission and reception at various heights on the Kazbek Peak in the Caucasus Mountains are being carried out by the Geographical Society of Georgia. Comparative measurements are to be made of signal strength at the foot of the Peak, at heights of 2,400 and 3,600 metres, and possibly at the summit, which is 16,541 feet high.

WIRELESS-CABLE MERGER BILL.

One of the most important debates during the present Parliamentary session will centre round the Wireless-Cable Merger Bill. It is expected that the Bill will be hotly contested.

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QUELLING DISORDER BY LOUD SPEAKER.

Loud speakers have been installed in the Belgian Parliament at Brussels. The microphone is under the control of the President of the Assembly, who, it is understood, will make full use of the apparatus in "shouting down" noisy members!

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PHOTO-TELEGRAPHY SOCIETY.

In view of the growing interest aroused by wireless picture transmission, it is felt that there is a need for a society devoting its activities exclusively to this subject. Such a society is now in process of formation, with headquarters in London, and arrangements are being made for a number of interesting lectures and demonstrations. Readers desirous of fuller information are invited to communicate with the hon. secretary (*pro. tem.*) at "Nanterre," Penton Hook, Laleham, near Staines, Middlesex.

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NO MARKINGS ON WIRELESS PANELS.

That ebonite panels for wireless purposes, if marked with the name of the country of origin, would suffer disfigurement and consequent reduction of value, was one of the main arguments advanced by dealers and importers at a Board of Trade Enquiry on Monday of last week, when, under the Merchandise Marks Act, the India Rubber Manufacturers' Association asked for both an import and sale Order that imported rubber goods should be clearly marked with the country of origin.

The applicants submitted that panels for wireless should be pressed (rolled or stamped) on both sides, and that the envelope or container should also be marked. It was contended that purchasers preferred goods of British manufacture, but that the absence of distinguishing marks made identification difficult.

The importers submitted that the Merchandise Marks Act had been passed

with the intention of protecting the purchaser in the United Kingdom to the extent of giving him the opportunity to distinguish between British and imported goods where a real possibility of confusion might be shown to exist. The applicants' case was an attempt to use the machinery of the Act to prejudice the respondents in their trade by asking for a Marking Order which in very many cases would have the effect of prohibiting the import of foreign made rubber goods in this country.

At Tuesday's hearing it was announced that the parties had come to an agreement regarding certain points, and that it was agreed that panels for wireless should not be marked.

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WIRELESS FOR THE SICK.

Serious epidemics may be expected among school children at Histon (Cambs), a wireless set having been installed "for the entertainment of scholars who may be sick."

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THE CAR OF THE FUTURE.

The day when no motor car is considered complete without a built-in wireless set is brought nearer by the enterprise of the Stutz Motor Co. of America, which has just produced a car incorporating a broadcast receiver in the instrument board. It is stated that the set is completely hidden except for the tuning dials and controls. Special shields are provided to eliminate dynamo and ignition noise. The aerial is concealed in the roof, and a miniature loud speaker occupies an inconspicuous place above the front screen.

COLOURS BY WIRELESS.

Prof. Arthur C. Hardy, of the Massachusetts Technological Institute, has demonstrated a "recording spectrophotometer" to the Optical Society of America. When applied to coloured material, this device supplies a colour analysis curve suitable for picture transmission, and the professor hopes that it will prove useful to dye experts when it is desired to match colours at a distance. The analysis curve gives adequate data for the reconstruction of the colour to the exact shade of the original specimen.

FORTHCOMING EVENTS.

WEDNESDAY, NOVEMBER 14th.

Edinburgh and District Radio Society.—At 8 p.m. At 117, George Street. "Loud Speakers."

Wigan and District Technical College Radio Society.—Lecture on Musical Appreciation, by Mr. Moses Baritz.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown N.10. "Members' General Interest Evening."

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.19. Demonstration by Messrs. The Celestion Radio Co.

Institute of Wireless Technology.—At 7 p.m. At the Engineers' Club, Coventry Street, W. Lecture: "A Radio Fog Signal Alarm for Ship Stations," by Mr. B. H. J. Kynaston.

THURSDAY, NOVEMBER 15th.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Grove House, High Road Leyton. Demonstration of "P.M. Nelson" Receiver.

Stretford and District Radio Society.—Annual general meeting.

FRIDAY, NOVEMBER 16th.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Auction of Members' surplus apparatus.

MONDAY, NOVEMBER 19th.

Newcastle-upon-Tyne Radio Society.—At 7.30 p.m. At 11, Saville Row. Lecture: "Quality in Radio Reception," by Mr. C. C. V. Hodgson.

Croydon Wireless and Physical Society.—At 8 p.m. At 5, Altyre Road, East Croydon. An account of Volume Control Experiments, by Mr. Arthur J. Webb, M.A., B.Sc.

N.S.F. CONDENSERS.

In connection with the review of these condensers on page 563 of the October 24th issue, it should be noted that the prices of the 0.0005 and 0.0003 capacities are 6s. 6d. and 6s. 3d. respectively, and not 7s. and 6s. 9d. as stated.

BURGLARS AND BROADCASTNG.

Although the brotherhood of burglars is experiencing qualms over the projected extension of police wireless facilities, it appears that what Bill Sikes may lose on the roundabouts can be recovered on the swings. An insurance assessor states that burglars have found wireless a useful ally on several occasions, particularly when their victims use headphones. In cutting out extraneous noises headphones help to cover up the little tactical mistakes which are made by even the most experienced burglars, and more than one robbery has recently occurred while householders have been enjoying the broadcast programme.

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S.R.S. SW COIL ADAPTION.

With reference to the illustration of an S.R.S. short-wave coil adaption, illustrated on page 475 of our issue of October 3rd, this component is marketed by the Stonehouse Radio Supplies, 54, Union Street, Plymouth, Devon, and not by Messrs. Redfern's Rubber Works, Ltd., as stated.

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TRANSMITTERS' NOTES AND QUERIES.

South African Transmitters.

According to a correspondent in Bloemfontein, amateurs in South Africa are not at present fettered with many restrictions. They work on whatever wavelength they choose, and are not very strictly tied down to the power employed. This happy state may, however, be changed if the South African authorities decide to be bound by the new International Regulations. Our correspondent's only complaint is on the subject of atmospherics; he writes, "Let no one at home ever grumble again about static: I have been out here three months in the South African winter with B.C.L. and short-wave receivers, and one is truly in luck's way if one hears *any* station above 20 metres free from a very virulent form of static." He also states that the shield-grid valve is used by some as a stage of R.F. for short-wave reception as, below 25 metres, the static does not appear to be amplified in the same ratio as the signal.

After November 15th, FO A7L (P. Kraus, Johannesburg) will be working on the 20-21-metre band on Sundays and Tuesdays from 2100 G.M.T., and hopes to get into touch with British stations. FO A3Y (A. S. Innes, Johannesburg) will also be transmitting at about the same time.

Japanese Broadcasting Stations.

A correspondent in Yokohama sends us some interesting information about the present and projected broadcasting stations in Japan. Those at present in operation are :—

JOAK	Tokio (Shingo), 870 kC (345 metres), 10 kW. to aerial.
JOBK	Osaka (Senri), 760 kC. (400 metres), 10 kW. to aerial.
JOCK	Nagoya, 810 kC. (370 metres) 1 kW. to aerial.
JODK	Keijo, 820 kC. (366 metres), 1 kW. to aerial.
JOFK	Hiroshima (Hara), 850 kC. (353 metres), 10 kW. to aerial.
JOGK	Kumamoto (Shimidzu), 790 kC. (380 metres), 10 kW. to aerial.
JOHK	Sendai (Haramachi), 770 kC. (390 metres), 10 kW. to aerial.
JOIK	Sapporo (Tsukisappu), 830 kC. (361 metres), 10 kW. to aerial.

(The names in brackets indicate the location of the respective transmitters.)

During 1929 it is proposed to erect another 10 kW. transmitter at Nagoya, and one of 3 kW. aerial energy at Kanazawa.

The Japan Broadcasting Association was formed by the amalgamation of three existing companies in the summer of 1926, and the directive board is appointed by the Japan Government Communications Department. It is hoped in the course of time to have a regular network of simultaneous broadcasting throughout the country.

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Joint Ownership.

Mr. H. V. Wilkins asks us to state that the amateur station, 6WN, illustrated on page 572 of our issue of October 24th, is owned jointly by H. and L. Wilkins.

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New Call-signs and Stations Identified.

6TZ	R. Bottomley, Glynwood, Brighouse, Yorks, (In place of old call-sign 6BY). Trans. mits on 5.3, 10.6, 21.2, and 42.4 metres-crystal controlled.
2ANW	G. Scott Sessions, 20, Grasmere Road, N.10.
5BC	J. Blake, 91, White Hart Lane, Barnes, S.W.13.
2AOU	C. C. Partridge, Government House Gardens, R.M. College, Camberley, Surrey.
5HH	(ex 6BJ), F. Halden, 5, Frinton Road, Stamford Hill, N.15.
6PA	H. C. Page, New Gardens Farm, Tevnham, nr. Sittingbourne, Kent. (Change of address).
6UQ	H. J. Eaves, 31, Oak Road Cheadle, Cheshire.
6WZ	(ex 2BQK), J. McK. Wilkie, 102, Stanley Street, Aberdeen.
2AFB	S. West, 33, Regent St., Great Yarmouth, wishes to co-operate with experimenters on 10 metres waveband.
2AUX	J. Douglas, 47, Coquet St., Jarrow.

BUYERS' GUIDE, 1928-29.

The "Wireless World" Reference List of Receiving Sets.

CABINET-TYPE RECEIVERS.

ABBREVIATIONS USED IN THE TABLES.—High-frequency Stages: **Ap** = Aperiodic Interstage Coupling. **TT** = Tuned H.F. Transformer. **TA** = Tuned Anode. **Detection:** **LG** = Grid Condenser and Leak. **AB** = Anode Bend. **Low-frequency Stages:** **TC** = Transformer Coupled. **RC** = Resistance-capacity Coupled. **Ch** = Choke-capacity Coupled. **Reaction:** **CC** = Condenser-controlled, generally in conjunction with a fixed coil and H.F. choke. **SC** = Swinging or Rotary Coil.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Reaction.	Price (including Royalties). £ s. d.	Remarks.
Automobile Accessories (Bristol), Ltd., Sion Road, Bedminster, Bristol.	P.D. Melody Two	American type. Cabinet, Oak	—	—	—	LG	TC	—	—	One	SC	3 17 6	Pentode valve optional.
" " "	P.D. Melodia Two	" " " Mahogany	—	—	—	LG	TC	—	—	One	SC	4 12 6	" " "
	P.D. Melody Three	" " " Oak	—	—	—	LG	TC	TC	—	One	SC	5 0 0	——
	P.D. Melodia Three	" " " Mahogany	—	—	—	LG	TC	TC	—	One	SC	5 15 0	——
Automatic Radio Manufacturing Co., Gosford Road, Beccles, Suffolk.	Universal Automatic	——	—	—	—	LG	TC	TC	—	None	—	26 10 0	With valves and grid batteries, provision for gramophone pick-up.
B.S.A. Radio, Ltd., Small Heath, Birmingham.	B.S.A. 0-V-1	——	—	—	—	LG	TC	—	—	One	SC	9 3 0	——
" " "	" 0-V-2	——	—	—	—	LG	TC	TC	—	One	SC	17 1 0	——
" " "	" 0-V-3	——	—	—	—	LG	TC	TC	TC	One	SC	32 6 0	Push-pull.
" " "	" 1-V-2	——	—	—	TA	LG	TC	TC	—	Two	SC	29 14 0	——
" " "	" 7-Valve	——	*	*	*	*	TC	TC	—	Four	—	69 13 0	**Seven-valve superhet.*
" " "	" 8-Valve	——	*	*	*	*	TC	TC	—	Two	—	60 18 0	**Eight-valve superhet.* Push-pull.
Baty, E. J., 157, Dunstable Road, Luton.	Baty One	Skeleton	—	—	—	LG	—	—	—	One	SC	2 15 0	Receiver only.
	Baty Four	Cabinet with cupboard	—	—	TA	LG	TC	Ch	—	Two	SC	36 0 0	Complete with mains eliminator and distant control.
Bowyer-Lowe Co., Ltd., Letchworth, Herts.	Pentavox 2	Oak cabinet	—	—	—	LG	TC	—	—	One	CC	6 8 9	With valves (Pentode last stage)
	Pentavox 3	"	—	—	TA	LG	TC	—	—	Two	CC	11 0 0	With valves (screened grid H.F., pentode L.F.).
Brandes, Ltd., Cray Works, Sidcup, Kent.	Brandset IIIA	Oak cabinet table model	—	—	—	LG	TC	TC	—	One	SC	7 5 0	With valves, mahogany cabinet, £1 extra.
	Brandset IIIB	" " "	—	—	—	LG	TC	TC	—	One	SC	8 17 6	With valves, mahogany cabinet, £1 7s. 6d. extra.
The British Radio Corporation, Ltd., Elm Grove Road, Weybridge, Surrey.	B.R.C. A.C. Mains Three	Cabinet	—	—	—	LG	RC	TC	—	One	CC	37 12 6	With valves and mains equipment.
" " "	" A.C. Mains Five	"	—	TA	TA	LG	RC	TC	—	One	—	50 12 6	" " "
" " "	" Long Range Five	"	—	TA	TA	LG	RC	TC	—	Three	—	39 5 0	" " " (Screened-grid H.F. valves).
" " "	" " Six	"	—	TA	TA	AB	RC	RC	RC	Two	—	45 0 0	" " " " " "
" " "	" Exchange	"	—	TA	TA	AB	RC	RC	RC	*	—	64 0 0	" " " " " "
													**4 switches for 8 stations.*
British Thomson Houston Co., Ltd., Alma Street, Coventry.	B.T.H. 2-Stage	Moulded base, cover and panel	—	—	—	AB	RC	—	—	One	CC	5 0 0	With " Mazda " combined 2-stage valve.
	B.T.H. 3-stage	Mahogany cabinet	—	—	—	AB	RC	TC	—	One	CC	9 10 0	With " Mazda " combined 2-stage valve, and L.F. valve.
	B.T.H. 2-Valve	"	—	—	—	LG	TC	—	—	One	CC	4 2 6	Receiver only.
	B.T.H. 5-stage	" cabinet	—	TA	TA	AB	RC	TC	—	Three	—	27 15 0	With " Mazda " combined 2-stage valve, 2-screened grid H.F. valves.
The Brownie Wireless Company of Great Britain, Ltd., Nelson Works, Mornington Crescent, London, N.W.1.	Brownie 2-V	Cabinet	—	—	—	LG	TC	—	—	One	SC	2 17 6	Including 2 coils.
	Dominion Three	"	—	—	—	LG	RC	TC	—	One	CC	5 17 6	*Excluding Royalties.*
Burndept Wireless (1928), Ltd., Eastnor House, Blackheath, S.E.3	Screened Ethophone	Metal case	—	—	TA	LG	TC	—	—	Two	CC	12 7 0	With valves. Screened grid H.F., pentode L.F.
	Screened Four	Mahogany Cabinet	—	—	TA	LG	RC	TC	—	Two	CC	29 16 0	With valves. Screened grid H.F. Extra for double-door cabinet; £2 7s. 6d.
" " "	Empire Screened Four	"	—	—	TA	LG	RC	TC	—	Two	CC	29 16 0	With valves. Screened grid H.F.
" " "	Ethodyne 7-Valve Superheterodyne.	"	—	*	*	*	LG	RC	TC	—	Two	CC	52 5 6	**Superhet* with two frame aerials. Extra for double-door cabinet, £5 7s. 6d.
Burne Jones & Co., Ltd., Magnum House, 296, Borough High Street, London, S.E.1.	Short-wave Mark IV.	Screened mahogany cabinet	—	—	—	LG	RC	TC	—	One	CC	31 13 6	With valves. Wave range 12–100 metres.
	Magnum 1929 Screened Five.	Table model	—	TT	TT	LG	RC	TC	—	One	CC	22 12 0	With valves.
Cholerton, F., 52, Bridge Street, St. Helens, Lancs.	Magnum Universal 3	"	—	—	TA	LG	TC	—	—	Two	CC	18 0 0	With valves. Screened grid H.F., pentode L.F.
	Rubyphone Super 3	——	—	—	TA	LG	TC	—	—	Two	CC	10 10 0	With valves only. Screened-grid H.F., pentode L.F.
Cook & Co., J. H., 51, Monks Road, Lincoln.	Chellatone	Cabinet	—	—	—	LG	TC	RC	—	One	SC	7 15 0	With valves, batteries and loud speaker.
		"	—	—	—	LG	TC	TC	—	One	SC	7 15 0	" " " "
Cooks Wireless Co., Ltd., St. Helens Street, Ipswich.	C.W.C. Popular	Cabinet or table models	—	—	—	LG	TC	(RC)	(RC)	One	SC	5 5 0	With valves and batteries, 2, 3 and 4 valve sets as required.
" " "	" Standard	" " "	—	—	—	LG	TC	(RC)	—	One	SC	to	
" " "	" De Luxe	" " "	—	—	—	LG	TC	RC	(RC)	One	SC	12 0 0	
	" S.G. Three	Table model	—	—	TA	LG	TC	—	—	Two	CC	17 17 0	With valves and batteries.
Dew & Co., A. J., 33-34, Rathbone Place, Oxford Street, London, W.1.	Dewola Three	Vignette front cabinet	—	—	—	LG	TC	TC	—	One	SC	14 1 6	With valves and batteries.
	Dewola Fidelity Four	Closed type cabinet	—	—	TA	AB	RC	RC	—	Two	SC	15 8 0	Receiver only.
												32 8 0	With valves, batteries, and loud speaker.
												43 18 0	With valves, batteries and moving coil loud speaker.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Reaction.	Price (including Royalties). £ s. d.	Remarks.
Eagle Engineering Co., Ltd., Eagle Works, Warwick.	Chakophone Screened Three.	Pedestal	—	—	TA	LG	TC	—	—	Two	SC	25 6 0	With valves and batteries. Screened grid H.F.
" " "	Economy Two	Table mode	—	—	—	LG	TC	—	—	One	SC	4 15 0	Receiver only. Pentode L.F.
" " "	Junior Series	Pedestal	—	—	—	LG	TC	—	—	One	SC	7 8 0	Receiver only. Pentode L.F.
" " "	"	Table	—	—	—	LG	TC	—	—	One	SC	4 2 6	Receiver and G.B. battery only.
Edison Bell, Ltd., Glengall Road, Peckham, S.E.15.	Majestic	Self-contained	—	—	—	LG	TC	TC	—	One	SC	6 7 6	Receiver and G.B. battery only.
	Compact Three	Oak case	—	—	TA	LG	TC	RC	—	Two	SC	15 12 6	Receiver only.
			—	—	—	LG	RC	TC	—	One	CC	9 0 0	" " extra for mahogany, 17s. 6d., or for Japanese lacquer, £3 10s.
Elleray, Ltd., R., Beacon Buildings, Kendal.	Beacon 3	Table model, American type	—	—	—	LG	TC	RC	—	One	SC	13 13 0	With valves, batteries and loud speaker. Provision for pick-up.
" " "	Beacon 4	" " "	—	—	TA	LG	TC	RC	—	Two	SC	18 0 0	" " " " "
	Beacon 2	Table model, upright	—	—	—	LG	TC	—	—	One	SC	6 0 0	With valves, batteries and headphone.
Ericsson-Telephones, Ltd., 67-73, Kingsway, London, W.C.2.	Family Two	Oak case, folding doors	—	—	—	LG	TC	—	—	One	SC	9 14 0	With valves, batteries and loud speaker.
Fada Radio, Ltd., 31, Kingsway, London, W.C.2.	Fada 8 (480-B.)	—	2TT	TT	TT	LG	TC	TC	TC	Two	None	73 2 6	With valves, wave range 200–600 metres.
" " "	Fada 7 All Electric A.C. (475–C.A.).	—	2TT	TT	TT	LG	TC	TC	—	Two	None	63 0 0	As for Fada 10 A.C.
" " "	Fada 7 (472–C.A.)	—	2TT	TT	TT	LG	TC	TC	—	Two	None	63 0 0	As for Fada 10 Z.A.C.
" " "	Special All Electric A.C. (265–C.A.).	—	TT	TT	TT	LG	TC	TC	—	Two	None	41 5 0	As for Fada 10 A.C.
" " "	Fada Special (262–C.A.).	—	TT	TT	TT	LG	TC	TC	—	Two	None	41 5 0	As for Fada 10 Z.A.C.
Falk Stadelmann & Co., Ltd., 83–93, Farringdon Road, London, E.C.1.	Cromwell Two	Cabinet	—	—	—	LG	TC	—	—	One	SC	8 18 0	With valves, batteries, headphones and aerial gear.
" " "	Wolfe Three	"	—	—	—	LG	RC	RC	—	One	SC	10 1 0	" " " " " "
	Wellington Three	"	—	—	—	LG	RC	TC	—	One	SC	14 13 6	" " " " " "
" " "	Waterloo Screened 5	"	—	—	TA	LG	TC	—	—	Two	CC	17 0 0	With valves and batteries. Screened-grid H.F., pentode L.F.
	Trafalgar Screened 4	"	—	—	TA	LG	TC	RC	—	Two	CC	25 10 0	" " " " " "
Fallowfield, Jonathan, Ltd., 61 and 62, Newman Street, London, W.1.	Corner Cabinet Three	Cabinet	—	—	—	LG	TC	TC	—	One	SC	31 0 0	With valves and batteries. Provision for eliminator.
Freed Eisemann Radio of Gt. Britain, Ltd., 91, Regent Street, London, W.1.	Neutrodyne NR9	Cabinet	TT	TT	TT	LG	TC	TC	—	Three	—	25 0 0	Receiver only
Galloway, J. & L., Ltd., 38, Mair St. Plantation, Glasgow.	Lyricon 3	Cabinet	—	—	TA	LG	TC	—	—	Two	CC	20 0 0	With valves and batteries. Loud speaker, £2 18s. extra, A.C. battery eliminator in cabinet, £12 extra. Screened grid H.F., pentode L.F.
" " "	" 7 V. HC. (for A.C. Mains).	Console cabinet	—	—	TA	LG	TC	TC	—	Two	CC	99 15 0	With valves, batteries and gramophone pick-up. Screened grid H.F. R.K. moving coil loud speaker.
Gambrell Radio, Ltd., Buckingham House, Buckingham Street, Strand, London, W.C.2.	Table-Model Two (for D.C. Mains).	Crystalline wood cabinet	—	—	—	LG	TC	—	—	One	CC	13 15 0	With valves and eliminator for D.C. mains.
	(For A.C. Mains)	"	—	—	—	LG	TC	—	—	One	CC	20 0 0	With valves and eliminator for A.C. mains.
" " "	Table-Model Three (for D.C. Mains).	Oak two-door cabinet	—	—	—	LG	TC	RC	—	One	CC	23 5 0	With valves. Change-over switch for long-waves, and eliminator for D.C. mains.
" " "	(For A.C. Mains)	" " "	—	—	—	LG	TC	RC	—	One	CC	29 12 6	With valves. Change-over switch for long waves, and eliminator for A.C. mains.
" " "	Screened-Grid Four (for D.C. Mains).	Mahogany two-door cabinet	—	—	TA	LG	TC	RC	—	One	CC	32 0 0	With valves. Change-over switch for long waves, and eliminator for D.C. mains (screened-grid H.F.).
" " "	(For A.C. Mains)	" " "	—	—	TA	LG	TC	RC	—	One	CC	38 10 0	With valves. Change over switch for long waves, and eliminator for A.C. mains (screened-grid H.F.).
" " "	Console Five (for D.C. Mains).	Pedestal cabinet	—	TA	TA	LG	TC	RC	—	One	CC	68 0 0	With valves, frame aerial and loud speaker. Two screened grid H.F. valves, and eliminator for D.C. mains.
" " "	(For A.C. Mains)	" "	—	TA	TA	LG	TC	RC	—	One	CC	—	With valves, frame aerial and loud speaker. Two screened grid H.F. valves, and eliminator for A.C. mains.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.	Gecophone 2-V.	Cabinet type	—	—	—	LG	TC	—	—	One	SC	10 7 6	With valves and batteries. Wave range 280–510 metres.
" " "	Gecophone Victor 3	" "	—	—	—	LG	RC	RC	—	One	CC	8 10 0	With valves and batteries.
" " "	Gecophone L. & D., 3-valve.	—	—	—	—	LG	TC	TC	—	*	Fixed	15 12 6	With valves and batteries. *One-control type. Switch for local and 5XX.
" " "	Gecophone, 3-v., BC 2830	—	—	—	—	LG	TC	TC	—	One	CC	19 12 6	With valves and batteries. Wave range 230–3,100 metres.
" " "	All Electric Three	Self-contained	—	—	—	LG	TC	TC	—	One	CC	34 7 6	With valves. Power from mains.
" " "	Receiver and Gramophone Reproducer.	—	—	—	TT	LG	TC	TC	—	Two	—	31 12 6	With valves and batteries.
" " "	World Wide Screened-grid Four.	—	—	TA	TA	AB	TC	—	—	Two	—	28 0 0	With valves and batteries. 2 screened-grid H.F.
" " "	" de Luxe	Cabinet model	—	TA	TA	AB	TC	—	—	Two	—	39 0 0	With valves and batteries; 2 screened-grid H.F.
" " "	Six Valve	—	—	TT	TT	LG	TC	Ch	Ch	Three	—	56 10 0	With valves and batteries.
" " "	Seven-Valve Super Heterodyne.	—	*	*	*	*	*	*	*	Two	CC	37 10 0	With valves and batteries. *7-v. Superhet.
" " "	Eight-Valve Super Heterodyne.	—	*	*	*	*	*	*	*	Two	CC	70 0 0	With valves and batteries. *8-v. Superhet.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Reaction.	Price (including Royalties). £ s. d.	Remarks.
Graves, Ltd., J. G., Westville, Durham Road, Sheffield.	Vulcan 2	Table model	—	—	—	LG	TC	—	—	One	SC	7 10 0	With valves, batteries, loud speaker, and aerial equipment.
" " "	Vulcan 3	" "	—	—	—	LG	RC	TC	—	One	CC	12 7 0	" " " " "
	Vulcan Electric 2	" "	—	—	—	LG	TC	—	—	One	CC	22 10 0	" " " " "
" " "	Vulcan Electric 3	" "	—	—	—	LG or AB	RC	RC	—	One	CC	26 0 0	With valves, batteries and loud speaker.
" " "	Megavox 3	——	—	—	TA	LG or AB	TC	—	—	Two	CC	25 0 0	" " " " " Screened grid H.F., pentode L.F. "
Hart Collins, Ltd., 38a, Bessborough Street, Westminster, S.W.1.	Empire Short-Wave	Mahogany cabinet	—	—	—	LG	RC	TC	—	One	CC	20 0 0	With valves and batteries. Wave-range 12-550.
Holrose Mfg. Co., Lonsdale Road, Kilburn, London, N.W.6.	Holrose 2-V	Pedestal Cabinet	—	—	—	LG	TC	—	—	One	SC	12 0 0	With valves and batteries.
	Holrose 3-V	" "	—	—	—	LG	TC	TC	—	One	SC	15 0 0	With valves and batteries.
The H.T.C. Electrical Co., Ltd., 2 Boundaries Road, Balham, London, S.W.12.	H.T.C. Standard 2	Cabinet	—	—	—	LG	TC	—	—	One	SC	5 5 0	Complete with valves, coils, batteries, loud speaker and aerial gear.
" " "	2 "H." Circuit	"	—	—	—	LG	TC	—	—	One	CC	5 15 0	" " " " "
	Standard 3	"	—	—	—	LG	TC	TC	—	One	SC	6 10 0	" " " " "
" " "	3 "H." Circuit	"	—	—	—	LG	TC	TC	—	One	CC	7 7 0	" " " " "
Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.	Neutrosonic 7	Domestic model	*	*	*	AB	TC	—	—	Two	—	41 5 0	*Seven-valve superhet. With valves and frame aerial. Pentode L.F., 10s. extra.
	Neutro-Regenerative Short-Wave 3-Valve.	Mahogany cabinet	—	—	TT	LG	TC	—	—	Two	CC	25 16 0	With aerial and H.F units for 15-35 and 30-65 metres. Units for 60-525 and 1,000-2,000 metres, extra.
" " "	" " 4-Valve	" "	—	—	TT	LG	TC	TC	—	Two	CC	28 15 0	" " " " "
" " "	Screened-grid Valve. Short-wave.	" "	—	—	TA	LG	TC	RC	—	Two	CC	33 0 0	With 4 sets of aerial and H.F units for 10-85 metres. Screened grid H.F.
Janes, W. H., 202, Dale Street, Chatham.	Janettphone Three	Cabinet	—	—	—	LG	TC	TC	—	One	SC	10 10 0	Valves, eliminator and coils, £8 extra.
Keen Wireless Co., 1, Dane Road, West Ealing, London, W.13.	Standard 2	Cabinet	—	—	—	LG	TC	—	—	One	SC	6 0 0	With valves.
Lamplugh, Ltd., S. A., King's Road, Tyseley, Birmingham.	Quality II.	Cabinet oak or mahogany	—	—	—	LG	TC	—	—	One	SC	10 7 6	
" " "	Quality III.	" " "	—	—	—	LG	TC	TC	—	One	SC	13 10 0	
" " "	Quality II.	Console type	—	—	—	LG	TC	—	—	One	SC	18 17 6	
" " "	Quality III.	" "	—	—	—	LG	TC	TC	—	One	SC	22 0 0	
" " "	Standard II.	Cabinet type	—	—	—	LG	TC	—	—	One	SC	5 7 6	
" " "	Standard III.	" "	—	—	—	LG	TC	TC	—	One	SC	7 0 0	
" " "	Standard II.	Console type	—	—	—	LG	TC	—	—	One	SC	10 17 6	With loud speaker.
" " "	Standard III.	" "	—	—	—	LG	TC	TC	—	One	SC	12 10 0	" " " " "
" " "	Screen Grid III.	Cabinet type	—	—	TA	LG	TC	—	—	Two	—	15 17 6	Screened grid H.F., pentode L.F.
" " "	Silver Ghost. Screened Grid III.	Metal cabinet	—	—	TA	LG	TC	—	—	Two	—	8 10 0	Screened grid H.F., pentode L.F.
	Popular II.	" "	—	—	—	LG	TC	—	—	One	SC	5 0 0	With valves.
" " "	Popular III.	" "	—	—	—	LG	TC	TC	—	One	SC	6 17 0	" " " " "
Langham Radio 96, Regent Street, London, W.1.	De Luxe Radio Gramophone.	Pedestal model	—	TT	Ap	LG	RC	TC	—	One	CC	84 0 0	With valves, battery and moving coil loud speaker.
" " "	" " "	" "	—	TT	Ap	LG	RC	TC	—	One	CC	100 0 0	With valves, battery and moving coil loud speaker, for mains supply.
Lawrence, P. H., 38, Market Street, Tamworth.	Aldergate 2	American cabinet	—	—	—	LG	TC	—	—	One	CC	8 10 0	With valves, batteries and loud speaker.
	Aldergate Super 3	" "	—	—	—	LG	RC	TC	—	One	CC	12 10 0	" " " " "
Liverpool Radio Supplies, 64, Myrtle Street, Liverpool.	Uniflex	Table model	—	—	—	LG	TC	Ch	—	One	SC	8 0 0	With valves and batteries.
	"	"	—	—	—	LG	TC	Ch	—	One	SC	13 18 0	With valves and batteries, and with eliminator and loud speaker.
" " "	"	" "	—	—	—	LG	TC	—	—	One	SC	4 19 0	With valves and batteries, pentode L.F.
" " "	"	" "	—	—	—	LG	TC	—	—	One	SC	9 18 0	With valves and batteries, pentode L.F. With eliminator and loud speaker.
Loewe Radio Co., Ltd., 4, Fountayne Road, Tottenham, N.15.	Local Receiver, Type OE 333.	——	—	—	—	AB	RC	RC	—	One	—	4 0 0	Triple-valve unit without coils.
London Electrical Co., 1, Sherborne Lane, King William Street, London, E.C.4.	Lecodyne S.G.3	Table model	—	—	TA	LG	TC	—	—	Two	CC	15 0 0	With valves, no batteries. Screened grid H.F., pentode L.F.
	Lecodyne 2	" "	—	—	—	LG	TC	—	—	One	CC	5 12 6	With valves but no batteries.
" " "	Lecodyne R2	" "	—	—	—	LG	TC	—	—	One	CC	9 10 0	" " " " "
" " "	Lecodyne 3	" "	—	—	—	LG	RC	TC	—	One	CC	7 15 0	With valves but no batteries.
" " "	Lecodyne R3	" "	—	—	—	LG	RC	TC	—	One	CC	12 5 6	" " " " "
" " "	Lecodyne Radio Gramophone.	Cabinet	—	—	TT	AB	RC	TC	—	Two	CC	60 0 0	With valves, eliminator, gramophone motor, pick-up and moving coil loud speaker. Screened grid H.F.
" " "	" " "	" "	—	—	TT	AB	RC	TC	—	Two	CC	65 0 0	For A.C. mains.
" " "	" " "	" "	—	—	TT	AB	RC	TC	—	Two	CC	65 0 0	With electric motor for D.C. mains.
" " "	" " "	" "	—	—	TT	AB	RC	TC	—	Two	CC	70 0 0	" " " " A.C. "
Mains Conversion Co., The Red House, Phillips Street, Aston New Town, Birmingham.	Red House 2	——	—	—	—	LG	TC	—	—	One	CC	5 17 6	With valves and batteries.
	Red House 3	——	—	—	—	LG	RC	TC	—	One	CC	7 17 6	" " " " "
	Red House 4	——	—	—	—	AB	RC	TC	—	One	CC	20 0 0	With valves, L.T. accumulator. Eliminator or H.T. accumulator.

Manufacturer.	Trade Name of Set.	Type.	Valves							No. of Tuning Controls (excluding Reaction).	Reaction.	Price (including Royalties).	Remarks.
			H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.			£ s. d.	
McMichael, Ltd., L., Wexham Road, Slough.	All Mains Screened Three	——	—	—	TA	LG	TC	—	—	Two	CC	34 13 0	With A.C. valves and mains equipment. Screened grid H.F.
Macnamara's, 116, Spring Hill, Birmingham.	Screened Dimic Three ..	Oak cabinet	—	—	TA	LG	TC	—	—	Two	CC	21 16 0	With valves, screened grid H.F., pentode L.F.
Mann, A., 14, Railway Approach, Worthing.	Sunbeam Minor	——	—	—	—	LG	RC	TC	—	One	CC	4 0 0	Receiver only.
Marconiphone Co., Ltd., 210–212, Tottenham Court Road, London, W.1.	Sunbeam Major	——	—	—	—	AB	RC	TC	—	One	CC	12 0 0	
" " "	——	Oak cabinet	—	—	—	LG	TC	RC	—	One	CC	22 14 0	" " With valves. Eliminator, accumulators and loud speaker.
	Marconiphone Model VI.	——	—	—	—	LG	—	—	—	One	Res.	4 16 0	With valve and batteries.
	Model 22	——	—	—	—	LG	TC	—	—	One	SC	8 14 9	With valves and batteries.
	"	——	—	—	—	LG	TC	—	—	One	SC	13 5 6	With valves and batteries and D.C. mains equipment.
	"	——	—	—	—	LG	TC	—	—	One	SC	16 5 6	With valves and batteries and A.C. mains equipment.
	Model 23	——	—	—	—	LG	TC	—	—	One	SC	10 0 3	With valves and batteries, pentode extra 14s. 7d.
	——	——	—	—	—	LG	TC	—	—	One	SC	13 13 0	With valves and batteries, pentode extra 14s. 7d., with D.C. mains equipment.
	——	——	—	—	—	LG	TC	—	—	One	SC	13 7 6	" " " with A.C. mains equipment.
	Marconiphone Model 23A	——	—	—	—	LG	TC	—	—	One	CC	13 9 10	With valves and batteries, pentode L.F. and loud speaker.
	" " D.C.	——	—	—	—	LG	TC	—	—	One	CC	16 8 0	With valves and batteries, pentode L.F. and D.C. mains equipment and loud speaker.
	" " A.C.	——	—	—	—	LG	TC	—	—	One	CC	16 2 6	With valves and batteries, pentode L.F. and A.C. mains equipment and loud speaker.
	Model 32	——	—	—	—	LG	TC	RC	—	One	SC	14 13 9	With valves and batteries.
	" D.C.	——	—	—	—	LG	TC	RC	—	One	SC	18 6 0	With valves and batteries and D.C. mains equipment.
	" A.C.	——	—	—	—	LG	TC	RC	—	One	SC	21 19 0	With valves and batteries and A.C. mains equipment.
	" 32A.	Pedestal Cabinet	—	—	—	LG	TC	RC	—	One	SC	30 13 9	With valves, batteries and loud speaker.
	" D.C.	" "	—	—	—	LG	TC	RC	—	One	SC	34 6 0	With valves, batteries and loud speaker for D.C. mains.
	" A.C.	"	—	—	—	LG	TC	RC	—	One	SC	38 2 6	With valves, batteries and loud speaker for A.C. mains.
	" 34	Short Wave	—	—	—	LG	RC	TC	—	One	CC	23 17 6	For 4-volt or 6-volt valves, 12-3000 metres.
	(Short-Wave) Model S.24	Short-wave converter	—	—	*	LG	—	—	—	One	—	14 10 0	*Oscillator.* Converter for use with sets with one or more H.F. stages. 15-50 metres.
	Model 35	——	—	—	TA	LG	TC	—	—	One	CC	16 18 9	With valves and batteries, screened grid H.F. pentode L.F.
	Model 44	——	—	TA	TA	AB	RC	—	—	Three	None	30 10 0	" " " " "
	Model 51	——	—	TA	TA	LG	TC	RC	—	One	CC	28 2 0	With valves and batteries, A.C. or D.C. mains equipment extra.
	Model 51A	Pedestal cabinet	—	TA	TA	LG	TC	RC	—	One	CC	44 12 0	With valves, batteries and loud speaker. A.C. or D.C. mains equipment extra.
	Model 61	——	TA	TA	TA	AB	RC	RC	—	Four	None	60 16 9	With valves and batteries. Screened grid H.F.
	Model 82	——	*	*	*	AB	TC	TC	—	One	None	68 0 0	With valves and batteries. *8-valve Superhet.*
Metro-Vick Supplies, Ltd., 155, Charing Cross Road, London, W.C.2	Met-Vick ANP3 (All Mains A.C.).	——	—	—	—	LG	RC	RC	—	One	CC	20 4 6	With valves and eliminator.
	(All Mains D.C.)	——	—	—	—	LG	RC	RC	—	One	CC	19 18 0	" " "
	(Battery operated)	——	—	—	—	LG	RC	TC	—	One	CC	13 14 6	With valves and batteries.
	ANP4 (All Mains A.C.)..	——	—	—	TA	LG	RC	RC	—	Three	CC	24 19 6	With valves and eliminator.
	" " D.C...	——	—	—	TA	LG	RC	RC	—	Three	CC	24 15 0	" " "
	(Battery Operated)	——	—	—	TA	LG	RC	RC	—	Three	CC	17 14 6	With valves and batteries.
	Met-Vick 5. (All Mains A.C. or D.C.).	——	—	TA	TA	LG	RC	RC	—	Three	CC	50 0 0	With valves, eliminator and provision for pick-up.
Mitchell, A. R., 15, Claremont Street, Shrewsbury.	Albertross	——	—	—	—	AB	RC	TC	—	One	CC	6 10 0	Receiver only.
Neophone Engineering Company, 9 and 10, Little St. Andrew Street, St. Martin's Lane, London, W.C.2.	P.P.X.4.....	American cabinet	—	—	TA	LG	TC	TC	—	One	CC and SC	12 10 0	Complete with valves, 2-v. accumulator and H.T.
Nottingham Radio Supplies, 33, Mansfield Road, Nottingham.	Chantecler Pentone II...	American pattern	—	—	—	LG	TC	—	—	One	CC	4 17 6	Pentode L.F. stage.
	Chantecler S.G.III.	" "	—	—	TC	LG	TC	—	—	Two	CC	16 0 0	Screened-grid H.F., pentode L.F. stage. Complete with valves and coils.
Nutter, C. H. P., Radio Corner, Selhurst Road, Norwood Junction, S.E.25.	Mains Three	Consol	—	—	—	AB	RC	TC	—	One	CC	35 0 0	Operated entirely from A.C. mains.
	Standard Two	Table cabinet	—	—	—	LG	TC	—	—	One	SC	4 17 6	Plug-in coils and complete with valves and batteries.
The Ormond Engineering Co., Ltd., 199–205, Pentonville Road, King's Cross, London, N.1.	Ormond Screened-Grid Three R/302.	Mahogany cabinet.....	—	—	*	LG	TC	—	—	Two	CC	15 14 5	*Screened-grid H.F. choke with tuned grid.* Pentode L.F. Price includes valves.
	Ormond Two-Valve Set. R/201A.	" "	—	—	—	LG	TC	—	—	One	CC	8 0 10	Price includes valves.
	Ormond Two-Valve Pentode Set. R/201A(P).	——	—	—	—	LG	TC	—	—	One	CC	8 13 4	Price includes valves. Pentode L.F.
	Ormond Three-Valve Set. R/202A.	Mahogany cabinet.....	—	—	—	LG	TC	TC	—	One	CC	10 13 9	Price includes valves.
	Ormond Two-Valve Set. R/201.	Oak cabinet	—	—	—	LG	TC	—	—	One	CC	6 0 6	" " "
	Ormond Two-Valve Pentode Set. R/201(P).	" "	—	—	—	LG	TC	—	—	One	CC	6 13 0	Pentode L.F. Price includes valves.
	Ormond Three-Valve Set.	" "	—	—	—	LG	TC	TC	—	One	CC	8 13 6	Price includes valves.
Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, London, W.C.2	Philips Type 2502	3-valve battery or H.T. mains unit operated.	—	—	TA	LG	TC	—	—	Two	SC	15 0 0	Screened-grid H.F. and pentode L.F. Complete with valves and leads.
	Philips Type 2501	3-valve L.T. and grid bias from mains.	—	—	TA	LG	TC	—	—	Two	SC	16 10 0	Screened-grid H.F. and pentode L.F. Complete with valves, leads, L.T. and grid bias from mains. With eliminator type 372. Price £22.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Re-action.	Price (including Royalties). £ s. d.	Remarks.
Priestley & Ford, 3–11, Carrs Lane, Birmingham.	"Peecanef" (P. & F.) Three.	Cabinet, walnut panel	—	—	—	LG	RC	TC	—	One	CC	12 12 0	Or complete with valves and batteries, £16 19s 6d.
W. G. Pye & Co., Montague Road, Cambridge.	Popular Two. No. 222	Cabinet model	—	—	—	LG	TC	—	—	One	CC	6 0 0	Price includes valves.
	Screened Three. No. 360	" "	—	—	TA	LG	TC	—	—	Two	CC	19 7 6	Fitted with battery compartment. Price includes valve ‡, screened grid H.F. and pentode L.F.
" " "	No. 730	" "	—	—	TT	LG	TC	—	—	Two	CC	16 0 0	Price includes valves.
" " "	No. 720	" "	—	—	—	LG	TC	—	—	One	CC	9 2 6	" "
" " "	No. 740	" "	—	—	TT	AB	RC	TC	—	Two	CC	19 15 0	" "
" " "	No. 830	" "	—	—	—	LG	TC	TC	—	Two	CC	15 0 0	" "
" " "	No. 750	" "	—	TT	TT	LG	TC	TC	—	Three	CC	30 0 0	" "
" " "	Contact Mains Receiver:												
" " "	No. 730/M/AC.	" "	—	—	TT	LG	TC	—	—	Two	CC	27 10 0	Complete with mains unit
" " "	No. 730/M/DC.	" "	—	—	TT	LG	TC	—	—	Two	CC	24 10 0	" " "
" " "	No. 740/M/AC.	" "	—	—	TT	AB	RC	TC	—	Two	CC	35 10 0	" " "
" " "	No. 740/M/DC.	" "	—	—	TT	AB	RC	TC	—	Two	CC	30 0 0	" " "
" " "	No. 250/M/AC.	" "	—	—	—	LG	TC	—	—	One	CC	22 2 6	" " "
" " "	No. 350/M/AC.	" "	—	—	TA	LG	TC	—	—	Two	CC	32 10 0	Complete with mains unit. Screened grid valve.
Radio Supply Co., Superfone Works, Four Oaks, Birmingham.	Superfone Maxum II.	Table model	—	—	—	LG	TC	—	—	One	CC	5 5 0	Receiver only. Pentode L.F. optional.
	Superfone Maxum III.	" "	—	—	TA	AB	TC	—	—	Two	CC	10 10 0	" " " "
R. I. & Varley, Ltd., 103, Kingsway, London, W.C.2.	Interdyne	Table cabinet	—	*	*	AB	RC	TC	—	One	CC	42 0 0	Price includes valves. *Interdyne valves and H.F. transformer.
Read Radio, Ltd., 32, Newman Street, Oxford Street, London, W.1.	Country House. Long Range.	Cabinet type	—	—	—	—	—	—	—	Two	—	47 5 0	Five valves, 2–v–2. Special coupling. Adapted with loud speaker and telephone extensions.
	Ultra Short Wave. Model U.S.3.	" "	—	—	—	—	—	—	—	—	—	—	15–70 metres. Four valves, 2–v–1 Special coupling.
Redcliffe Radio Mfg. Co., 91A, Temple Street, Bristol.	Redcliffe Three	American type cabinet	—	—	—	LG	TC	TC	—	One	SC	7 13 6	With valves. Pentode L.F.
	Redcliffe Screened Three	" "	—	—	TA	LG	TC	—	—	Two	CC	18 18 0	With valves, screened-grid H.F., pentode L.F.
The Rothermel Corporation, Ltd., 24–26, Maddox Street, London, W.1.	Bandbox Neutrodyne	Cabinet type	TT	TT	TT	LG	TC	TC	—	One	—	16 16 0	*Excluding Royalties.* Wave range 250–550 metres.
Saxon Radio Co., Henry Street Works, Blackpool, Lancs.	"All-Electric-Three"	Cabinet or pedestal	—	—	—	AB	RC	TC	—	One	SC	11 15 0	Price includes battery eliminator, but excludes valves.
	"Super-Four"	" "	—	—	TA	AB	RC	TC	—	Two	—	9 17 6	Valves and accessories extra. Screened-grid H.F.
	Three-Valve Loud Speaker.	" "	—	—	—	LG	RC	TC	—	One	SC	6 10 0	Valve and accessories extra
" " "	Two-Valve Loud Speaker	" "	—	—	—	LG	TC	—	—	One	SC	5 5 0	
Selectors, Ltd., 1, Dover Street, London, W.1.	Short Wave Three	Cabinet	—	—	—	LG	TC	TC	—	One	CC	15 19 0	Price excludes valves and batteries. Wave range 15–100 metres.
Sherman, P., Criterion Works, 12, Criterion Mews, Holloway, London, N.	Claremont II.	Cabinet type	—	—	—	LG	TC	—	—	One	SC	8 10 0	With all accessories, valves, batteries and loud speaker.
Simpler Wireless, Ltd., 55, Cardington Street, London, N.W.1	Simpler Wireless D.C. Model.	Cabinet	—	—	—	AB	*	*	—	One	CC	16 16 0	*Direct coupled L.F. stages.* Price includes all accessories and complete mains equipment.
" " "	Simpler Wireless A.C. Model.	"	—	—	—	AB	*	*	—	One	CC	22 1 0	*Direct coupled L.F. stages.* Price includes all accessories and complete mains equipment.
Smith & Son, W. Weymouth, Dorset.	Smith III.	"	—	—	TA	LG	TC	—	—	Two	—	12 0 0	Screened grid H.F., pentode L.F. Provision for gramophone pick-up.
Stratton & Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.	Eddystone S.W. Scientific Three.	"	—	—	TA	LG	TC	—	—	One	CC	14 10 0	*Excluding Royalties.* Accessories extra. Screened-grid H.F., pentode L.F. Wave range 14–3,000 metres.
Tutills, Ltd., 7–9, Swan Street Manchester.	1929 N.R.IV.	American cabinet	—	—	TA	LG	TC	TC	—	Two	CC	24 12 0	Screened grid H.F. and push-pull output.
	Chronicle D.R.3	" "	—	—	TA	LG	TC	—	—	Two	CC	16 10 0	With valves. Screened grid H.F., pentode L.F.
" " "	Gramo Radio	Pedestal cabinet	—	—	—	LG or AB	TC	—	—	One	CC	15 13 6	With valves and batteries, pentode L.F.
" " "	Tinol Pedestal Pentode.	" "	—	—	—	LG	TC	—	—	One	CC	10 13 0	" " " "
Wathes & Co., Ltd., T. H., 86–88, High Street, Leicester.	Aureola 2V.	Table model	—	—	—	LG	TC	—	—	One	SC	6 6 0	With valves and batteries.
" " "	" 3-V.	" "	—	—	—	LG	RC	TC	—	One	SC	10 10 0	" " " Pentode L.F.
" " "	" 2-V.	" "	—	—	—	LG	TC	—	—	One	SC	10 10 0	" " " Screened-grid H.F., pentode L.F.
" " "	" 3-V.	" "	—	—	TA	LG	TC	—	—	Two	CC	20 0 0	" " " with loud speaker.
" " "	"	Bureau	—	—	TA	LG	TC	—	—	Two	CC	35 0 0	

PORTABLES AND SELF-CONTAINED SETS.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Re-action.	Weight.	Dimensions.	Price (including Royalties). £ s. d.	Remarks.
												lbs.	in.		
Atonic Wireless Co., Ltd., Coventry House, South Place, Moorgate Street, London, E.C.1.	Atonic Portable Combined Gramophone and 5-V. Receiver.	Self-contained cabinet	—	Ap	Ap	LG	TC	RC	—	One	CC	40	18×15×10½	55 0 0	With valves and batteries.
,, ,,	Suitcase Five	Suitcase	—	Ap	Ap	LG	TC	RC	—	One	CC	22	15¼×12½×8½	16 16 0	,, ,, ,,
,, ,,	Transportable Five	Self-contained cabinet	—	Ap	Ap	LG	TC	RC	—	One	CC	28	16½×17½×8½	19 19 0	,, ,, ,, Oak cabinet. Mahogany £2 2s. extra.
Atkinson C. Creswick, 356, High Street, Bedford.	N.S.5 Rover	Despatch case	—	Ap	Ap	LG	TC	TC	—	One	CC	30	15½×12½×10½	31 10 0	With valves, etc.
,, ,,	,, Universal	,,	—	Ap	Ap	LG	RC	TC	—	One	CC	28	15½×12½×9½	18 18 0	With valves, etc., and pentode.
,, ,,	,, Reliance	Transportable	—	Ap	Ap	LG	TC	TC	—	One	CC	40	16½×17½×7¾	32 11 0	With valves, etc., and gramophone pick-up.
,, ,,	,, Drawing-Room	,,	—	Ap	Ap	LG	TC	TC	—	One	CC	60	—	36 15 0	With valves, etc., and gramophone pick-up.
,, ,,	,, Ball Room	,,	—	Ap	Ap	LG	RC	TC	—	One	CC	—	—	84 0 0	With valves, etc., and gramophone pick-up. Pentode in parallel, moving coil loud speaker and eliminator.
Automobile Accessories (Bristol), Ltd., Sion Road, Bedminster, Bristol.	P.D. Melody Three Pedestal.	Self-contained model	—	—	—	LG	TC	TC	—	One	SC	—	—	7 7 6	
B. & J. Wireless Co., 2 and 3, Athelstane Mews, London, N.4.	All British Super Four	Oak case	—	Ap	Ap	LG	TC	—	—	One	CC	30	15×15×8½	19 10 0	With valves and batteries. Pentode L.F. Extra for mahogany, £1 1s.
Bedford Electrical & Radio Co., Ltd., 22, Campbell Road, Bedford.	Peerless Portable	——	—	—	TA	LG	TC	RC	—	Two	CC	30	18×17×9	25 0 0	With valves and batteries.
Bligh, S. W., 1 and 2, North Lane, Canterbury.	Peerless Resonic	Aluminium	—	—	—	LG	TC	—	—	One	SC	—	13×7×8	6 5 0	
,, ,,	Super Duovalve	Pedestal Cabinet	—	—	—	LG	TC	—	—	One	SC	25	17×17×30	16 17 6	,, ,, ,, With valves D.C., H.T. eliminator and L.T. accumulator. Pentode L.F.
,, ,,	R.C. Trivalve	Cabinet	—	—	—	AB	RC	RC	—	One	SC	40	18×18×14	23 7 6	With valves and batteries.
,, ,,	,, ,,	,,	—	—	—	AB	RC	RC	—	One	SC	40	18×18×14	25 0 0	With D.C. eliminator.
,, ,,	Duovalve	Pedestal Cabinet	—	—	—	LG	TC	—	—	One	SC	30	17×17×30	12 0 0	With valves and batteries.
,, ,,	,,	,, ,,	—	—	—	LG	TC	—	—	One	SC	30	17×17×30	15 10 0	With D.C. eliminator.
,, ,,	Super Five	Cabinet	—	—	Ap	AB	RC	RC	RC	One	SC	72	24×24×24	46 10 0	With valves, D.C. eliminator and two L.T. accumulators.
Bowyer-Lowe Co., Ltd., Letchworth, Herts.	Vox Populi 3	Oak cabinet	—	—	TT	AB	RC	—	—	Three	CC	21	11½×24×12	20 0 0	With valves and G.B. battery. Battery cabinet extra, £1 15s., screened grid H.F., pentode L.F.
,, ,,	Vox Populi 4	,, ,,	—	—	TT	AB	RC	TC	—	Three	CC	25	11½×24×12	24 0 0	With valves, G.B. battery and frame aerial in lid, screened grid H.F.
,, ,,	Gramoradiophone	Combined gramophone and receiver.	—	—	TT	AB	RC	—	—	Three	CC	—	34×20×34	39 0 0	With valves and G.B. battery, screened grid H.F., pentode L.F.
The British Radio Corporation, Ltd., Elm Grove Road, Weybridge, Surrey.	B.R.C. Screened Five Portable.	Portable cabinet	—	TA	TA	LG	TC	TC	—	One	—	35	18×14×7	30 9 0	With valves, batteries and loud speaker.
British Thomson-Houston Co., Ltd., Alma Street, Coventry.	B.T.H. Portable	Self-contained	—	—	TA	LG	RC	TC	—	Two	CC	42	—	26 10 0	With valves and batteries. "Mazda" 2-stage combined valve. Screened grid H.F.
,, ,,	B.T.H. 5-Stage de Luxe.	Mahogany inlaid pedestal cabinet.	—	TA	TA	AB	RC	TC	—	—	—	184	20½×40×16½	110 0 0	Complete with valves, loud speaker and amplifier, battery eliminator and 2 screened grid H.F. Last stage has 2 valves in parallel. Provision for gramophone pick-up.
Burgoyne Manufacturing Co., Ltd., 34a, York Road, King's Cross, London, N.1.	Burgoyne A	Self-contained	—	Ap	Ap	LG	RC	TC	—	One	CC	26	15×12×8	21 0 0	With valves and batteries. Wave-range, 250–550 metres.
,, ,,	,, A1	,,	—	Ap	Ap	LG	RC	TC	—	One	CC	26	15×12×8	22 1 0	,, ,, ,, ,,
,, ,,	,, B	De Luxe in Morocco case	—	Ap	Ap	LG	RC	TC	—	One	CC	26	15×12×8	26 5 0	,, ,, ,, ,,
Burndept Wireless (1928), Ltd., Eastnor House, Blackheath, S.E.3.	Screened Portable	Mahogany or crocodile leather	—	—	TA	LG	TC	TC	—	Two	CC	30	16×16×9	25 12 6	With valves, batteries and loud speaker. Screened grid H.F.
,, ,,	,, ,,	Morocco case	—	—	TA	LG	TC	TC	—	Two	CC	30	16×16×9	30 0 0	,, ,, ,, ,,
Cantophone Wireless Co., Remo House, 310, Regent Street, London, W.1.	Portable Five	Self-contained	—	Ap	Ap	LG	TC	TC	—	One	CC	27	17×14×7½	31 10 0	With valves, batteries and built-in loud speaker. Pentode L.F. Provision for pick-up.
,, ,,	,, Two	,,	—	—	—	LG	TC	—	—	One	CC	10	12×9×5	10 10 0	With valves, batteries and headphones.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning (Controls excluding Reaction).	Reaction.	Weight.	Dimensions.	Price (including Royalties). £ s. d.	Remarks.
												lbs.	in.		
Castagnoli Gordon. Castophone Radio Works, 71, Culver Street, Colchester.	Castophone E. III. S.	Self-contained	—	—	—	LG	TC	RC	—	One	SC	—	12×8×8	9 0 0	With valves and batteries.
	,, E. II. S.	,,	—	—	—	LG	TC	—	—	One	SC	—	12×8×8	7 3 9	With valves and batteries.
Catesbys, Ltd. 61–67, Tottenham Court Road, London, W.	Pedestal, Type A	Self-contained	—	—	—	LG	TC	TC	—	One	CC	—	16×30½×16	11 15 0	With valves, batteries and loud speaker.
Cavendish Trading Co., Ltd., 5a, Palace Chambers, Bridge Street, Westminster, S.W.1.	Cavendish III.	Self-contained	—	—	TA	LG	TC	—	—	One	CC	26	14×12×9	24 17 6	With valves and batteries. Screened grid H.F., pentode L.F.
Cliftophone & Records, Ltd., 95, Park Street, London, S.E.1.	Pelican III.	Self contained	—	—	Ap	LG	TC	—	—	One	CC	30	17×17½×7½	14 14 0	With valves. Wave-range 250–610 metres.
Cole, Ltd., E. K., London Road, Leigh-on-Sea.	Ekco Mains-Drive 3. A.C.	—	—	—	—	LG	RC	TC	—	One	CC	25	22½×9½×8½	22 1 0	With valves and unit for A.C. mains.
,, ,, ,,	,, ,, ,, D.C.	—	—	—	—	LG	RC	TC	—	One	CC	25	22½×9½×8½	19 13 0	With valves and unit for D.C. mains.
Cook & Co., J. H., 51, Monks Road, Lincoln.	Chellotone	Cabinet	—	—	—	LG	TC	RC	—	One	SC	—	7½×15×10	7 15 0	With valves, batteries and loud speaker.
Cooks Wireless Co., Ltd., St. Helens Street, Ipswich.	C.W.C. Portable	Waterproof cover	—	Ap	Ap	LG	TC	RC	—	One	CC	—	15½×15½×7½	22 10 0	With valves and batteries.
,, ,, ,,	,, Pedestal	Self-contained	—	—	TA	LG	TC	RC	—	Two	CC	—	51×20×20	31 10 0	Swinging frame aerial enclosed screened grid H.F.
Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, N. Acton, W.3.	Westminster Portable Radio Gramophone.	Self-contained	—	Ap	Ap	LG	TC	—	—	One	CC	50	19×17×9	42 0 0	With valves and batteries, pentode L.F.
Dunham, C. S., Elm Park, Brixton Hill, London, S.W.2.	Simplicity 2	Self-contained	—	—	—	LG	TC	—	—	One	Special	11	7×8×12	8 2 6	With valves, batteries and loud speaker.
	,, 5	,,	—	—	—	LG	TC	TC	—	One	Special	12	7×8×12	10 12 6	With valves, batteries and loud speaker. Battery eliminator extra, £4 10s.
,, ,, ,,	Long-Range 51D	,,	—	—	TA	LG	TC	—	—	Two	Special	28	10×24×10	20 0 0	With valves, batteries and loud speaker. Battery eliminator extra, £5 10s.
Dyson & Co., Ltd., J., 2, Coleman Street, London, E.C.2.	Godwinex Portable 5-V.	—	—	Ap	Ap	LG	RC	TC	—	One	CC	36	18×17½×8½	25 15 0	With valves and batteries.
Eagle Engineering Co., Ltd., Eagle Works, Warwick.	Chakophone Portable	—	—	—	TA	LG	TC	—	—	Two	SC	30	16×16×11	25 8 6	With valves, batteries and loud speaker. Provision for pick-up. Pentode L.F.
,, ,, ,,	,, Screened Three	—	—	—	TA	LG	TC	—	—	Two	SC	32	17×17×11	25 8 6	With valves, batteries and loud speaker. Screened grid H.F. Provision for pick-up.
,, ,, ,,	Pedestal Grand	Self-contained pedestal	—	—	TA	LG	RC	TC	—	Two	SC	70	18×12×42	38 17 0	With valves and batteries. Screened grid H.F. and pentode L.F.
,, ,, ,,	,, ,,	,, ,,	—	—	TA	LG	RC	TC	—	Two	SC	70	18×12×42	45 3 0	With valves and batteries. Screened grid H.F. and pentode L.F. and mains A.C. equipment.
,, ,, ,,	,, ,,	,, ,,	—	—	TA	LG	RC	TC	—	Two	SC	70	18×12×42	40 19 0	With valves and batteries. Screened grid H.F. and pentode L.F. and mains D.C. equipment.
Edison Bell, Ltd., Glengall Road, Peckham, S.E.15.	Hylo Five Portable	Self-contained, walnut case	—	Ap	Ap	LG	RC	TC	—	One	CC	34	17×17×7½	28 5 0	With valves, batteries and loud speaker.
,, ,, ,,	,, ,,	,, Japanese Lacquer	—	Ap	Ap	LG	RC	TC	—	One	CC	34	17×17×7½	30 15 0	,, ,, ,, ,,
,, ,, ,,	Picnic Five Portable	Self-contained	—	Ap	Ap	LG	RC	TC	—	One	CC	26	13½×13½×10	18 12 0	With valves and batteries.
Elleray, Ltd., R., Beacon Buildings, Kendal.	Beacon 5 Portable	Self-contained, mahogany case.	—	Ap	Ap	LG	TC	TC	—	One	CC	28	15½×14½×12½	24 3 0	With valves and batteries. Provision for pick-up.
Empire Electric Co., 10, Fitzroy Square, London, W.1.	Empire Four	Self-contained	—	—	—	LG	RC	RC	RC	One	CC	16	19×16×5	12 12 0	Wave range 250–550 metres.
,, ,, ,,	,, Three	,,	—	—	—	LG	RC	RC	—	One	CC	15	19×16×5	10 10 0	,, ,, ,,
,, ,, ,,	Faerie Five	,,	—	Ap	TA	LG	RC	RC	—	Two	CC	19	13×12×8	23 2 0	,, ,, ,, Two screened grid H.F.
,, ,, ,,	Metropolis Super Het.	,,	*	*	*	LG	TC	—	—	Two	—	22	13×12×8	31 10 0	*5-Valve superhet. Screened grid 1st detector. Screened grid intermediate.
Fada Radio, Ltd., 31, Kingsway, London, W.C.2.	Fada 12 D.C. All Electric	Cabinet	TT	TT	TT	LG	TC	TC	—	One	None	42	9×21×12	27 0 0	With valves and eliminator for 90–130 volts. Resistance for higher voltages extra. Wave range 200–600 metres.
,, ,, ,,	Fada 10 A.C. All Electric	,,	TT	TT	TT	LG	TC	TC	—	One	None	42	9×21×12	36 5 0	With valves and eliminator for 90–130 volts A.C. 50–60 cycles. Step-down transformer for higher voltages, £2 15s. extra. Wave range 200–600 metres.
,, ,, ,,	Fada 10 Z.A.C.	,,	TT	TT	TT	LG	TC	TC	—	One	None	42	9×21×12	36 5 0	As above, but for 25–49 cycles.
Falk Stadelmann & Co., Ltd., 83–93, Farringdon Road, London, E.C.1.	Blenheim Screened Four	Portable	—	—	TA	LG	RC	TC	—	Two	CC	30	18½×15½×8½	26 15 0	With valves and batteries. Screened grid H.F., pentode L.F.
Forster, G., Carlton House, Regent Street, London, S.W.1.	Advance. Radio Gramophone Combination.	Oak or mahogany	—	Ap	Ap	LG	TC	TC	—	One	CC	—	38×20×20	38 0 0	With valves, batteries and loud speaker, and gramophone pick-up.

Manufacturer.	Trade Name of Set.	Type.	Valves.							No. of Tuning Controls (excluding Reaction).	Re-action.	Weight.	Dimensions.	Price (including Royalties).	Remarks.
			H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.						
												lbs.	in.	£ s. d.	
Forster, G., Carlton House, Regent Street, London W.1.	Advance Portable 5-Valve	Mahogany or oak case	—	Ap	Ap	LG	TC	TC	—	One	CC	30	16×17 ×9	22 15 0	With valves, batteries and loud speaker. Waterproof cover 10s. extra.
" " "	" " 3-Valve	" "	—	—	—	LG	TC	TC	—	One	CC	28	16×17 ×9	17 15 0	With valves and batteries. Provision for pick-up.
Franklyn, A. G., 3, Boar Lane, Leeds.	Pegasus Four	Self-contained oak case	—	—	—	AB	RC	RC	RC	One	CC	12¾	10×17 ×12	12 0 0	With valves and batteries. H.T. eliminator, £6 extra. Provision for pick-up.
" " "	Pegasus Rover	Mahogany or oak case	*	*	*	AB	RC	TC	—	Two	—	32	17×20 ×7	40 0 0	*8-Valve superhet. With valves and batteries. Provision for pick-up.
Galloway, J. & L., Ltd., 38, Mair Street, Plantation, Glasgow S.W.1.	Galloway S.P. 8-V.	——	*	*	*	*	*	RC	TC	Two	—	16	16×10 ×8	39 9 6	With valves, batteries and aerial. *8-Valve superhet.
Garnett Whiteley & Co., Ltd., Lotus Works, Broadgreen Road, Liverpool.	Lotus Transportable	Self-contained, oak model	—	—	TA	LG	TC	—	—	Two	CC	38	15¾×19¾ ×9¼	31 10 0	With valves and batteries. Screened grid H.F., pentode L.F. Extra for mahogany or walnut, 21s.
" " "	Lotus Portable	Self-contained	—	—	TA	LG	TC	—	—	Two	CC	35	12×15¼ ×13	31 10 0	With valves and batteries.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.	Gecophone 5-V Portable	Self-contained	—	Ap	TT	LG	TC	TC	—	Two	CC	—	20⅝×14½ ×8½	29 0 0	With valves and batteries.
Gottlieb & Co., Ltd., J. L., 15, Cromer Street, Gray's Inn Road, London, W.C.1.	R.S.V.P. Portable V.	Self-contained cabinet	—	Ap	Ap	LG	TC	RC	—	One	CC	28	16½×17½ ×8½	19 19 0	With valves and batteries.
	" Screened Grid Four	" "	—	—	TA	LG	TC	TC	—	Two	CC	28	16½×17½ ×8½	25 0 0	" " " Screened grid H.F.
Hart Collins, Ltd., 38a, Bessborough Road, Westminster, S.W.1.	Tourist Portable 5	Oak cabinet	—	Ap	Ap	AB	TC	TC	—	One	CC	29	16×16½ ×7	30 0 0	With valves and batteries. Mahogany, £1 extra.
" " "	" "	Suitcase, crocodile leather	—	Ap	Ap	AB	TC	TC	—	One	CC	24	12×14½ ×8½	32 0 0	With valves and batteries. Provision for pick-up.
" " "	Passport Transportable 5	Walnut cabinet	—	Ap	Ap	LG	TC	TC	—	One	CC	28	13½×15½ ×7½	21 12 6	With valves and batteries.
" " "	" " "	Suitcase	—	Ap	Ap	LG	TC	TC	—	One	CC	24	12×14½ ×8½	21 12 6	" " "
Heath Plugs, Ltd., Kennington Cross, London, S.E.11.	H.P.L. Local 3	Self-contained	—	—	—	LG	TC	TC	—	One	SC	20	12×12 ×9	15 10 0	With valves and batteries. Wave range 225–550 metres.
" " "	H.P.L. Super 5	"	—	Ap	Ap	LG	TC	RC	—	One	CC	23	18×18½ ×6	23 12 6	With valves and batteries Wired for pick-up.
Henderson & Co., Ltd., W. J., 351, Fulham Road, London, S.W.10.	Henderson "O."	Self-contained	—	Ap	Ap	LG	TC	RC	—	One	CC	28	14×13½ ×9⅝	30 0 0	With valves and batteries.
" " "	" "P."	"	—	Ap	Ap	LG	TC	RC	—	One	CC	24½	14½×13 ×7¼	26 0 0	" " "
" " "	" "R."	"	—	Ap	Ap	LG	TC	RC	—	One	CC	23	15×13 ×7⅛	26 0 0	" " "
" " "	" "S."	"	—	Ap	Ap	LG	TC	RC	—	One	CC	31	17×12⅝ ×9⅞	28 0 0	" " "
Igranic Electric Co., Ltd., 149, Queen Victoria Street, London E.C.	Neutrosonic 7	Transportable	*	*	*	AB	Ch	—	—	Three	—	24	17×14 ×11	42 12 0	*7-V. superhet. With valves and headphones. Batteries, frame aerial and loud speaker in containers, £21 extra.
" " "	Universal Portable	Portable	—	TA	Ap	LG	RC	TC	—	One	CC	22½	16½×16½ ×9	26 7 0	With valves, G.B., battery, aerial and earth equipment, frame aerial and loud speaker. Screened grid H.F. Extra for battery case and batteries £7.
Langham Radio, 96, Regent Street, London, W.1.	Transportable V.	Oak case	—	TT	Ap	LG	TC	TC	—	One	CC	36	19½×11½ ×15	36 15 0	With valves and batteries. Mahogany case, £1 1s. extra. Provision for pick-up.
" " "	Transatlantic Portable Radio Gramophone.	——	—	TT	Ap	LG	TC	TC	—	One	CC	27½	14×14 ×9	36 15 0	With valves and batteries. Provision for pick-up.
Lawrence Radio, 262, Midland Station Approach, Leytonstone, London, E.11.	Atophone	Self-contained	—	Ap	Ap	LG	RC	TC	—	One	CC	24	14×14 ×9	22 10 0	With valves, batteries and loud speaker.
Lever, E. J. (Trix), Ltd., 8–9, Clerkenwell Green, London, E.C.1.	Trix Portette	Mahogany case	—	—	—	LG	—	—	—	One	CC	6¼	6×6×8	5 10 0	With valve, batteries and headphones. Rexine covered 10s. 6d. extra. Wave range 250-500 metres.
" " "	Trix Portable 5	Mahogany cabinet	—	Ap	Ap	LG	RC	TC	—	One	CC	28	17×15½ ×8½	18 13 10	With valves, batteries and loud speaker. Provision for pick-up. Wave range 250-500 metres.
" " "	" "	Leather case	—	Ap	Ap	LG	RC	TC	—	One	CC	26	16½×15 ×8	19 16 4	With valves, batteries, and loud speaker. Provision for pick-up.
Lindley & Co., 14, Great Queen Street, Kingsway, London, W.C.2.	Lindley Five	Transportable	—	Ap	Ap	LG	RC	TC	—	One	CC	33	18×16 ×9	27 0 0	With valves and batteries.
" " "	" "	Attaché case	—	Ap	Ap	LG	RC	TC	—	One	CC	27	12½×15 ×9	19 19 0	" " "
London Electrical Co., 1, Sherborne Lane, King William Street, London, E.C.4.	Lecodyne P.5	——	—	Ap	Ap	LG	TC	TC	—	One	CC	33	18×16½ ×7½	28 5 0	With valves, batteries and loud speaker

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Reaction.	Weight.	Dimensions.	Price (including Royalties).	Remarks.
												lbs.	in.	£ s. d.	
London Radio Manufacturing Co., Ltd., Station Road, Merton Abbey, London, S.W.19.	Orphean	Transportable	—	—	Ap	LG	TC	—	—	Two	CC	30	14¾×17½ ×8½	21 0 0	With valves and batteries. Screened-grid H.F., pentode L.F. Provision for pick-up.
M.P.A. Wireless, Ltd., 62, Conduit Street, London, W.1.	Octroda	Self-contained	—	—	—	LG	TC	—	—	One	CC	20	15×19½ ×9	15 1 6	With valves, batteries and loud speaker. Pentode L.F.
,, ,, ,,	Octroda de Luxe	,,	—	—	—	LG	TC	—	—	One	CC	22	15½×20 ×9½	20 6 6	With valves, batteries and moving coil loud speaker. Pentode L.F.
McMichael, Ltd., L., Wexham Road, Slough.	Portable Five	Leather case	—	Ap	Ap	LG	TC	TC	—	One	SC	30	15½×12¾ ×8¾	28 7 0	With valves, batteries and loud speaker.
,, ,, ,,	Super Screen Portable Four.	Walnut case	—	TA	Ap	LG	TC	—	—	One	CC	35	18×15⅞ ×7	36 15 0	,, ,, Screen grid H.F., pentode L.F.
Marconiphone Co., Ltd., 210–212, Tottenham Court Road, London, W.1.	Marconiphone Model 53	Self-contained cabinet	—	Ap	Ap	LG	TC	TC	—	One	CC	30	18×16 ×7½	29 8 0	With valves, batteries and loud speaker.
The Nottingham Radio Supplies, 33, Mansfield Road Nottingham.	Chantecler Transportable III.	Self-contained	—	Ap	Ap	LG	TC	—	—	One	—	—	36×20 ×20	19 4 0	Pentode L.F. Complete with valves and loud speaker built in.
The Ormond Engineering Co., Ltd., 199–205, Pentonville Road, King's Cross, London, N.1.	Ormond Console Radio Gramophone R/351.	Self-coutained	—	—	—	LG	TC	TC*	—	One	CC	100	37×19 ×40	50 0 0	Complete with valves, batteries and Woodroffe pick-up. *Push-pull output.
,, ,, ,,	Ormond Leather Portable R/303.	,,	—	Ap	Ap	LG	TC	TC	—	One	CC	28	16×13 ×9	27 19 10	In brown crocodile, complete with valves and all accessories.
,, ,, ,,	Ormond Cabinet Portable R/203.	,,	—	Ap	Ap	LG	TC	TC	—	One	CC	32	18×14 ×9	25 8 9	Complete with valves, turntable and all accessories.
,, ,, ,,	Ormond Pedestal Radio Gramophone R/301.	,,	—	—	—	LG	TC	TC	—	One	CC*	80	16×18 ×46	45 0 0	Complete with valves and all accessories, including Woodroffe pick-up. *Push-pull output.
Pendona Wireless Co., 3, Edmond Street, Birmingham.	Pandona S.C. IV.P.	Self-contained	—	—	TA	LG	TC	TC	—	Two	CC	30	15×19 ×10	24 3 0	Including valves, batteries and loud speaker. Screened-grid H.F., pentode output.
F. D. Phillipps, 42a, Catharine Street, Liverpool.	Classic Three	Self-contained	—	—	—	LG	RC	TC	—	One	CC	—	18×14 ×10	14 0 0	Price with valves and batteries.
,, ,, ,,	Classic Screened Three	,,	—	—	TA	LG	TC	—	—	Two	CC	—	18×14 ×10	16 0 0	Screened-grid. Price with valves and batteries.
Portable Utilities Co., Ltd., The, Eureka House, Fisher Street, London, W.C.1.	Orth-o-dyne 3	Portable	—	—	TA	LG	TC	—	—	Two	CC	30	15½×12½ ×9½	27 6 0	Complete. Screened-grid H.F., pentode L.F. Wave range, 200–550 metres.
	,, 3	Transportable	—	—	TA	LG	TC	—	—	Two	CC	38	17×14½ ×12	27 6 0	Complete. Screened-grid H.F., pentode L.F. Wave range, 1,000–1,900 metres.
,, ,, ,,	,, 5	Portable	—	Ap	Ap	LG	TC	TC	—	One	CC	30	15½×12½ ×9½	33 12 0	Complete.
,, ,, ,,	,, 5	Transportable	—	Ap	Ap	LG	TC	TC	—	One	CC	38	17×14½ ×12	33 12 0	,,
Price & Co., Alexander, 11, Hart Street, New Oxford Street, London, W.C.2.	Classic III.	Portable	—	—	TA	LG	TC	—	—	One	CC	27	16×16 ×6	17 6 0	Complete. Wave range, 250–550 metres.
Pye & Co., W. G., Montague Road, Cambridge.	No. 25	Portable	—	Ap	Ap	LG	TC	TC	—	One	SC	30	8½×16½ ×16½	23 10 0	Inclusive of all accessories.
,, ,, ,,	Presentation Two	Self-contained, type 275	—	—	—	LG	TC	—	—	One	CC	19	15×14 ×8	13 0 0	Inclusive of all accessories and Celestion speaker.
R. I. & Varley, Ltd., 103, Kingsway, London, W.C.2.	Mains Receiver	Self-contained	—	—	TA	AB	RC	TC	—	One	CC	—	19¼×13¾ ×15	35 0 0 29 0 0	A.C. } Complete with valves and elim- D.C. } inator. Screened-grid H.F.
Radiocraft Supplies, Ltd., 9, The Arcade, Walsall, S. Staffs.	Peter Pan	Self-contained	—	—	—	AB	TC	—	—	One	CC	—	14×8×8	5 15 0	Including valves (pentode) and batteries.
,, ,, ,,	Consol	Transportable	—	—	TA	AB	TC	—	—	Two	—	—	36×18 ×18	26 5 0	Complete with valves (screened-grid and pentode), batteries and loud speaker.
Radio Supply Co., Superfone Works, Four Oaks, Birmingham.	Superfone Maxum Portable 5.	Self-contained, mahogany cabinet.	—	Ap	Ap	LG	TC	RC	—	One	CC	—	14½×17½ ×8¾	26 5 0	With batteries and loud speaker.
Read & Morris, Ltd., Castle Street, Oxford Street, London, W.1.	Boudoir D.C. Three	Self-contained	—	—	—	LG	RC	TC	—	One	SC	—	18×14 ×12	22 10 0	Complete with valves and D.C. eliminator.
,, ,, ,,	Simplicity Mains Two	,,	—	—	—	LG	TC	—	—	One	SC	—	16×10 ×9½	20 0 0	Complete with valves and A.C. eliminator.
,, ,, ,,	Melody Master	Self-contained floor cabinet	—	TT	TT	AB	RC	TC	—	One	CC	—	31×25 ×24	75 0 0	A.C. mains model with valves and eliminator for M.C. loud speaker
,, ,, ,,	Lone Star Overseas Four	Self-contained teak cabinet	—	—	TA	LG	RC	TC	—	Two	CC	—	27×9 ×14	37 10 0	A.C. eliminator, £12 extra, or including short wave adaptation, £52. Complete screened-grid H.F.
Read Radio, Ltd., 32, Newman Street, Oxford Street, London, W.1.	Reaco	Portable	—	Ap	Ap	LG	TC	TC	—	One	CC	24	—	26 0 0	Complete with loud speaker.
	Real	Transportable	—	Ap	Ap	LG	TC	TC	—	One	CC	—	—	35 2 6	,, ,, ,,
Redcliffe Radio Mfg. Co., 91A Temple Street, Bristol.	Redcliffe V.	Portable	—	Ap	Ap	LG	TC	TC	—	One	CC	32	18×18 ×7	27 15 0	With valves and Batteries. Pentode L.F. if required.

Manufacturer.	Trade Name of Set.	Type.	Valves. H.F.	H.F.	H.F.	D.	L.F.	L.F.	L.F.	No. of Tuning Controls (excluding Reaction).	Reaction.	Weight.	Dimensions.	Price (including Royalties).	Remarks.
												lbs.	in.	£ s. d.	
Rees Mace Manufacturing Co., Ltd., 39a, Welbeck Street, London W.1.	Screened Five	Self-contained	—	TA	Ap	LG	TC	TC	—	Two	CC	33	17½×16½×8½	35 14 0	With valves and batteries, screened-grid H.F.
	Grand Five	"	—	Ap	Ap	LG	TC	TC	—	One	CC	38	20½×19½×9¾	35 14 0	With valves and batteries.
	Medium Five	"	—	Ap	Ap	LG	TC	TC	—	One	CC	30	17½×16½×8½	28 7 0	" " "
	Baby Grand Five	"	—	Ap	Ap	LG	TC	TC	—	One	CC	30	15¼×14½×8½	26 5 0	" " "
	Pentode Three	"	—	—	Ap	LG	TC	—	—	One	CC	29	15¼×14½×8½	19 19 0	" " " pentode L.F
Rialton Radio (H. & S. Scott, Ltd.), 27, Old Bond Street, London, W.1	Rialton IV.	Portable	—	Ap	Ap	LG	TC	—	—	One	CC	—	12×9×19	19 19 0	Uses pentode valve.
	Melva V.	Transportable	TA	TA	TA	LG	TC	—	—	Two	—	—	17×18×9	42 0 0	Three screened-grid stages and pentode. Complete with valves and batteries.
Ridged Cone Co., Ltd., York House, Southampton Row London, W.C.1.	Majestic	Self-contained	—	Ap	Ap	LG	TC	TC	—	One	CC	30	9×14½×17¾	23 10 0	Complete with valves, batteries and loud speaker.
The Rothermel Corporation Ltd., 24–26, Maddox Street, London, W.1	Rothermel Gembox	Self-contained	—	TT	TT	LG	TC	TC	—	One	—	—	—	25 0 0	A.C. mains operated. Wave range, 250–550 metres.
	Rothermel Showbox	"	TT	TT	TT	LG	TC	TC*	—	One	—	—	18×11×7½	37 10 0	A.C. mains operated. *Push-pull output. Wave range 250–550 metres.
Royal Radio Co., 4–5, Dorset Mews North, Upper Gloucester Place, London, N.W.1.	Royal 3	Suitcase Portable	—	—	—	LG	RC	TC	—	One	CC	23	14¾×14¾×9	12 12 0	Complete with valves, batteries and loud speaker. Wave range 250–650 metres.
	" 4	" "	—	—	Ap	LG	RC	TC	—	One	CC	23½	14¾×14¾×9	13 13 0	" " " "
	" 5	" "	—	Ap	Ap	LG	RC	TC	—	One	CC	24	14¾×14¾×9	14 14 0	" " " "
	" 5. De Luxe	" "	—	Ap	Ap	LG	RC	TC	—	One	CC	24	14¾×14¾×9	15 15 0	" " " " Wave range 250–650 and 950–2,000 metres.
Selectors, Ltd., 1, Dover Street, London, W.1.	Screened Grid Three	Self contained	—	—	TA	LG	TC	—	—	Two	—	24	7×12×16½	21 0 0	Complete with valves and batteries Screened-grid H.F.
	Attaché Case. Five	"	—	Ap	Ap	LG	TC	TC	—	One	CC	28	13×13½×8½	31 10 0	Complete with all accessories. Provision for gramophone pick-up.
	Cabinet Five	"	—	Ap	Ap	LG	TC	TC	—	One	CC	28	17×17×7	31 10 0	Price includes all accessories, including cover.
	Super Seven Portable	"	*	*	*	LG	TC	TC	—	—	—	50	18×18×8	54 12 0	*7-valve super-heterodyne. Provision for gramophone pick-up.
Sherman, P., Criterion Works, 12, Criterion Mews, Holloway, London, N.	Claremont Automatic	Self-contained. Clock or console type.	—	—	—	—	—	—	—	Two	CC	—	—	75 0 0	Four valves 1-v-2. Switches on and off at predetermined times, acts as clock and drives other clocks, automatically charges batteries.
	" III	Self-contained pedestal cabinet	—	—	—	—	—	—	—	Two	CC	16	—	15 10 0	Three valves 1-v-1. Complete with valves batteries and loud speaker.
	" IV.	Self-contained	—	—	—	—	—	—	—	Two	CC	—	—	35 0 0	Four valves 1-v-2. Includes pick-up, gramophone and moving coil loud speaker.
Stratton & Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.	Eddystone Scientific Portable Three.	Portable	—	—	TA	LG	TC	—	—	Two	CC	34	15¼×15¼×10	26 15 0	Price includes all accessories and loud speaker. Screened-grid H.F. and pentode L.F.
Victor Portable Wireless Co., Ltd., Charterhouse Chambers, Charterhouse Square, London, E.C.	Nustyle Five	Self-contained set and Gramophone.	—	Ap	Ap	LG	TC	TC	—	One	CC	35	17×18×10	19 19 0	Complete with all accessories, and gramophone pick-up, also voltmeter.
	Super Six	Self-contained	*	*	*	*	TC	—	—	Two	CC	35	9×18×20	30 0 0	*6-valve super-heterodyne. Price includes all accessories 2 screened-grid H.F., pentode L.F.
	Victor Three	"	—	—	TA	LG	TC	—	—	Two	CC	32	14×16×10	17 17 0	Price includes all accessories. Screened-grid H.F., pentode L.F.
	Victor Five	"	—	Ap	Ap	LG	TC	RC	—	One	CC	—	17×17×8½	16 16 0	Including cover.
Whittingham Smith & Co., 110, Kew Green, Kew.	Portadyne Junior	Self-contained cabinet	—	Ap	Ap	LG	RC	TC	—	One	CC	26	14½×12×8	19 19 0	With valves and batteries.
	Portadyne F	"	—	Ap	Ap	LG	TC	TC	—	One	CC	30	17×14×8½	31 10 0	" " "
Wingrove & Rogers, Ltd., Arundel Chambers 188–189, Strand, London, W.C.2.	Polar Portable	Wooden case	—	Ap	Ap	LG	TC	TC	—	One	CC	36	17½×16½×8½	27 6 0	With valves and batteries.
	Polar IIIA	"	—	—	—	LG	RC	TC	—	One	CC	14½	10×16½×11½	11 18 6	" " " Pentode L.F if desired.

PROGRAMMES FROM ABROAD

SATURDAY, NOVEMBER 17th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (**344.8 metres**); 1.5 kW.—**6.0,** Market Report and Exchange Quotations. **6.10,** Sextet Selections: Pasacalle, Sabor de España (Fuste); Le charme étrange (Ackermans); Romance (Calvo); Waltz, Charmaine (Parés); Selection from Benamor (Luna). **8.30,** Advanced French Lesson by Prof. Martin. **9.0,** Chimes and Weather Report. **9.5,** Exchange Quotations and News. **9.10,** Orchestral Concert: March, On the Quarter Deck (Alford); Selection from Gigantes y Cabazudos (Caballero); Ritmos de España (Raurich); Demande et réponse (Coleridge-Taylor); Intermezzo (d'Ambrosio); Czardas (Monti). **10.0,** Programme relayed from **Madrid,** EAJ7.

BERLIN (Königswusterhausen) (**1,250 metres**); 40 kW.—**3.0,** Talk by Prof. Lampe. **3.30,** Programme from **Hamburg.** **4.30,** Herr Falkenberg, Talk: An Official's Leisure. **5.0,** The "Eternal Source"—Dialogue by Fritz Ramin and a Waterworks Employee. **5.30,** Elementary Spanish Lesson. **5.55,** Dr. Elias Hurwicz, Talk: The Russian World. **6.20,** Herr Haase-Faulenorth, Talk: Genealogy. **7.0,** Orchestral Concert: Overture to Jessonda (Spohr); Romance in F Major for Violin (Beethoven); Selection from Czar and Carpenter (Lortzing); Peer Gynt Suite No. 1 (Greig); Overture to Tannhäuser (Wagner); Dance Suite from The Bartered Bride (Smetana); Violin Solo, Zigeunerweisen (Sarasate); Waltz, Wiener Blut (Joh. Strauss). Followed by News and Dance Music from **Voxhaus.**

BERLIN (Voxhaus) (**484 metres**); 4 kW.—**9.10 a.m.,** Market Prices. **9.15 a.m.,** Weather Report, News and Time Signal. **10 a.m.,** Programme of Gramophone Records. **10.30 a.m.,** Exchange Quotations. **11.55 a.m.,** Time Signal. **12.30,** Weather Report and News. **1.0,** Programme of Gramophone Records. **2.0,** Exchange Quotations. **2.10,** Agricultural Report and Time Signal. **3.0,** Legal Talk by Dr. Karsen. **3.30,** Concert from the Kristall-Palast-Lichtspielhaus: Klänge aus Opern; Vision (Gounod); O Lass dich halten, gold'ne Stunde (Jenssen); Nebraska (Revel-Sissle); My Blue Heaven (Donaldson); Ich küsse ihre Hand, Madame (Erwin); Firefly (Nicholls). **4.0,** Talk on Music, followed by Orchestral Concert and Advertising Notes. **5.10,** Advertising Talk by Max Hansen. **5.30,** Dr. Erich Schrader, Talk: War on Rats! **6.0,** Wolfgang Schwarz: Talk: War and Peace under Capitalism. **6.30,** Kurt Lubinski, Talk: Coming Lands of the East—With Wife and Camera in Siberia. **7.0,** "With the Microphone through Berlin," followed by Weather Report, News, Time Signal, Sports Notes and Dance Music. **11.30** (approx.), Close Down.

BERGEN (**370.4 metres**); 1.5 kW.—**5.30,** Programme for Girls. **6.0,** Programme for Children. **7.0,** Orchestral Concert. **7.50,** Topical Talk. **8.0,** Song Recital: Air (Sinding); Min tanke er et maegtig fjeld (Greig); Zueignung (R. Strauss); Der Wanderer (Schubert); Air from Hérodiade (Massenet). **8.30,** Sig. Stinessen, Talk: Walking Tours and What to Wear on Them. **9.0,** Weather Report, News and Time Signal. **9.15,** Dance Music. **11.0** (approx.), Close Down.

BERN (**411 metres**); 1.5 kW.—**6.29,** Time Signal and Weather Report. **6.30,** Schubert Recital, relayed from the Bern Münster; Memorial Talk; German Mass; Three Contralto Solos; Choral Selections, (a) Grab und Mond, (b) Sehnsucht; Four Contralto Solos; Wehmut; Salve Regina; Song of the Spirits over the Water. **8.45,** News and Weather Report. **9.0,** Orchestral Selections. **9.35,** Dance Music. **11.0** (approx.), Close Down.

BRESLAU (**322.6 metres**); 4 kW.—**3.0,** Review of Books. **3.30,** Orchestral Concert. **5.0,** Talk relayed from **Gleiwitz** (329.7 metres). **5.25,** Esperanto Talk by Alfred Hanuschke. **5.35,** Dr. Eberhard Peter, Talk: Irregular Teeth and their Prevention. **6.20,** Legal Shorthand Lesson. **6.50,** Talk on Queen Elizabeth. **7.15,** Military Concert: Coronation March from Die Folkunger (Kretschmer); Overture to Maritana (Wallace); Two Movements from the Military Symphony No. 11 in G Major (Haydn—arr. Hackenberger); Slavonic Rhapsody (Friedemann); Selections (Stiebewitz), (a) Hoch Danzig March, (b) Heimatgrüss; Selections (Suppé), (a) Uber Berg und Tal, (b) Teufelsmarsch, (c) Morning, Noon and Night Overture, (d) Song, Das Vergissmeinnicht; Waltz on motives from The Count of Luxembourg (Lehár); Selection from The Merry Widow (Lehár). **9.0,** Announcements, followed by Dance Music relayed from **Gleiwitz.** **11.0** (approx.), Close Down.

BRÜNN (**441.2 metres**); 3 kW.—**3.30,** Programme for Children. **4.30,** Talk: The Principles of Music. **4.45,** German Transmission: Fantasia Op. 159 in C Major (Schubert). **5.15,** Weekly Report. **5.55,** Programme from Prague. **9.25,** Dance Music relayed from **Bratislava** (300 metres).

BRUSSELS (**508.5 metres**); 1.5 kW.—**5.0,** Orchestral Concert from the Palace Hotel. **6.0,** Elementary English Lesson. **6.25,** Intermediate English Lesson. **6.45,** Spanish Symphony (Lalo). **7.0,** Gramophone Selections of Dance Music. **8.15,** Gala Concert. **9.0,** Topical Talk. **9.10,** Concert (continued). **10.10,** News and Announcements. **10.15,** Dance Music by the Orchestra of the Palace Hotel. **11.0** (approx.), Close Down.

BUDAPEST (**556.6 metres**); 20 kW.—**3.45,** Time Signal, Weather Report and News. **4.10,** Literary Talk. **5.15,** Talk: The World of the Biedermeyer, with Illustrations. **6.0,** Cabaret Concert. **8.0,** Time Signal and News. **8.15,** Selections by Therese Koszeghy (Vocalist) and Tibor Polgár (Pianist). **8.55,** Orchestral Concert. **10.0,** Selections of Tzigane Music from the Café Spolarich.

CRACOW (**566 metres**); 1.5 kW.—**4.10,** Mr. W. Molé, Talk: Art in the Christian Catacombs. **4.35,** Mr. Adam Abdank, Talk: Historical Personages in the Anecdotes of their Period—the XVIth Century. **5.0,** Programme from **Warsaw.** **6.0,** Miscellaneous Items. **6.25,** English Reading by Mr. Jean Stanislawski. **6.55,** Time Signal from the Observatory. **7.0,** Agricultural Report. **7.5,** Mr. J. Regula, Talk: Review of Foreign Politics during the Last Week. **7.30,** Programme from **Warsaw.** **9.30,** Restaurant Concert. **10.30** (approx.), Close Down.

DUBLIN, Call 2RN (**319.1 metres**); 1.5 kW.—**1.30,** Weather Report and Gramophone Selections. **7.20,** News. **7.30,** Health Talk by Mrs. A. Russell, M.B. **7.45,** Irish Lesson by Seamus O'Duirinne. **8.0** Pib Uileann by Leo Rowsome. **8.15,** Amhrain Ghaedhilge by Padraig MacGreinne. **8.30,** Selections by the Station Orchestra. **9.0,** Talk. **9.20,** Programme by the Top Knots Concert Party. **10.0,** Opera Selections by Mamie Dingle (Soprano) and the Station Orchestra. **10.30,** News, Weather Report and Close Down.

FRANKFURT (**428.6 metres**); 4 kW.—**12.15,** Orchestral Concert. **2.5,** Programme for Children. **2.55,** Hints for the Housewife, by Fini Pfannes. **3.35,** Orchestral Programme of Old Dance Music. In the Interval, Wireless and other Announcements. **5.10,** O. W. Studtmann reads from the Novel "On Two Planets" (Lasswitz). **5.30,** The Letter Box. **5.45,** Ernst Engelbrecht, Talk: Sicily and Tripoli. **6.15,** Ing. Schweitzer, Talk: The Economic and Political Importance of Trade Unions. **6.45,** Dr. Galliner, Talk: Impressions of the International Congress for Art Education in Prague. **7.15,** Gala Concert, followed by Dance Music from **Voxhaus.** **11.30** (approx.), Close Down.

HAMBURG, Call HA (in Morse), (**394.7 metres**): 4 kW.—**9.15 a.m.** News. **10.0 a.m.,** Programme of Gramophone Records. **11.10 a.m.,** Weather Report. **11.15 a.m.,** Exchange Quotations. **11.30 a.m.,** Concert relayed from **Hanover** (297 metres). In the Interval at **11.55 a.m.,** Time Signal. **12.10,** News **1.40,** Exchange Quotations. **2.30,** Review of Books. **3.0,** Illustrated Music Talk by Dr. Wilh. Heinitz. **3.30,** Programme from **Königswusterhausen.** **4.30,** Request Programme. **5.30,** Prof. Walter, Talk: The Development of Social Thought. **6.0,** Director Margolis, Talk: The Hamburg Municipal Heating System. **6.55,** Weather Report. **7.0,** Concert by Child Artistes; Edgar Pos-Carloforti (Age 12—Vocalist), Hans Herbert Winkel (Age 13—Pianist), and Horst Thiem (Age 9—Violinist); Songs, (a) The Nightingale (Alabieff), (b) The Virgin's Cradle Song (Max Reger); Pianoforte Solos, (a) Romance in F Minor Op. 5 (Tchaikovsky), (b) Prelude in D Sharp Major (Chopin), (c) Novelette in F Major (Schumann); Violin Solos, (a) Concertino in D Major, Op. 54 (Jansa Sitt), (b) Minuet (Beethoven), (c) Ständchen (Schubert), Songs (a) Variations (Proch), (b) Last Rose from Martha (Flotow). **8.30,** Concert for Brass Instruments: March, Hoch Heidecksburg (Herzer); Overture to Die Fledermaus (Strauss); Waltz, Winter Storms (Fucik); Selections from Cavalleria Rusticana (Mascagni); Minuet (Paderewsky); Army March No. 7. **9.30,** Weather Report, News, Sports Notes, and Programme Announcements, followed by Cabaret Concert. **10.50,** North Sea and Baltic Weather Reports.

HILVERSUM (**1,071 metres**); 5 kW.—**11.40 a.m.,** Police Announcements. **12.10,** Concert of Trio Music. **1.40,** Programme relayed from the Colonial Institute, **Amsterdam,** The Tenth Anniversary of the Citizen Guard. **3.40,** Italian Lesson. **4.40,** French Lesson. **5.10,** Orchestral Concert: Prince Methusalem (Joh. Strauss); Waltz, Dynamiden (Joh. Strauss); Mariette Coquette (Ancliffe); Major and Minor (Schreiner); Mighty like a rose (Nevin); Selection (Dostal); Finale. **6.10,** German Lesson. **7.25,** Police Announcements. **7.45,** Programme organised by the Workers' Radio Society—Concert and Talk. **11.15** (approx.), Close Down.

HUIZEN (**340.9 metres**); 4 kW.—Transmits on 1,870 metres from 5.40 p.m.—**12.10,** Concert of Trio Music. **2.40,** Programme for Children. **5.10,** Gramophone Selections. **6.10,** Talk by M. v. Roosmalen. **6.30,** Catholic Bulletin. **6.40,** English Lesson. **7.10,** Lesson in Dressmaking. **7.40,** Orchestral and Choral Concert, followed by Talk. **10.10,** Orchestral Selections from the Royal Cinema, **Amsterdam.**

JUAN-LES-PINS (Radio L.L.) (**244 metres**); 1.5 kW.—**1.0,** Orchestral Concert. **9.0,** News, Talk for Women and Concert. **10.0** (approx.), Close Down.

KALUNDBORG (**1,680 metres**); 7 kW.—Programme also for **Copenhagen** (337 metres).—**6.30 a.m.,** Morning Gymnastics. **10.0 a.m.,** Weather Report. **11.0 a.m.,** Chimes from the Town Hall. **11.5 a.m.** (approx.), Orchestral Concert from Wivel's Restaurant. **2.0** Programme for Children. **2.30,** Orchestral Concert: In the Interval—Recitations by Ingeborg Hagelberg. **5.20,** Arthur G. Haasö, Talk: The Copenhagen Fire Insurance. **5.50,** Weather Report. **6.0,** News and Exchange Quotations. **6.15,** Time Signal. **6.30,** Dr. M. Neiiendam, Talk: The History of the Danish Church. **7.0,** Chimes from the Town Hall. **7.2,** Talk and Reading on Rome, by Mr. P. A. Rosenberg. **8.0,** News. **8.15,** Radio Cabaret by Aÿoe Willumsen, Erna Schroder, and Axel Boesen. **9.45,** Dance Music by the Orchestra of the Industri Restaurant. **11.0,** Chimes from the Town Hall. **11.15** (approx.), Close Down.

KATTOWITZ (**422 metres**); 10 kW.—**2.45,** Financial Report. **3.0,** Concert of Gramophone Selections. **4.10,** Music Lesson by Prof. F. Sachse. **4.35,** Children's Letter Box. **5.0,** Programme for Children. **6.0,** Announcements. **6.30,** Talk by Mr. R. Sumowski. **6.56,** Time Signal. **7.0,** Mr. K. Rutkowski. Talk: Impressions of a Journey to Greece. **7.30,** Programme from **Warsaw.** **9.0,** Weather Report and News. **9.30,** Dance Music.

KAUNAS (**2,000 metres**); 7 kW.—**3.0,** Instrumental Concert: Valse Mélancholique (Berlin); Overture from the First Suite (Becce); Sehnsucht (Tchaikovsky); Temptation Rag-Jazz (Lodge); Mädchenstraum (Faustini); Spanish Intermezzo, Los Banderileros; 'Cello solo, Elégie (Fauré); Die Nachtigal (Hofmekler); Valse triste (Sibelius); Fair Women from Valencia (Morena); Poème (Fibisch); Neues Leben-March. **4.15,** Agricultural Talk by Herr Strazdas. **4.45,** Announcements. **5.30,** News. **6.0,** Weather Report. **6.15,** Aviation

Programmes from Abroad.—

Notes. **6.45,** Musical Interlude. **7.30,** Mr. J. Slapsinskas, Talk: The Co-operation of the People and the Intelligentzia. **8.0,** Variety Programme. **8.30,** Dance Music and Miscellaneous Items.

LAHTI (1,522.8 metres); 35 kW.—**4.0,** Orchestral Selections: Military March; Valse (Waldteufel); Mephistopheles (Boito); Valse (Melartin). **4.35,** Talk. **4.57,** Time Signal, Weather Report and News. **5.15,** Orchestral Selections from Madame Butterfly (Puccini). **5.40,** Talk. **6.0,** Programme by Paavo Kiuku (Elocutionist) and Aapo Similä (Vocalist). **6.40,** Orchestral Selection. **7.0,** Song from The Merry Widow (Lehár). **7.10,** Orchestral Selection, Rondo and Caprice (Beethoven). **7.20,** Songs (a) La Bayadère (Kálmán), (b) Viennese Waltz (Strauss). **7.30,** Orchestral Selection, Overture to The Thieving Magpie (Rossini). **7.45,** News in Finnish and Swedish and Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-le-Chapelle** (400 metres), **Cologne** (283 metres), and **Münster** (250 metres).—**10.10 a.m.,** Talks: The Choice of Careers for Girls. **11.10 a.m.,** Gramophone Selections. **12.5,** Orchestral Concert. **1.30,** Hints for the Housewife. **2.40,** Herr. P. Brüls, Talk: The Basis of Wireless Technology—the Electric Current. **3.0,** Talk for Young Men, by Herr C. Schlossmacher. **3.25,** Dr. Emmy Wingerath, Talk for Women: The Third Generation of the Feminist Movement. **3.55,** Dr. Huber, Talk: Pictures from Ancient Babylon. **4.20,** English Lesson by Prof. F. Hase. **4.45,** Trio Concert: First Movement from the Trio in C Major (Mickenschreiber); Guitar Solos (Albert), (a) Minuet, (b) Mandolinata, Two Dances in Old Style for Trio (Jaap Kool); Zither Solos, (a) Romance (Mickenschreiber), (b) Waltz Intermezzo (Kollmaneck); Trio Selection, Huldigung (Mickenschreiber). **5.30,** Herr W. Stern, Talk: Building and Architectural Problems of Large Towns. **6.15,** Talk: Social Problems of Cities. **6.40,** Dr. Otto Förster, German Cathedrals. **7.0,** Variety Concert: "Birds from my Garden"; "Der Papagei"—Intermezzo (Müller-Schlösser). **9.30** (approx.), News, Sports Notes, Business Announcements, Orchestral Selections and Dance Music. **12.0 Midnight** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—**3.30,** Concert by the Station Orchestra: Overture to Athalie (Mendelssohn); Selections from Cavalleria Rusticana (Mascagni); In dämmernder Mondnacht (Eluken); Selections from The Mikado (Sullivan); Waltz, In einem kühlen Grunde (Siede). **4.45,** Wireless News and Talk. **5.20,** Weather Report, Time Signal and Labour Exchange Report. **5.30,** Programme from **Königswusterhausen. 6.0,** Josef Greff, Talk: Psycho-Analysis. **6.30,** Prof. Hermberg, Talk: Modern Socialism. **7.0,** Variety Programme. **9.0,** News, Programme Announcements, and Sports Notes. **9.30,** Dance Music from the Lunapark, **Leipzig.**

MADRID (Union Radio), Call EAJ7 **(375 metres)**; 3 kW.—**7.0,** Chimes and Concert by the Station Sextet: Selection from La Tuna de Alcalá (Rivas and Redondo); Selection from The Puritans (Bellini); Selection from El sueño de Pierrot (Barrera); Interlude by Luis Medina. **8.0,** Dance Muisc from the Alkázar. **8.25,** News and Announcements. **9.45,** Weekly Market Report. **10.0,** Chimes and Selection from "La Fiesta de San Antón"—Musical Comedy, followed by News. **12.30 a.m.** (approx.), (Sunday), Close Down.

MILAN, Call 1MI **(549 metres)**; 7 kW.—**7.15,** Time Signal. **7.17,** Announcements. **7.35,** Time Signal and Illustrated Talk on Verdi. **7.45,** News. **7.50,** Concert of Vocal and Instrumental Selections. In the Interval, Reading by Angele Sodini. **9.55,** News. **10.0,** Musical Selections from the Fiaschetteria Toscana. **10.45** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Böden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres), **Sundsvall** (545.6 metres).—**4.0,** Concert of Light Music by Wertheimer's Viennese Orchestra from the Meeth Tea Rooms, **Göteborg. 5.0,** Programme for Children—"The Swine Herd" (Hans Andersen). **5.45,** Selection of Old Time Dance Music. **6.45,** Pianoforte Recital from the Works of Greig: Fjärlin; The Lonely Wanderer; In the Home Town; Little Bird; Erotica; To Spring. **7.0,** Selection of Sea Shanties. **8.0,** Topical Talk. **8.45,** Dance Music from the Restaurant Riche. **11.0** (approx.), Close Down.

NAPLES, Call 1NA **(333.3 metres)**; 1.5 kW.—**7.30,** Wireless Notes. **7.40,** Announcements. **7.50,** News. **7.55,** Harbour Notes. **8.0,** Time Signal. **8.2,** Concert of Chamber Music and Theatre Music. In the Intervals, "Occhi a Lutto"—Comedy (Quintero) and "Banco"—Comedy (Monicelli). **9.0,** Review of the Fourth Act of "La Wally"—Opera (Catalani); Review of Art and Literature by Lucio D'Ambra; Selection from "The Huguenots"—Opera (Meyerbeer). In the Interval, Talk for Women. **9.50,** News. **10.0** (approx.), Close Down.

Saturday, November 17th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

Week. **9.50,** News. **9.55,** Calendar and Programme Announcements. **10.30,** Close Down.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres) and **Rjukan** (448 metres).—**5.0,** Programme for Children. **6.0,** Children's Birthday Greetings. **6.15,** Weather Report, News and Agricultural Prices. **6.30,** Mr. L. Funder, Talk: Bread. **7.0,** Time Signal and Orchestral Concert: Prelude to Lohengrin (Wagner); Selection from Carmen (Bizet); Intermezzo and Drinking Song from Cavalleria Rusticana (Mascagni); Selection from Madame Butterfly (Puccini); Air from Samson and Delilah (Saint-Saëns); Selection from The Nuremberg Doll (Adam); Ballet Music from Faust (Gounod). **8.15,** Topical Talk. **8.30,** Second Act of the Revue from "Le Chat noir" Cabaret. **9.45,** Weather Report and News. **10.0,** Dance Music from the Grand Hotel. **11.0** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT **(458 metres)**; 0.5 kW.—**6.30,** "Radio-Journal de France." **8.0,** Talk arranged by the Union des Grandes Associations. **8.15,** Talk on Social Hygiene. **8.30,** Concert arranged by the Auditeurs de T.S.F., followed by Dance Music from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL **(2,650 metres)**; 5 kW.—**5.0,** Pasdeloup Concert. **7.10,** Weather Report. **7.30,** "Le Journal Parlé."

PARIS (Petit Parisien) **(340.9 metres)**; 0.5 kW.—**8.45,** Gramophone Selections, Talk, News and Announcements. **9.0,** Concert: Overture to Surcouf (Planquette); Suite, La Jeunesse joyeuse (Coates). **9.25,** News. **9.30,** Symphony Concert: Spanish Caprice (Rimsky-Korsakoff); Shylock (Fauré); Suite, Mes filles reçoivent (Cools); Suite of Viennese Waltzes (Gilson); Highlanders' March from Scènes écossaises (Godard).

PARIS (Radio-Paris), Call CFR **(1,759 metres)**; 5 kW.—**12.30,** Concert of Gramophone Selections: Fox-Trot, Just like a Melody out of the Sky, by Paul Whiteman and his Orchestra; Fox-Trot, Because my Baby don't mean "may be" now, by Paul Whiteman and his Orchestra; Song, Ramona, by Chick Endor; Jeux d'eau (Eavel); Pianoforte Interlude by M. Robert Casadesus; Air from Thaïs (Massenet); Air from Der Wanderer (Schubert); Orchestral Selection from The Flying Dutchman (Wagner), under the direction of Bruno Walter; The Unfinished Symphony (Schubert). **1.0,** News and Exchange Quotations. **1.15,** Concert (continued). **2.0,** Exchange Quotations, Market Prices and Religious Information. **3.45,** Dance Music by the Joss Ghislery Symphonians. News in the Intervals. **7.0,** Agricultural Report. **7.45,** Talk arranged by the Union des Grandes Associations françaises, All the Religious Powers of the World against War. Followed by Market Prices. **8.15,** Concert arranged by "Le Matin": Symphony Music; 'Cello Solos, (a) Adagio and Allegro (Boccherini); Concerto in D Minor (Bach); Selections (de Flers-Caillavet-Terrasse). News in the Intervals.

POSEN (344.8 metres); 1.5 kW.—**4.45,** Talk: Scouts. **5.0,** Programme for Children, relayed from **Warsaw. 6.0,** Talk by Mr. Stürmer. **6.25,** Advanced English Lesson by Dr. Arend. **6.50,** Talk for Women by Mme. Sabina Swidzinska. **7.10,** Finance Report. **7.30,** Programme from **Warsaw. 9.0,** Time Signal, Miscellaneous Items, News and Weather Report. **9.30,** Cabaret Programme. **11.0,** Concert arranged by La Maison Philipps. **1.0 a.m.** (approx.) (Sunday), Close down.

PRAGUE (348.9 metres); 5 kW.—**2.45,** Programme for Children. **3.10,** Programme for Women. **3.20,** Public Instruction. **3.30,** Pianoforte Recital. **4.30,** Public Instruction. **4.40,** Talk for Workers. **4.50,** Agricultural Report. **5.0,** German Programme: Lyrical Poetry during the Ten Years of the Czecho-Slovakian Republic. **5.55,** Opera Relay from the National Theatre. **9.0,** Time Signal and News. **9.20,** Dance Music.

ROME, Call 1RO **(447.8 metres)**; 3 kW.—**7.29,** Announcements. **7.30,** Time Signal. **7.45,** The

SCHENECTADY, Call 2XAD and 2XAF **(21.96 and 31.4 metres)**; 30 kW.—**12.0 Midnight,** Statler's Pennsylvanians, directed by Johnny Johnson, from **New York. 12.30 a.m.** (Sunday), Concert from the Hotel Sagamore, **Rochester. 1.0 a.m.,** Concert from the Onondaga Hotel, **Syracuse. 1.30 to 4.0 a.m., New York** Relay. **1.30 a.m.**, "The Park Bench." **2.0 a.m.,** Symphony in Brass. **3.0 a.m.,** Lucky Strike Programme. **4.0 a.m.,** Time Signal and Dance Music from the Hotel vau Curler. **5.0 a.m.** (approx.), Close Down.

STAMBOUL (1,200 metres); 5 kW.—**5.15,** Concert of Turkish Music. **7.30,** Weather Report and Time Signal. **7.40,** Concert: Symphony No. 4 (Mozart); Songs: Romance from the Symphony No. 4 (Schumann). **9.0,** News and Announcements. **9.10** (approx.) Close Down.

STUTTGART (379.7 metres); 4 kW.—**5.0,** Time Signal and Weather Report. **5.15,** Legal Talk by Herr L. Leibfried. **5.45,** Dr. H. von Bronsart, Talk: New Ways of Protecting Plants. **6.15,** Dr. H. Wolff; Talk, American Book-keeping. **6.45,** Time Signal and Sports Notes. **7.15,** 'Cello Recital by Edmund Kurtz: Sonata (Brewald); Concerto (Haydn); Air (Bach); The Bee (Schubert); Goescas (Granados); Scherzo (Polony), followed by Cabaret Concert: Fox-Trot, Hab' mich Lieb! (Arnold); The Language of Flowers (Benatzky); The Flower Parade (Nelson); Yes, once in the good old times (May); The great love comes only once (May); Fox-Trot, Tabu, "Tommy is not afraid"—Comedy (Tilly Bunzl); Fox-Trot, Ich reiss' mir eine Wimper aus (Raymond); Englein (Knepler); Schlager; Die billige Annette (Benatzky); Humorous Entertainment with Orchestral Interludes, (a) Folies Bergère (Lincke), (b) Waltz, Wine, Woman and Song (Strauss), (c) Pierrot March (Bosc), followed by News. **10.30** (approx.), Dance Music from the Pavillon Excelsior.

TOULOUSE (Radiophonie du Midi) **(391 metres)**; 3 kW.—**12.45,** Concert. **8.0,** Exchange Quotations and News. **8.30,** Orchestral Concert: Napolitana (Lehár); Le Pantin (Stolz); Parade des petits lutins (Noack); Cinderella's Betrothal March (Rhode); Fête au harem (Prichytal); La Fête des gnomes (Hagen). **8.45,** Selections from Lakmé (Delibes). **9.45,** Dance and Accordion Music. **10.0,** Instrumental Selections: Overture to Poet and Peasant (Suppé); Trumpet Solos, (a) Dans la nuit tranquille, (b) Ivresse d'amour; Mandoline Selection from The Millions of Harlequin (Drigo). **10.15,** North African News.

VIENNA (517.2 metres); 15 kW.—**3.0,** Orchestral Concert: Overture to Djamileh (Bizet); Waltz, Red Roses (Lehár); Fantasia, Gounodiana (Rhode); Song, Wenn die Puszta schweigt (Kálmán); DieSpieluhr (Blauw); Aus Offenbachs Musterkoffer (Urbach); Heinzelmännchens Hochzeit—Character Sketch (Köpping); Potpourri, Der Oberstieger (Zeller); March, Heimat, süsse Heimat (Ohlsen). **4.30,** Reading from the Works of Selma Lagerlöf, by Hilda Wegner. **5.30,** Rudolf Osterreicher, Talk: Music, Composers and the Public. **6.0,** Recital of Sonatas, Arpeggione Sonata (Schubert); 'Cello Sonata in A Major, Op. 69 (Beethoven). **7.5,** "Die Kreuzelschreiber"—Comedy in Three Acts (Anzengruber), followed by Orchestral Concert and Phototelegraphy Transmission.

VILNA (435 metres); 1.5 kW.—**2.10,** Concert of Gramophone Selections. **3.10,** News in Lithuanian. **3.30,** Announcements. **3.45,** Talk for Men by Mr. Stanislas Czaplicki. **4.10,** Poem Recital from the Works of Jean Wiktor. **4.35,** Programme from **Warsaw. 5.0,** Literary Programme. **5.45,** Art Talk by Prof. Jules Ktos. **6.10,** News. **6.30,** Programme from **Warsaw.**

WARSAW (1,111 metres); 10 kW.—**4.10,** Talk. **4.35,** Talk by Prof. H. Moscicki. **5.0,** Programme from **Cracow. 6.0,** Miscellaneous Items. **6.30,** "Radio-Chronique" by Mr. M. Stepowski. **6.56,** Time Signal from the Observatory. **7.0,** Agricultural Report. **7.5,** Mr. B. Winawer, Talk: Wireless Construction. **7.30,** "Le Chateau de Czorsztyn" or "Bajomir et Wanda"—Opera (Kurpinsky). **9.0,** Aviation Notes, Weather Report, News, Police Announcements and Sports Notes. **9.30,** Dance Music from the Oaza Restaurant. **10.30** (approx.), Close Down.

ZURICH (588 metres); 1 kW.—**5.0,** Programme of New Gramophone Records. **6.0,** Chimes from the Zürich Churches. **6.15,** Time Signal and Weather Report. **6.17,** Orchestral Concert. **7.0,** Programme relayed from **Vienna. 9.0.** Weather Report and News.

Programmes from Abroad.—

BARCELONA (Radio-Barcelona), Call EAJ1 **(344.8 metres)**; 1.5 kW.—**11.0 a.m.**, Relay of Chimes from the Barcelona Cathedral, followed by Weather Report and Forecast and Aviation Route Conditions. **1.30**, Concert of Popular Music by the Iberia Trio and Gramophone Records in the Intervals. **2.45 to 6.0**, No Transmission. **6.0**, Opening Signal and Stock Exchange Quotations. **6.10**, Vocal and Instrumental Concert, Soprano Solos by Maria Teresa Gonzalez; in the Interval from **7.0 to 7.20**, Agricultural Notes from the Catalonian Agricultural Institute at San Isidro. **8.40**, Sports Notes. **9.0** (approx.), Close Down.

BASLE (1,010 metres); 1.5 kW.—Programme relayed from **Bern**. **7.0**, Concert of Latvian Music. Soprano Solos by Johanna Matthaei. **9.15** (approx.), Close Down.

BERGEN (370.4 metres); 1.5 kW.—**9.30 a.m.**, Relay of Church Service. **11.30 a.m.**, Weather Report and Forecast and General News Bulletin. **7.0**, Concert by the Bergen Wireless Orchestra. **7.20**, Recitation by the Norwegian Actress, Doris Johannessen and Mrs. Jenny Jebsen; "The Wages of Sin," by Hjalmar Meidell. **7.50**, Talk on Current Events. **9.0**, Weather Report and Forecast, Late News Bulletin and Time Signal. **9.15**, Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) **(1,250 metres)**; 40 kW.—**7.55 a.m.**, Chimes, relayed from the Potsdam Garrison Church. **8.0 a.m.**, Choral and Instrumental Music and Address, relayed from **Voxhaus**, and followed by Berlin Cathedral Chimes. **1.30 to 2.25**, Three Agricultural Talks, relayed from **Voxhaus**. **2.30**, Tales for the Young, from **Voxhaus**. **3.0**, Talk from **Voxhaus**. **3.30**, Musical Programme from **Voxhaus**. **5.0 to 7.0**, Talks, arranged by the "Deutsche Welle," followed by Relay of another German Programme. **9.15**, Late News Bulletin and Sports Notes. **9.30**, Dance Music. **11.30** (approx.), Close Down.

BERLIN (Voxhaus) **(484 metres)**; 4 kW.—**7.55 a.m.**, Chimes from the Potsdam Garrison Church. **8.0 a.m.**, Recital of Choral and Instrumental Music and Address in the Interval, followed by Chimes from the Berlin Cathedral. **1.30 to 2.25**, Three Talks for Farmers on Some Practical Hints, The Weekly Markets and Weather Conditions, and The Care of Animals. **2.30**, Stories for Young People. **3.0**, Talk. **3.30**, Instrumental Concert, followed by Advertisements. **5.40 to 7.0**, Three Talks. **7.0**, Popular Entertainment. **8.15** (approx.), Instrumental Programme. **9.15**, Weather Report and Forecast, Time Signal, Sports Notes and Late News Bulletin. **9.30**, Dance Music by the Marek Weber Orchestra. **11.30** (approx.), Close Down.

BERN (411 metres); 1.5 kW.—**10.0 a.m.**, Relay of Schubert Centenary Festival (from **Vienna**). **12.0 Noon**, Time Signal and Weather Report and Forecast. **12.5**, Concert. **6.29**, Time Signal and Weather Report. **6.30**, Reading or Talk. **7.30**, Concert. **8.10** (approx.), Sports Notes, Late News Bulletin and Weather Report, followed by Musical Programme. **9.35** (approx.), Close Down.

BEZIERS (158 metres); 0.6 kW.—**8.30**, Sports News. **8.45**, Concert arranged by "La Maison Relin," Popular Gramophone Records. **10.30** (approx.), Close Down.

BRESLAU (322.6 metres); 4 kW.—Programme relayed by **Gleiwitz** (329.7 metres). **8.15 a.m.**, Chimes relayed from Christ Church. **10.0 a.m.** (approx.), Catholic Recital of Music with Address. **11.0 a.m.**, Instrumental Concert. **1.0**, Guessing Competition. **1.10**, Talk or Literary Selections. **1.35**, Hints for Chess Players by Adolf Kramer. **2.0**, Children's Corner. **2.30**, Agricultural Talk. **6.25**, Weather Report, followed by Talk. **7.30**, "Schlesische Philharmonie" Concert. **9.0**, General News Bulletin. **11.0** (approx.), Close Down.

BRUSSELS (508.5 metres); 1.5 kW.—**10.0 a.m.**, Concert relayed from **Vienna** in commemoration of the Schubert Centenary. "Gott in der Natur"—Hymn for Choir and Orchestra, executed by the Vienna Academy of Singing and Amateur Musical Society. **5.0**, Light Music relayed from the Palace Hotel, Brussels. **6.0**, Entertainment for Children by Bonzo and Sylvia of the Théâtre des Enfants. **6.30**, Instrumental Music by the Station Trio. **7.30**, Le Journal Parlé. **8.15**, Vocal and Instrumental Concert by the Station Orchestra and Artistes of Radio-Belgique. **10.15**, News Bulletin. **10.30** (approx.), Close Down.

BUDAPEST (556.6 metres); 20 kW.—**8.0 a.m.**, News from the Press and Beauty Notes. **9.0 a.m.**, Relay of Sacred Music and Sermon. **11.30 a.m.** (approx.), Concert. **6.40** (approx.), Concert or Relay of an Opera. **9.30**, Selections by a Tzigane Orchestra. **10.30** (approx.), Close Down.

COLOGNE (283 metres); 4 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Langenberg** (468.8 metres) and **Münster** (250 metres).—**7.5 a.m.**, Programme Review in Esperanto by Alfred Dormanns. **7.15 a.m.**, Lute and Guitar Instruction by Olly Wirtz-Koort. **7.35 a.m.**, Esperanto Talk by Alfred Dormanns. **8.0 a.m.**, Relay of Chimes. **8.5 a.m.**, Catholic Festival of Music with Address in the Interval. **9.30 a.m.**, Talk by Fritz Worm on the German Language. **1.30**, Talk on Chess by Dr. van Nüss. **3.30**, Instrumental Concert. **7.0**, "Die Freunde von Salamanca," Musical Play in Two Acts by Schubert; Lyrics by Johann Mayrhofer. Producer: Herr Kühn, Selections by the Zimmermann Choir. Followed by Late News Bulletin, Sports News and Selections of Dance Music. **11.0** (approx.), Close Down.

CORK, Call 6CK **(400 metres)**; 1.5 kW.—**8.30**, Concert in celebration of the Schubert Centenary. Artistes: Signor F. Grossi (Violin); Madame M. Grossi (Pianoforte); and Lucas Bassett (Tenor). **11.0**, National Anthem, and Weather Report and Forecast. **11.15** (approx.), Close Down.

CRACOW (563 metres); 1.5 kW.—**10.0 a.m.**, Programme relayed from **Vienna** in celebration of the Schubert Centenary. **1.0 and 1.20**, Two Talks for Farmers. **1.42**, "La Chronique Agricole," by Dr. St. Wasniewski. **2.15**, Concert relayed from **Warsaw**. **5.35 to 10.0**, Programme relayed from **Warsaw**. **10.0** (approx.), Close Down.

DUBLIN, Call 2RN **(319.1 metres)**; 1.5 kW.—**8.30 to 11.15** (approx.), Programme relayed from **Cork**. **8.30**, Concert on the occasion of the Schubert Centenary, arranged by Signor F. Grossi, assisted by the Augmented Station Orchestra. **11.0**, National Anthem and Weather Report. **11.15** (approx.), Close Down.

FRANKFURT (428.6 metres); 4 kW.—Programme relayed by **Cassel** (252.1 metres). **7.30 a.m. to 8.30 a.m.** (approx.), Morning Recital. **11.0 a.m.** (approx.), Concert. **12.0 Noon**, Report of the Wiesbaden Agricultural Institute. **7.30**, Musical or Literary Programme. **9.30** (approx.), Popular Dance Tunes. **11.0** (approx.), Close Down.

HAMBURG, Call HA (in Morse) **(394.7 metres)**; 4 kW.—Programme relayed from **Bremen** (272.7 metres), **Hanover** (297 metres) and **Kiel** (254.2 metres).—**7.25 a.m.**, Time Signal. **7.30 a.m.**, Weather Report and Forecast and General News Bulletin. **7.50 a.m.**, Economic Questions of the Day. **8.0 a.m.**, Legal Hints. **8.15 a.m.**, Recital of Music. **9.55 a.m.** (for **Kiel** only), Relay of Service from the Kiel University Church. **11.55 a.m.**, Time Signal relayed from **Nauen**. **12.5** (for **Hamburg** and **Kiel**), Musical Programme. **12.5** (for **Bremen**), Concert. **12.5** (for **Hanover**), Gramophone Records. **1.0**, Children's Corner by Funkheinzelmann. **2.0**, Orchestral Concert. **6.30**, Transmission by the Hamburg School of Physical Training. **6.40**, Sports News. **6.55**, Weather Report and Forecast. **7.0** (approx.), Concert or Play. **9.30**, Weather Report and Late News Bulletin followed by Concert of Light Music. **10.50**, North Sea and Baltic Weather Report. **11.0** (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—**12.40**, Concert of Trio Selections. **2.10**, Concert of Vocal and Orchestral Music. **3.40**, Musical Selections. **7.40**, General News Bulletin and Sports Notes. **7.50**, "Lilac Time," by Schubert. **11.0** (approx.), Close Down.

HUIZEN (340.9 metres); 4 kW.—Transmits on 1,870 metres from 5.40.—**8.10 a.m. to 9.10 a.m.**, Relay of Morning Service and Address. **12.10**, Concert of Trio Music. **1.10**, Talk. **2.10**, Concert. **5.0**, Relay of Evening Service from **Amsterdam** (on 1,870 metres): at the Organ, Mr. Jac v.d. Byl. **7.30** (approx.), Orchestral Concert. **10.25**, Epilogue by the Choir, under the Direction of Mr. Jos. H. Pickkers. **10.40** (approx.), Close Down.

JUAN-LES-PINS (Radio LL) **(244 metres)**; 1.5 kW.—**1.0 to 2.0**, Selections of Light Music. **9.0**, Orchestral Concert, followed by General News Bulletin. **10.30** (approx.), Close Down.

SUNDAY, NOVEMBER 18th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

KALUNDBORG (1,680 metres); 7 kW.—Programme also for **Copenhagen** (337 metres).—**9.0 a.m.**, Morning Service, relayed from a Church in **Copenhagen**. **10.30 a.m. to 10.40 a.m.** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **12.0 Noon to 12.25**, The "Radiolytteren" German Lesson. **12.30 to 12.55**, The "Radiolytteren" French Lesson. **5.50** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **6.0**, News from the Press. **6.15**, Time Signal. **6.30**, Talk. **7.0**, Relay of the Town Hall Chimes from **Copenhagen**. **7.5**, "The Bird Fancier," Operetta in Three Acts, by M. West and L. Neld, Danish Translation by Kaj Allen and Alfred Kjerulf, Music by Zeller. **9.45**, Dance Music, by the Orchestra at the Palace Hotel, **Copenhagen**, under the Direction of Teddy Petersen; in the Interval, at **11.0**, Chimes, relayed from the Town Hall, **Copenhagen**. **11.30** (approx.), Close Down.

KATTOWITZ (422 metres); 10 kW.—**1.0**, Regious Talk. **1.20**, Talk for the Gardener in Silesia. **1.40**, Talk for Farmers. **2.0**, Weather Report and Forecast. **2.15**, Concert, relayed from **Warsaw**. Selections by the Philharmonic Orchestra. **5.0**, Concert of Orchestral Music. **6.0**, Announcements. **6.20**, Prof. St. Ligon in Humorous Selections. **7.30**, Orchestral Concert. **9.0**, Weather Report and Forecast, Press Review and Sports News. **9.30**, Concert of Light Music. **10.30** (approx.), Close Down.

KAUNAS (2.000 metres); 7 kW.—**2.30**, Children's Corner. **3.0**, Orchestral Concert. **3.30**, Transmission for Young People. **4.0**, Talk. **5.0**, Health Talk by Dr. Jurgelionis. **6.0**, Weather Report and Political Notes. **6.15**, Programme on the occasion of the Tenth Anniversary of the Independence of Latvia; Talk on Latvia and Concert of Latvian Songs, Poetry and Selections from the Musical Works of Darzin and Vitols. **9.30** (approx.), Close Down.

KÖNIGSBERG (303 metres); 4 kW.—Programme relayed by **Danzig** (272.7 metres).—**8.0 a.m.**, Concert of Instrumental and Vocal Items, and Address. **10.0 a.m.** (**Königsberg** only), Weather Report and Forecast. **1.30**, Talk on Chess Problems by P. S. Leonhardt. **2.0**, Spanish Lesson for Beginners by Kurt Metze, Lecturer in Spanish at the Königsberg Technical Institute. **3.15**, Concert by the Station Orchestra. **7.5**, Concert by the Station Orchestra, conducted by Walter Kelch, and Songs by Frida Weber-Flessburg and Alexander Flessburg. **9.15** Late News Bulletin and Sports News. **9.30** (approx.), Dance Music, relayed from **Berlin**. **11.30** (approx.), Close Down.

LAHTI (1,522.8 metres); 35 kW.—Programme also for **Helsingfors** (375 metres).—**8.0 a.m.**, Relay of Church Service. **9.50 a.m.**, General News Bulletin. **10.5 a.m.**, Musical Programme. **11.0 a.m.**, Relay of Church Service in Swedish. **3.0**, Concert by the Station Orchestra, conducted by Erkki Linko. **4.0**, Talk. **4.25**, Concert by the Station Orchestra: Selections from the Operetta, "Paganini," by Lehár. **7.15**, Concert. **7.45**, Late News Bulletin, given in Finnish and Swedish. **9.0** (approx.), Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres) and **Münster** (250 metres).—**7.5 a.m.**, Notes (in Esperanto) on the Week's Programmes, by Alfred Dormanns. **7.15 a.m.**, Lute and Guitar Instruction, by Olly Wirtz Koort. **7.35 a.m. to 7.55 a.m.**, Esperanto Talk, by Alfred Dormanns. **8.0 a.m.**, Relay of Church Chimes. **8.5 a.m.**, Catholic Festival of Choral and Instrumental Music, with Address in the Interval. **10.0 a.m.**, Fritz Worm, Talk: The German Language. **3.30**, Vocal and Orchestral Concert. **5.0 to 5.30**, Reading: Hope, the Tomcat, by Walter Gutkelch. **7.0**, See **Cologne** Programme, followed by Late News Bulletin, Sports Notes and Dance Music. **11.0** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—Programme relayed by **Dresden** (275.2 metres).—**7.30 a.m.** Organ Recital. **8.0 a.m.**, Recital of Vocal and Instrumental Music. **1.0**, News from the Foreign Press. **1.45**, Notes from the German Speaking Union. **2.0**, Programme of Light Music. **5.30**, Talk. **6.0**, Talk. **6.30**, Selections of well-known Operettas: The Feiereis Orchestra, conducted by Max Feiereis, and Songs by Otto Marlé, of Dresden. **9.0**, Sports News. **9.30**, Dance Music, relayed from **Berlin**. **11.30** (approx.), Close Down.

LYONS (Radio Lyon) **(291 metres)**; 1.5 kW.—**7.45**, Le Journal Parlé with General News Bulletin and Press Review. **8.0**, Instrumental Concert. Artistes: M. Camand (Violin); Madame Ducharne (Pianoforte), and M. Testaniére (Cello); Selection from "Mam'zelle Nitouche," by Hervé. **9.0** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 **(375 metres)**; 3 kW.—Programme relayed by **Salamanca** (EAJ22) (405 metres).—**11.30 a.m.**, Relay of Concert from El Retiro by the Municipal Band Conducted by Maestro Villa. **2.0**, Relay of Chimes and Time Signal. **2.5**,

Programmes from Abroad.—

Orchestral Selections by the Union Radio Orchestra, with interlude by Luis Medina. **3.30 to 7.0.** No Transmission. **7.0,** Relay of Chimes followed by Music by the Station Sextet. **8.0,** The Palermo Orchestra in Popular Dance Music relayed from the Alkazar. **8.30 to 10.0,** No Transmission. **10.0,** Chimes and Time Signal. **10.5,** Concert by the Band of the Saboya Regiment, conducted by Don Tomas Romo. **12.0 Midnight,** Chimes followed by Dance Music from the Alkazar. The Palermo Orchestra. **12.30** (approx.) (Monday), Close Down.

MILAN, 1MI (549 metres); 7 kW.—**9.30 a.m.** to **10.0 a.m.,** Vocal and Instrumental Sacred Concert. **11.30 a.m.,** Time Signal and Concert by the Milan Wireless Quartet. **12.30 to 3.0,** No Transmission. **3.0,** Opening Signal. **3.5,** Concert of Quintet Music. **5.0 to 7.25,** No Transmission. **7.25,** Opening Signal and Topics of the Day. **7.35,** Time Signal and History Talk by C. A. Blanche. **7.45,** Sports News. **7.50,** Concert devoted to Compositions inspired by Goethe's "Faust." **10.45** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Boden** (1,100 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres) and **Sundsvall** (545.6 metres).—**10.0 a.m.,** Relay of Morning Service from a Church in **Stockholm.** **4.55,** Chimes relayed from the Stockholm Town Hall. **5.0,** Drama by Gerhart Hauptmann. **8.15,** Late News Bulletin and Weather Report. **8.40,** Musical Programme. **11.0** (approx.), Close Down.

MUNICH (535.7 metres); 4 kW.—Programme by **Augsburg** (566 metres), **Kaiserslautern** (277.8 metres), and **Nuremburg** (241.9 metres).—**2.0,** Concert. **7.0,** "Hanns im Glück," Folk Play in Four Acts by Max Grube and Franz Koppel-Ellfeld. Producer: Rolf Pinegger. **9.0,** Late News Bulletin. **9.30,** Relay of a Concert Programme. **10.30** (approx.), Close Down.

NAPLES Call 1NA (333.3 metres); 1.5 kW.—**9.0 a.m.,** Sacred Recital. **3.45,** Children's Corner. **4.0,** Variety Concert. **4.30,** Time Signal. **7.30,** Topical Notes. **7.50,** Report of the Harbour Authorities at Naples. **8.02,** Relay of an Opera from Teatro Bellini, and in the intervals Selections of Operatic Music. Overture to "Rosamunde" (Schubert) by the Orchestra. **9.0** Sports Notes. **9.55,** Calendar and Notes on the Programmes for the next day. **10.0** (approx.), Close Down.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres), **Rujkan** (448 metres).—**6.15,** Weather Report and Forecast and Press Review followed by Literary or Musical Programme. **7.0,** Time Signal and Orchestral Concert. **8.30** Weather Report and Press News. **8.45,** Topical Talk. **9.30** (approx.), Relay of Dance Music from the Hotel Bristol. **11.0,** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—Programme relayed at Intervals by the following stations: **Bordeaux PTT** (275 metres), **Eiffel Tower** (2,650 metres), **Grenoble** (416 metres), **Lille** (264 metres), **Limoges** (285 metres), **Lyons PTT** (480 metres), **Marseilles** (303 metres), **Rennes** (280 metres), **Toulouse PTT** (260 metres).—**8.0 a.m.,** General News Bulletin and Time Signal. **9.25 a.m.,** International Time Signal and Weather Report and Forecast. **12.0 Noon,** Concert arranged by "Les Editions Salabert," and conducted by M. de Buxeuil and M. L. Raiter. **1.0,** Economic Report. **1.30,** Concert organised by the General Association of French Wireless Listeners, "The Flying Dutchman" (Wagner). **4.0,** Pasdeloup Symphony Concert relayed from the Théâtre des Champs Elysées and organised by Philips Radio. Conductor: M. Rhené Bâton. **6.30,** "Le Radio Journal de France." **8.0,** Sports Results. **8.15,** Talk arranged by the Union of French Associations. **8.30,** Concert organised by the General Association of French Wireless Listeners, followed by Late News Bulletin, Time Signal and Weather Report. **10.30** (approx.), Dance Music by the Orchestra at the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (2,650 metres); 5 kW.—**7.56 a.m.,** Time Signal on 32.5 metres.—**9.26 a.m.,** Time Signal on 2,650 metres. **7.10 to 7.20,** Regional Meteorological Report and Aviation Notices. **7.30,** "Le Journal Parlé, par T.S.F.," with Talks by its Regular Contributors, including Dr. Pierre Vachet, Detective Ashelbé, and M. René Casalis, on Portez-vous bien; Police Memoirs; and The Day's Sport. **7.56,** Time Signal on 32.5 metres. **8.0 to 9.0,** Concert, Masques et Bergomasques, First Orchestral Suite, (Gabriel Fauré). **10.26,** Time Signal on 2,650 metres. **11.15** (approx.), Close Down, with Weather Forecast for Following Day.

Sunday, November 18th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

PARIS (Petit Parisien) (340.9 metres); 0.5 kW.—**8.45,** Gramophone Selections. **8.50,** Talk. **8.55,** News from the Press. **9.0,** Vocal and Instrumental Concert. **9.25.** News Bulletin; the Symphony Half-Hour, under the Direction of Prof. Estyle, of the Paris Conservatoire. **10.0,** Late News Bulletin. **10.15,** Selections of Orchestral Music: "La Rôtisserie de la Reine Pédauque" (Charles Levadé). **11.0** (approx.), Close Down.

PARIS (Radio Paris), Call CFR (1,750 metres); 6 kW.—**8.0 a.m.,** General News Bulletin and News from the Press. **8.30 a.m.,** Instruction in Physical Culture, conducted by Dr. Diffre. **12.0 Noon,** Religious Address, followed by Recital of Sacred Music, with Choral Selections by "Les Petits Chanteurs de la Croix de Bois," arranged by "La Vie Catholique." **12.30,** News from the Press. **12.45,** Concert by the Albert Locatelli Orchestra, with Selection by Bilboquet in the Interval. **4.30,** Programme of Gramophone Records, arranged by "L'Industrie Musicale"; in the Interval: News from the Press. **7.0,** Talk for Farmers and News from the Press. **7.45,** The Radio-Paris Circus. **8.30,** Music Hall Concert; in the Intervals: News from the Evening Press and Late News Bulletin. **10.30** (approx.), Close Down.

PITTSBURGH, Call KDKA (63 and 27 metres); 25 kW.—**4.0,** Sessions Chimes, followed by Divine Service. **7.0,** Programme arranged by "Roxy's Stroll," from WJZ, **New York. 9.45,** Evening Service, relayed from the Shadyside Presbyterian Church; Address by the Pastor. **11.30,** Musical Programme, arranged by the Whittall Anglo-Persians, from WJZ, **New York. 12.0 Midnight,** Session Chimes; Divine Service with Sermon by the Pastor, Dr. E. J. van Etten, relayed from the Calvary Episcopal Church, Pittsburgh. **1.0 a.m.** (Monday). National Broadcasting Company Programme from **New York. 1.15 a.m.,** Collier's Radio Programme. **2.15 a.m.,** The Utica Jubilee Singers, from WJZ, **New York. 2.45 a.m.** El Tango Romantico, from WJZ, **New York. 3.15 a.m.** Longine Time. **3.30 a.m.** (approx.), Close Down.

POSEN (344.8 metres); 1.5 kW.—**9.15 a.m.** to **10.45 a.m.,** Relay of Cathedral Service. **11.5 a.m** and **11.30 a.m.,** Two Talks for Farmers. **11.55 a.m.,** Talk by Mr. Winiewicz. **2.15,** Concert of Symphony Music, relayed from the Philharmonic Hall at **Warsaw. 6.45,** Talk. **7.15,** Programme in celebration of Ten Years of Latvian Independence. Address by the Latvian Consul at Posen. **9.0,** Time Signal. **9.20,** General News Bulletin. **10.0,** Programme of Dance Music, relayed from the Carlton Restaurant. **11.0** (approx.) Close Down.

PRAGUE (348.9 metres); 5 kW.—**8.0 a.m.,** Recital of Sacred Compositions. **11.0 a.m.,** Concert. **12.5,** Trade Report. **12.20** Social Announcements. **3.30,** Orchestral Concert. **5.0,** Programme for German Listeners. **9.0,** Time Signal and Late News Bulletin. **9.20,** Concert of Light Music. **10.15** (approx.), Close Down.

RABAT Call PTT (416 metres); 2 kW.—**12.30,** Concert by the Radio Maroc Orchestra. **4.0 to 5.0,** Military Music. **8.30,** Concert by the Radio Maroc Orchestra and Soloists. **10.30,** Relay of Dance Music. **11.0** (approx.), Close Down.

RIGA (526.3 metres); 4 kW.—**9.15 a.m.,** Morning Service, relayed from the Mara Church. **12.0 Noon,** Children's Corner. **3.0,** Concert by the Station Orchestra, conducted by Arved Parups. **4.0,** Talks. **6.0,** Concert with Vocalists. **8.0,** Weather Report and Forecast, and Late News Bulletin. **8.30,** Relay of Dance Music from the Café de l'Opera. **10.0** (approx.), Close Down.

ROME, Call 1RO (447.8 metres); 3 kW.—**9.0 a.m.,** Morning Recital of Sacred Music. **9.45 a.m. to 12.0 Noon,** No Transmission. **12.0 Noon,** Opening Signal. **12.5 to 1.0,** Concert of Trio Selections. **1.0 to 4.0,** No Transmission. **4.0,** Opening Signal. **4.5,** Concert of Light Music. **6.50,** Opening Signal, followed by News of the Day. **7.45,** Concert by the Grand Symphony Orchestra: The Sixth Symphony in F Major, Op. 68 (Pastoral), (a) Allegro non troppo, (b) Andante mosso, (c) Allegro, (d) Temporale, (e) Allegretto. **9.50,** Late News Bulletin. **10.15** (approx.), Close Down.

SCHENECTADY Call 2XAD and 2XAF (21.96 and 31.4 metres); 30 kW.—**6.30 to 7.0,** Programme arranged by the United Radio Corporation. **8.30,** Recital of Organ Music from the Union College Memorial Chapel, Schenectady: Organist, Elmer Tidmarsh. **9.0,** Men's Conference, arranged by the Bedford Branch of the Y.M.C.A., with an Address by Dr. S. Parkes Cadman, relayed from **Brooklyn, N.Y. 10.30,** Acousticon Programme from **New York. 11.0,** Stetson Parade and American Legion Band, relayed from **Boston, Mass. 11.30,** Programme of Music from **New York. 12 midnight,** "Old Company's" Programme, with Reginald Werrenrath, Baritone, from **New York. 12.30 a.m.** (Monday), Evening Entertainment from the Capitol Theatre, **New York. 2.0 a.m.,** Lecture, "Our Government," by David Lawrence, Editor of the "United States Daily," relayed from **Washington, D.C. 2.15 a.m.,** Atwater Kent Programme from **New York. 3.15 a.m.,** Correct Time. **3.17 a.m.,** Broadcast of Experimental Television. **3.30 a.m.** (approx.), Close Down.

SEVILLE (Union Radio), Call EAJ5 (434.8 metres); 1 kW.—**2.0 to 3.0,** Concert of Light Orchestral Selections, and Gramophone Records. **9.30,** Orchestral Concert with Vocal Items. **11.0,** Flamenco Songs and Dance Music by the Seville Orchestra. **11.30** (approx.), Close Down.

STAMBOUL (1,200 metres); 5 kW.—**3.30,** Concert. **4.30,** Local Market Prices. **5.15,** Selections of Turkish Music. **7.30,** Weather Report and Forecast and Time Signal. **7.40,** Talk on the History of Music. **7.55,** Concert by the Station Orchestra. **9.0,** Late News Bulletin. **9.30** (approx.), Close Down.

STUTTGART (379.7 metres); 4 kW.—Programme relayed by **Freiburg** (577 metres). **10.15 a.m.** (approx.), Concert of Instrumental Music. **11.0 a.m.** (approx.), Concert of Orchestral Selections, followed by Gramophone Records. **1.0,** Children's Corner by Funkheinzelmann. **5.0,** Time Signal and Sports News. **5.15,** Talk. **6.45,** Time Signal and Sports News. **7.15** (approx.), Concert or Play, followed by Musical Programme, Late News Bulletin and Sports News. **10.0** (approx.), Close Down.

TALLINN (408 metres); 2.2 kW.—**8.0 a.m.** (approx.), Relay of Church Service. **1.0,** Concert of Instrumental Music. **6.0,** Orchestral Concert. **9.0** (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (391 metres); 3 kW.—**12.30,** Weather Report and Forecast and Local Market Prices for Toulouse. **12.45,** Concert of Orchestral Music. **1.0,** Time Signal (Carillon). **1.45,** Press News. **8.0,** Prices of Cereals and News from the Fournier Agency. **8.15,** News from the Press. **8.30,** Concert. **9.5,** Concert arranged by "L'Association des Commerçants Radio-Electriciens du Midi." Selections from Cavalleria Rusticana, Opera in One Act by Mascagni. **10.15,** "Le Journal sans papier" with News from North Africa, followed by Late News Bulletin. **10.30** (approx.), Close Down.

VIENNA (517.2 metres); 15 kW.—Programme relayed by **Graz** (357.1 metres), **Innsbruck** (294.1 metres), **Klagenfurt** (272.7 metres) and **Linz** (254.2 metres). **9.20 a.m.,** Recital of Organ Music. **10.0 a.m.,** Relay of Programme from the Grosse Konzerthaussaal, on the occasion of the Schubert Centenary Celebration by the Austrian Federal Government. "Gloria" from the Mass in A Flat Major. **2.15,** Experimental Transmission of Pictures. **3.0,** Concert of Orchestral Music. **6.30,** Vocal and Instrumental Concert, followed by Musical Programme and Experimental Transmission of Pictures. **10.15** (approx.), Close Down.

VILNA (435 metres); 1.5 kW.—**10.0 a.m.,** Relay from **Warsaw. 1.0 to 6.0,** Programme relayed from **Warsaw. 1.0 to 2.0,** Three Talks on Agriculture. **2.15,** Orchestral Concert. **4.20,** Talk. **5.0,** Concert. **6.0,** Talk in Lithuanian. **7.30 to 10.30,** Programme relayed from **Warsaw. 7.30,** Concert of Light Music. **9.0,** Aviation Route Report and Weather Forecast. **9.5,** News from the Polish Telegraphic Agency. **9.20,** Sports Notes and Police Report. **9.30,** Dance Music relayed from the "Oaza" Restaurant, **Warsaw,** under the direction of W. Rozkowski. **10.30** (approx.), Close Down.

WARSAW (1,111 metres); 10 kW.—**10.0 a.m.,** Programme relayed from **Vienna.** Concert in celebration of the Schubert Centenary by the Vienna Academy of Singing, the Amateur Musical Society and the Vienna Symphony Orchestra. **1.0,** Agricultural Talks. **2.0,** Weather Report and Forecast. **2.15,** Programme of Instrumental Music. **4.20,** Talk. **7.30,** Concert. **9.0,** Aviation Route Conditions and Weather Forecast. **9.5,** Late News Bulletin. **9.20,** Police and Sports News. **9.30,** Dance Music by the Orchestra of the "Oaza," conducted by W. Rozkowski. **10.30** (approx.), Close Down.

BROADCASTING BY WIRED WIRELESS.

The Underlying Principles of the System Fully Explained.

IN wired wireless or carrier-wave telephony high-frequency oscillations developed by some suitable type of high-frequency generator, such as a valve transmitter, are modulated by microphone currents and the resulting modulated oscillations, instead of being radiated into space from an aerial as in radio telegraphy, are introduced into a land-line circuit along which they are transmitted as electro-magnetic waves. The possibility of transmitting electric waves was known long before the days of radio telegraphy, but it is only comparatively recently that the development of wireless technique has made the technical application of the transmission of fairly high-frequency currents along wires or cables a practicable means of making fuller use for communication purposes of existing telephone or power lines. One of the more recent suggested applications of wired wireless is the broadcasting of programme matter over existing wire networks without interfering with the main services for which the wires are intended. In view of the increasing demands continually being made on an overcrowded ether, the provision of further channels for broadcasting without further congesting the ether has obvious attractions, and the object of the present article is to review the possibilities of wired wireless for this purpose.

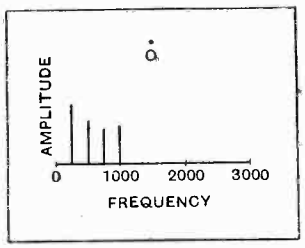


Fig. 1.—The amplitude and frequency of the more important components making up the sound of a long "O."

As most readers of *The Wireless World* are, no doubt, aware, when a speech sound or a musical note falls on a microphone electrical currents of complicated wave form are produced in the circuit connected to the microphone. These currents can be regarded as built up of a number of simple alternating currents having the form of sine-waves, and having various amplitudes and frequencies, according to the nature of sound under analysis. In the case of speech the important components lie in a band of frequencies between about 100 and 3,000 cycles per second, while in the case of music they lie in a wider band of between 50 and, perhaps, 7,000 to 8,000 cycles.

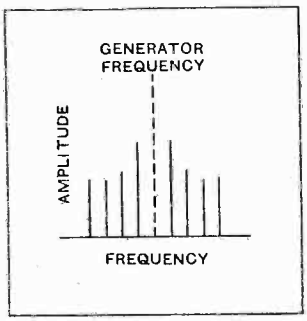


Fig. 2.—When a carrier wave is modulated the upper and lower side-bands are symmetrically arranged on either side of the frequency generated by the transmitter.

The amplitude and frequency of the more important components making up the sound of a long "O," for example, are shown in Fig. 1. If high-frequency oscillations from a continuous wave transmitter are modulated by this sound spoken into a microphone, the resulting complex wave form produced is composed of simple components lying in two groups, known as the upper and lower side bands, symmetrically arranged on either side of the frequency generated by the transmitter, *i.e.*, the carrier-wave frequency.

The amplitude and frequency of the components present are represented in Fig. 2. It will be clear from this chart that the effect of modulation is to provide a complex signalling wave which contains a group of components which bear the same relation to each other, as do the components present in the original telephone currents. Modulation is, therefore, really nothing more than a translation of the original telephone frequencies to another part of the frequency scale. For reception, the modulated carrier-wave must be demodulated so that the current acting on the diaphragm of the receiving telephones or loud speaker once more occupy their proper place on the lower end of the frequency scale. This, in ordinary broadcast radio telephony, is, of course, done by the detector.

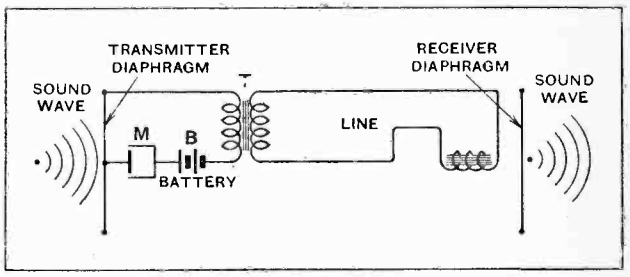


Fig. 3.—Representation of an elementary telephone circuit.

Carrier-wave and Ordinary Telephony Compared.

The relationship between ordinary telephony and carrier-wave telephony for wired wireless is illustrated in Fig. 3. In Fig. 3 sound waves are shown falling on the diaphragm of a simple carbon microphone M, energised by a D.C. battery B, and coupled to the line by a transformer T. The D.C. energising current cannot reach the line while the alternating components due to the sound waves, induced into the line by the transformer T, and passing through the field windings of the receiving telephone, are causing vibrations of the diaphragm.

With carrier-telephony the D.C. battery B may be supposed to be replaced by an A.C. generator, which produces a high-frequency carrier-current. A second transformer T_1 and the demodulator are introduced at the receiving end (Fig. 4). The carrier current itself, being an alternating current, is introduced into the line by T_1 but is suppressed by the demodulating arrangement in the receiving circuit coupled to the line by T_1. Except that currents of high frequency are transmitted over the

Broadcasting by Wired Wireless.—line, it will be seen that in principle there is no difference at the generating end between ordinary and carrier-wave telephony. In fact, communication at ordinary telephony frequencies can be regarded as a particular case of carrier-wave working by considering the energising D.C. as being a carrier-current of zero frequency.

It will be seen from the above that there is no real difference between the mode of transmission of the high frequencies used in carrier-wave working and currents of ordinary telephonic frequencies. It has often been suggested that the carrier-waves on the land line circuits for some reason do not suffer the same transmission losses as the lower frequency currents. There is no justification either on theoretical or practical grounds for this view. As a matter of fact, the attenuation of the higher frequency currents is greater than that of the low frequency currents owing to the increased effective resistance of the wires and to increased leakage effects. As compared with ordinary telephony frequencies, higher generating power must be employed or "repeaters" must be inserted at more frequent intervals. Much less power is, of course, required than for ordinary radio telephony, since the waves are guided along the wires instead of being radiated in all directions into space.

Interference on Long Waves.

It follows from what has been written above that carrier-wave working between two fixed points offers no special advantages over ordinary telephone working. Carrier-wave working, however, by employing a different range of frequencies, provides by selective tuning the possibility of using the same land-line network, simultaneously for more than one communication, just as the use of various wavelengths allows this to be done in the ether.

Owing to the attenuation on land lines of the higher frequencies, already referred to, about 30,000 cycles per second is regarded at present as the upper limit of frequency available for carrier-wave working. This frequency corresponds to a wavelength of 10,000 metres, so that the upper limit lies well within the frequencies used for high-power radio stations, and the difficulty of cutting out interference of such stations sometimes arises.

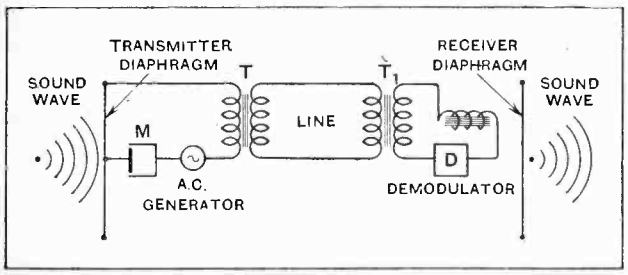
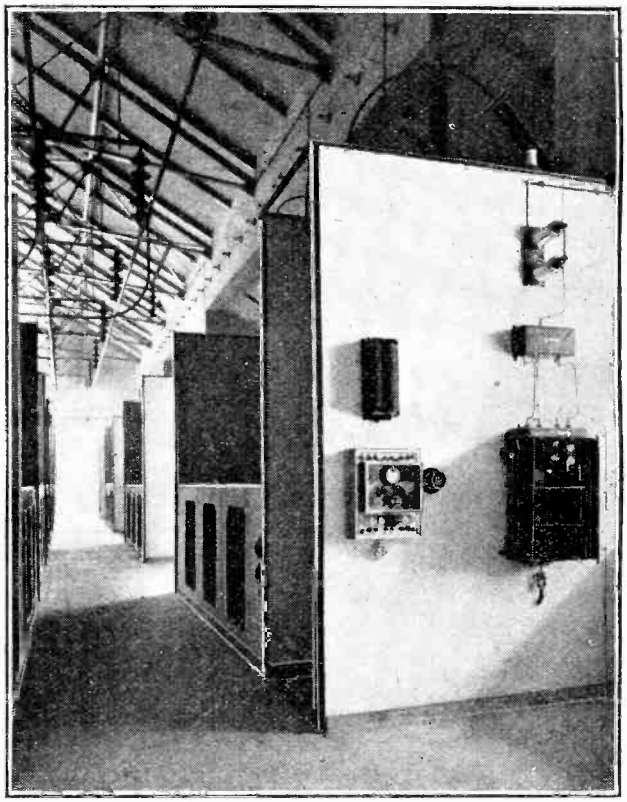


Fig. 4.—The essential components in an elementary carrier-wave telephone circuit.

In America and Central Europe wired wireless or carrier-wave working has been applied to a considerable extent both for the purpose of making better use of existing telephone circuits and also along overhead high-voltage power lines for providing a communication system for the control of their operation and for the notification of switching instructions, etc. The Bell Telephone System, for example, has used several carrier channels on the pole-line telephone system from Chicago to Harrisburg, a distance of 750 miles, and between Harrisburg and Detroit, a distance of 596 miles. More



A German power station where speech currents are superimposed on supply lines.

recently the submarine cable between the Island of Catalina and Los Angeles on the mainland has been fitted for carrier-wave working. Catalina always seems in the forefront of communication developments, as before the cable was laid, its traffic with the mainland was dealt with by the first public radiotelephony link to be operated—the second being the transatlantic service from Rugby. To deal with seasonal summer traffic, arrangements were made in 1926, whereby it was possible to provide over the two single conductor cables a total of fourteen telephone channels in addition to two telegraph channels, all capable of being worked simultaneously. In Germany many carrier-wave channels are in use. In this country it is understood that the B.B.C. and the Post Office experimented some years ago between Plymouth and London with a carrier telephone for "simultaneous broadcasting." The transmission is stated to have given good quality, but the experiments were discontinued on account of interference caused by high-power radio stations. In America carrier-wave telephony on overhead power lines has given very successful results.

Except for one or two isolated experiments in America

Broadcasting by Wired Wireless.—

and Germany, the use of wired wireless for broadcasting has not been developed. In Staten Island (U.S.A.) a broadcasting service, it is believed, has been carried out over the lighting mains of the local supply company with a transmitter generating 250 watts. The receiving apparatus loaned by the company could be plugged into the supply by a simple arrangement. The radius covered by the system is 10 kms. The receiving apparatus was hired by the Supply Company at 2 dollars per month for telephone sets, and 5 dollars for loud speaker sets. In Germany the opera performances at Munich were for a time broadcast to subscribers over the telephone system, but this was apparently done on ordinary telephonic frequencies and was not, therefore, properly an example of wired-wireless distribution. An experiment in true wired-wireless distribution was, however, made at Rositz, where the programme of the Liepzig broadcasting station was transferred to the distributing system of an electrical generating station.

Although there have been few commercial applications of wired wireless to broadcasting, nevertheless the Western Electric Co. of America have worked out in detail and patented (Brit. Pat. 192,359) a complete system for the purpose. The methods proposed allow several broadcasting programmes to be superimposed on a telephone system so as not to interfere with the use of subscribers' circuits for ordinary telephonic communications. The method depends on the introduction in the lines of carefully designed selective apparatus known as filters, unless the proposed differentiation of frequencies is wide enough to allow selection by ordinary tuning circuits. Before describing, therefore, the arrangements for introducing the broadcast transmissions into the line system it will be desirable to describe briefly the various varieties of filters employed, on the successful use of which satisfactory working would depend.

The Importance of Filters.

The three main types of filters, together with their transmission characteristics, are shown in Fig. 5. Fig. 5(a) represents what is known as a "low pass filter." This filter causes considerable attenuation to frequencies above a certain value, depending on the sizes of coils and condensers used in it. It transmits freely, however, all frequencies below the critical value with little loss. Such a filter can, for example, be designed to pass all frequencies below, say, 10,000 cycles, but impose a high impedance to all frequencies above this value. Fig. 5(b) represents a "high pass filter." By properly choosing the inductances and capacities such a filter can be designed to pass all frequencies above, say, 10,000 cycles and cut out those below this value. Fig. 5 (c) represents a "band filter," which passes frequencies within a specified range equally without loss, but cuts out all other frequencies both below and above this range.

It will be seen from the chart of Fig. 2 that all the components necessary for the transmission of any sound are present in either the upper or lower side band, and with suitable arrangements at the demodulating end the transmission of the carrier-wave itself and one or other of the side bands is not essential. The cutting-out of one side-band and the carrier-wave at the transmitting end is not difficult, and the method is used in the present transatlantic telephony service. For speech the transmission of both side-bands occupies 6,000 cycles, while if one side-band is eliminated 3,000 cycles is occupied. If, therefore, one side-band is suppressed the number of possible channels available for different communications for carrier-wave working between zero and 30,000 cycles is doubled. A suitable gap of 1,000 to 2,000 cycles must be left between the carrier groups,

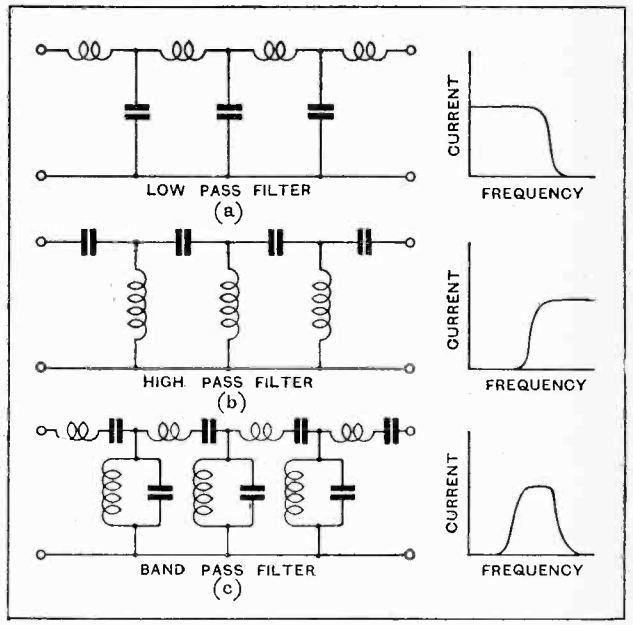


Fig. 5.—Three main types of filter employed in wired wireless. Their main transmission characteristics can be seen from the graphs on the right.

and we see, therefore, that in addition to the ordinary telephony band about eight carrier single side-bands can be got in, or four channels in which both side-bands are employed. Since the satisfactory transmission of music requires each side-band to occupy at least 6,000 cycles, only two additional music channels are available between the frequency limits at present considered feasible for carrier-wave working, if both side-bands are transmitted, or four if only one side-band is employed. O. F. B.

(To be concluded.)

"THE WIRELESS WORLD" OLYMPIA SHOW COMPETITION.

Next week's issue will contain an illustrated description of the apparatus which has won first place in the ballot. A list of the successful exhibits was published in our last issue.

USEFUL DATA CHARTS. (No. 16.)

Time Constant of Grid Leak and Condenser.

IF in the circuit of Fig. 1 a charge be given to the lower plate of the condenser it will leak away through the resistance and the potential of the plate will fall exponentially from its initial value to zero

The time required for the potential to fall to $\frac{1}{2.718}$ of its initial value is called the Time Constant T and we have the simple relation $T = RC$.

Blocking in Speech Amplifiers.

The above phenomenon is of interest in amplifiers where the signal from the plate of a valve is impressed through a grid leak and condenser on the grid of the following valve. Under the action of an excessively strong signal the grid potential may swing to a positive value: grid current will flow, and at the end of the signal the grid will be left with a high negative potential. This potential will decrease as in Fig. 1 by discharge through the grid leak, and until it has returned to an almost normal value the valve will be working on the lower bend of its characteristic, and will be *paralysed*. This is the phenomenon known as blocking—a momentary or intermittent cessation of sound.

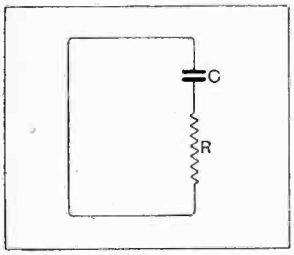


Fig. 1.—If a charge be given to the lower plate of the condenser C, it will slowly leak through the resistance R; meanwhile the plate potential will fall.

Compromise Necessary.

The abac gives the time constant when the values of grid leak and condenser are known. A second scale

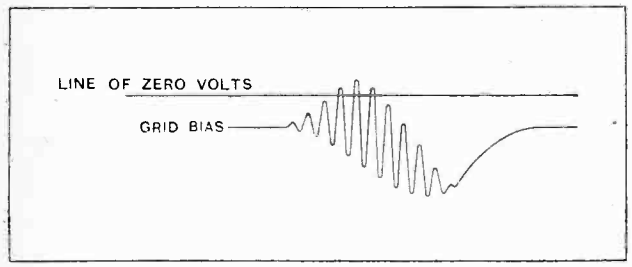


Fig. 2.—A strong signal makes the grid potential negative and time is required for return to the initial value.

is also provided on the middle line giving the time required for the shock potential to fall to 0.1 of its initial value: this time is the time constant multiplied by 2.4.

The time constant and consequently the blocking effect are reduced by making R or C small: but, as was mentioned in the discussion of abac No. 15, such small values lead to inefficient transmission of signals from one valve to the next, and so a compromise must be arranged. It was shown in that discussion that the efficiency of transmission V/E, i.e., $\frac{\text{signal applied to grid}}{\text{signal from plate of preceding valve}}$ is equal to $\frac{R}{\sqrt{R^2+X^2}}$ i.e., $\sqrt{1+\left[\frac{1}{R.C.2\pi f}\right]^2}$ and so at any given frequency V/E, depends only on RC, which is the time constant.

In Fig. 3 the broken curve gives the relation between the efficiency and the time in which a disturbance falls

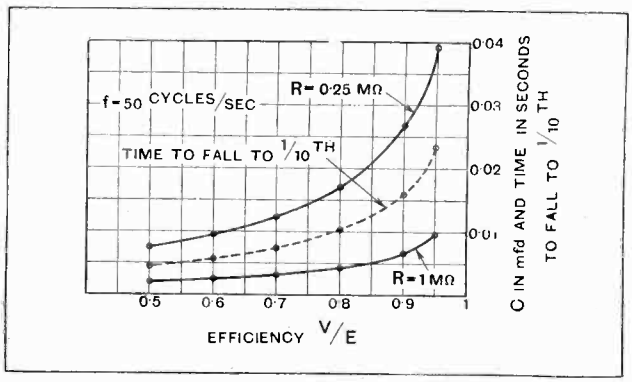
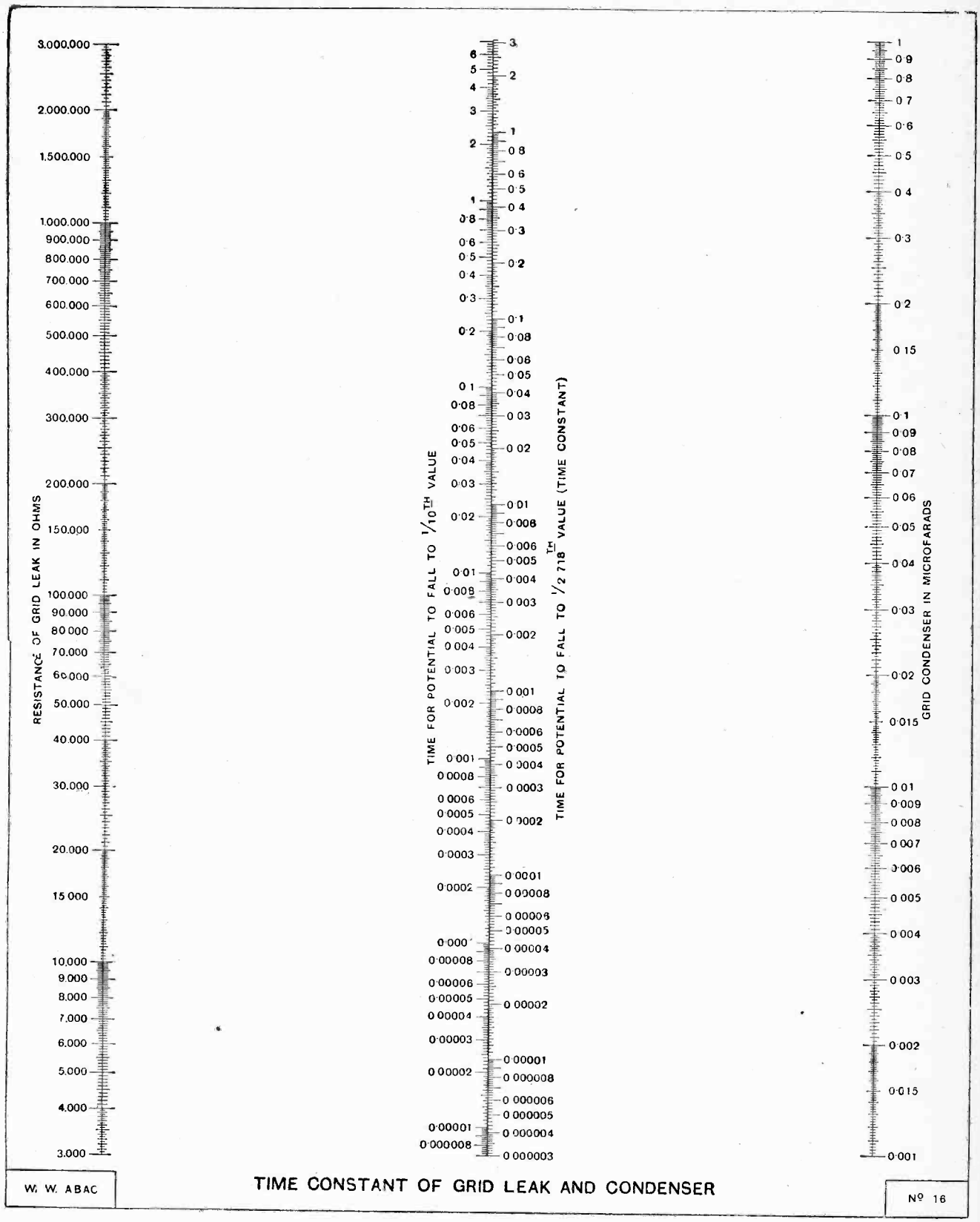


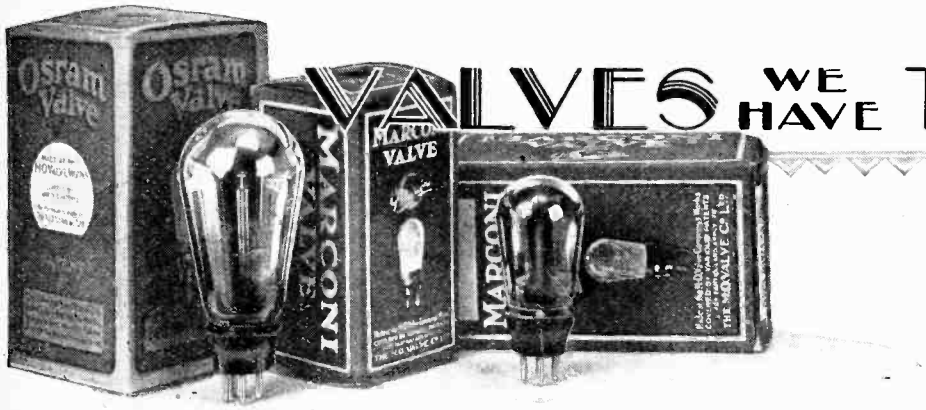
Fig. 3.—The broken curve gives the relation between the efficiency and the time in which a disturbance falls to one-tenth its initial value. The solid line curves give the values of C for 1 and for 0·25 megohm leaks.

to 1/10th its initial value. It is difficult to assign the value at which blocking will become noticeable, since so much depends on the magnitude of the shock, but we shall not be far wrong in taking the figure 0.015 second. This corresponds to an efficiency of 90%. The full curves give the values of C for grid leaks of 1 and 0.25 megohm, copied from the discussion on abac No. 15

Summary.

It appears then that at 50 cycles/sec the efficiency should not exceed 90% lest blocking should take place: at higher frequencies the efficiency will of course be greater since the impedance of the grid condenser will diminish. Suitable combinations are R = 1 megohm, C = 0.0065mfd, or R = 0.25 megohm, C = 0.026mfd, which are included in the general result, megohms × microfarads = 0.0065: a larger product may cause blocking; a smaller one gives unnecessary loss of efficiency for low notes.—R. T. B.





VALVES WE HAVE TESTED

Marconi and Osram Power Valves.

THE general improvement in valves was one of the most important features of the Radio Exhibition, and the new power valves in particular are likely to produce a marked change in the quality of reproduction obtainable from the ordinary domestic receiving set. A few years ago the L.S.5A, a comparatively high-priced valve designed to withstand anode voltages seldom used in the home, was the only available valve for superlative loud speaker reproduction. Then came the D.E.5A, which gave the equivalent of L.S.5A quality at a volume sufficient for the average room and required a filament current of only 0.25 amp. This valve came to be regarded as the standard output valve, and was largely responsible for the creation of the present critical attitude of the listening public towards the question of quality of reproduction. Now we have the "P" type valves which, for the same filament current, give power outputs six or seven times greater than the D.E.5A.

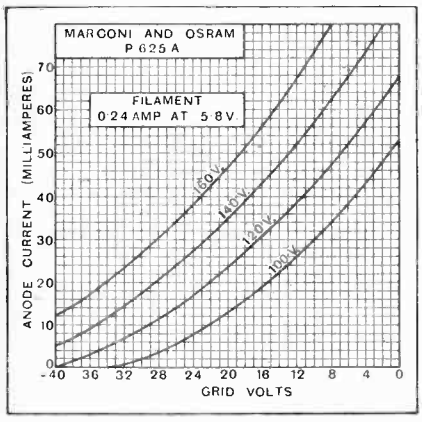
Of the three valves under review, the P 615 is best suited to the requirements of the average listener. The A.C. resistance is well matched to the impedance of the best moving-coil and cone loud speakers, and the high amplification factor enables the full output to be maintained with a comparatively low input; this property is reflected in the low grid bias values required for various H.T. voltages. A further advantage of the high amplification factor is that amplification can be thrown away in the earlier stages of the receiver, if necessary, in the interests of quality, without sacrificing volume.

The valve can be used for anode voltages up to 250, provided that the grid bias is adjusted properly and that the anode current does not exceed 24 milliamperes. In the valves tested the anode current was rather in excess of the makers' rating, and,

P 625A.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

P 625A.	Amplification Factor.	A.C. Resistance. (ohms.)	Mutual Conductance (mA per volt).
Maker's Rating .	3.7	1,600	2.3
Specimen 1	3.86	1,430	2.7
Specimen 2	3.57	1,660	2.15
Specimen 3	3.22	1,370	2.35

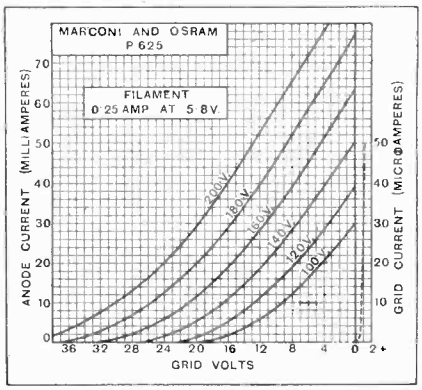


Average values under amplifying conditions.
Amplification Factor = 3.6.
A.C. Resistance = 1.920 ohms.
Mutual Conductance = 1.87 mA/volt.

P 625.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

P 625.	Amplification Factor.	A.C. Resistance (Ohms).	Mutual Conductance (mA per volt).
Maker's Rating .	6	2,100	2.5
Specimen 1	4.65	1,750	2.65
Specimen 2	5.56	1,920	2.9
Specimen 3	5.91	2,080	2.85

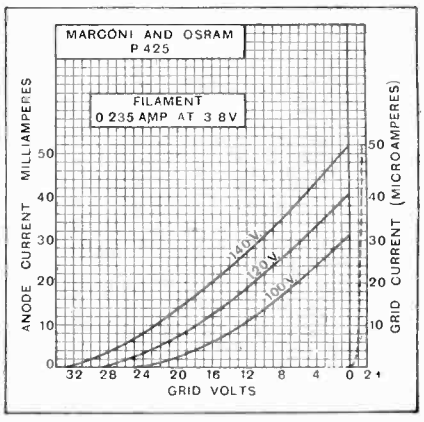


Average values under amplifying conditions.
Amplification Factor = 5.
A.C. Resistance = 2,080 ohms.
Mutual Conductance = 2.4 mA/volt.

P 425.

CHARACTERISTICS AT ZERO GRID BIAS AND 100 VOLTS H.T.

P 425.	Amplification Factor.	A.C. Resistance (Ohms).	Mutual Conductance (mA per volt).
Maker's Rating .	4.5	2,300	1.95
Specimen 1	3.45	2,380	1.45
Specimen 2	4.08	2,270	1.8
Specimen 3	3.01	1,960	1.55



Average values under amplifying conditions
Amplification Factor = 4.0.
A.C. Resistance = 2,530 ohms.
Mutual Conductance = 1.56 mA/volt.

Valves We Have Tested—

as might be expected, the mutual conductance was even better than the remarkably good rated value of 2.5 mA. per volt. Supplied with 200 volts from a mains unit, wonderful volume and quality was obtained with a moving-coil loud speaker, and there can be no reservation in recommending the installation of this valve in any receiver deriving H.T. current from the mains. If there is no alternative to the use of dry-cell H.T. batteries, the anode voltage should be limited to 150 volts and only the super-capacity type of battery is permissible.

P 625A.

H.T.	Grid Bias.	Anode Current (mA).	
		Maker's Rating.	Measured.
100	−13.5	14	23
140	−21	22	33
180	−30	28	—

The P 625A is rather a special valve, and is intended for use with large input amplitudes or where the impedance of the loud speaker is exceptionally low. The mutual conductance is 2.3 as compared with 2.5 for the P 625, and the maximum anode voltage is restricted to 180.

Osram P 425 super power valve.

P 625.

H.T.	Grid Bias.	Anode Current (mA).	
		Maker's Rating.	Measured.
100	−6	10	16
150	−12	14.5	23
200	−18	19	34
250	−24	24	—

Nevertheless the available power output is only about 10 per cent. less than the P 625. In general, the anode current should be derived from the mains or accumulators rather than dry-cell batteries.

Where the filament supply is four instead of six volts, the P 425 should be used. Although not such a good valve as the P 625, its output when supplied with the maximum H.T. voltage of 150 is nevertheless about twice that of the D.E.5A. The anode current taken is well within the capabilities of the larger type H.T. batteries, and these can be used economically if supply mains are not available.

P 425.

H.T.	Grid Bias.	Anode Current (mA).	
		Maker's Rating.	Measured.
100	−9	11	15
125	−12	15	24
150	−16.5	17	26

The remarkable improvement in the characteristics of these valves is due to the special coated filament, which should be treated with care to ensure long life. In no circumstance should the grid bias be adjusted without first switching off the H.T., and the grid bias voltage should be checked from time to time and the cells renewed if necessary in order that the anode current may be kept well within the rated maximum value.

LONGER LIFE FOR H.T. BATTERIES.

A Simple Way of Using D.C. Mains for the Output Stage.

THERE must be many listeners who, although they have direct-current mains in the house, have for financial reasons refrained from investing in a battery eliminator, but have remained faithful to the dry battery as provider of anode current. Using a dry battery, it is hardly an economical proposition to employ a "super-power" valve in the output stage, on account of the large current drawn by these valves, so that the user of batteries is limited, if expense is a serious consideration, to valves having an impedance not less than about 6,000 ohms.

Solving the H.T. Problem.

Now that cone loud speakers of various types are becoming more and more generally used, it is being found that a "super-power" valve is really essential for their satisfactory operation; what, then, is the user of dry batteries to do? If he invests in a "super-power" valve he will find the life of his high-tension batteries becomes very short, while if he keeps to the small power valve he has to put up either with a very small output or with overloading on all the louder passages.

Although dry batteries are most uneconomical where heavy currents are required, for small currents they are just the opposite; if only some 5 milliamperes is required, there is no cheaper or better source available. If, bearing this in mind, the circuit-diagram of any standard four- or five-valve receiver is examined, it will be seen that all the difficulties of current supply are bound up with the output valve. The earlier valves take an average of perhaps 1 to 2 milliamperes apiece—even less in the case of a resistance-coupled amplifier—and this is well within the power of the dry battery to supply. It is the output valve which consumes the bulk of the current, taking perhaps some 12 to 15 milliamperes. If there are direct-current mains in the house it is possible to take advantage of this distribution of current between the valves of the set, and, without going to the expense of buying or making up a battery eliminator, to draw from the mains the current required for the last valve only, leaving the rest to be supplied, as before, by the dry battery.

A battery eliminator for D.C. mains consists chiefly of a smoothing circuit to remove the ripple that would otherwise cause hum in the loud speaker. If it is decided to feed the last valve only with plate current

Longer Life for H.T. Batteries.—

from the mains, the need for smoothing practically disappears, because the unsmoothed current is introduced into the receiver at such a point that it is not amplified by the valves. In consequence the amount of hum heard in the loud speaker is so small that it is not likely to cause annoyance to anyone.

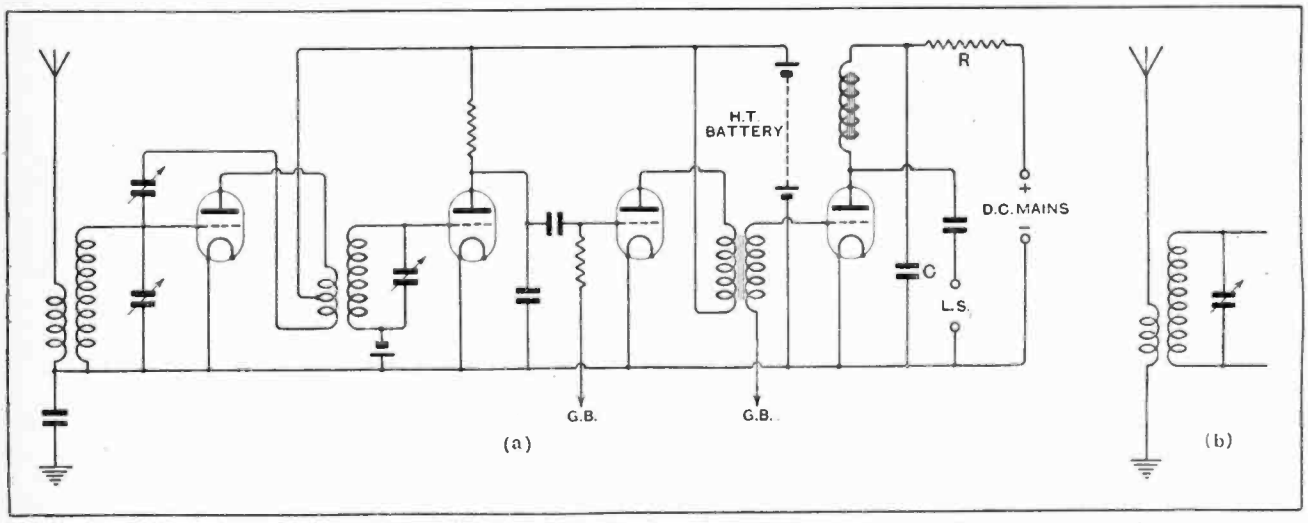
In supplying the output valve from the mains, it will usually be necessary, for the sake of securing a reasonable valve life, to break down the original voltage, which may be from 200 to 250 volts, to some 160 volts, which is about the highest value that it is safe to employ. This can most economically be done by the introduction of a series resistance, which, for "super-power" valves, may have the following values; a plate current of approximately 12 milliamps. per valve is assumed.

Mains voltage.	Resistance (ohms). One output valve.	Resistance (ohms). Two output valves.
200	3,500	1,700
210	4,000	2,000
220	5,000	2,500
230	5,600	2,800
240	6,400	3,200
250	7,600	3,800

For one output valve the resistance may be wound with 40-gauge Eureka wire, which has a resistance of 37 ohms per yard; for two valves 38-gauge Eureka, resistance 23.8 ohms per yard, will be more suitable.

Avoiding a Double Earth.

The arrangement suggested is indicated in the diagram given, which shows a four-valve receiver to which this system is applied. The condenser C will probably be of assistance in reducing any slight traces of hum that may be heard in the loud speaker, but it need not be regarded as an extra component, as it will already be in position on most receivers.



An eliminator without complications. How to supply the output valve from D.C. mains.

If the circuit of the set is such that the filaments are earthed, it will be necessary to insert a condenser in the earth-lead as shown to prevent the supply mains from being short-circuited or illegally earthed; this condenser must be capable of withstanding continuously the full supply voltage. If, as in the small diagram, the filaments are not earthed, this condenser may be omitted, in which case the provision of the resistance R becomes the sole outlay in installing as near an approach to free anode current as one may reasonably hope to find for so small an initial cost. A. L. M. S.

NEWS FROM THE CLUBS.

New Headquarters.

Owing to the rapid expansion of Slade Radio (Birmingham) it has been found necessary to seek more commodious accommodation at the Parochial Hall, Erdington, where the last meeting, on Oct. 25th, was held, the Mullard Valve Co. giving a demonstration of screened-grid, pentode and other valves.

The Society held its second whist drive and dance on Tuesday, Oct. 23rd. This was a great success and there was a full attendance.

Hon. Secretary—Mr. H. Clews, 52, St. Thomas Rd., Erdington, Birmingham.

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Long Life in Accumulators.

Valuable advice on how to cherish an accumulator was given by Mr. Burnett, of Messrs. Tungstones, at the meeting of the Bec Radio Society on Oct. 23rd. The speaker emphasised the small details in accumulator maintenance which make such a difference, and explained why so many accumulators do not last as long as they should.

Later in the evening Mr. Porter, of Messrs. McMichael, Ltd., demonstrated the Screened Dimic Three, and showed the fascinating possibilities of a receiver employing a screened-grid valve, detector and pentode.

Hon. Secretary, Mr. A. L. Odell, 171, Tranmere Rd., S.W.18.

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Popularity of Coil-driven Loud Speakers.

That the moving-coil loud speaker is gaining in popularity was shown during a discussion at the meeting of the Wembley Wireless Society on November 2nd, when it was revealed that a number of members were installing moving-coil instruments. In a talk on the subject, Mr. Crowther said that it was wrong to imagine that moving-coil loud speakers required a tremendous power to operate them; quite satisfactory results had been obtained in a small room with an ordinary two-valve set.

Mr. Comben demonstrated a receiver entirely operated from the A.C. mains. It was noticed that there was an absolutely silent background, no "mains hum" being present.

Hon. Secretary: Mr. H. E. Comben, B.Sc., 24, Park Lane, Wembley.

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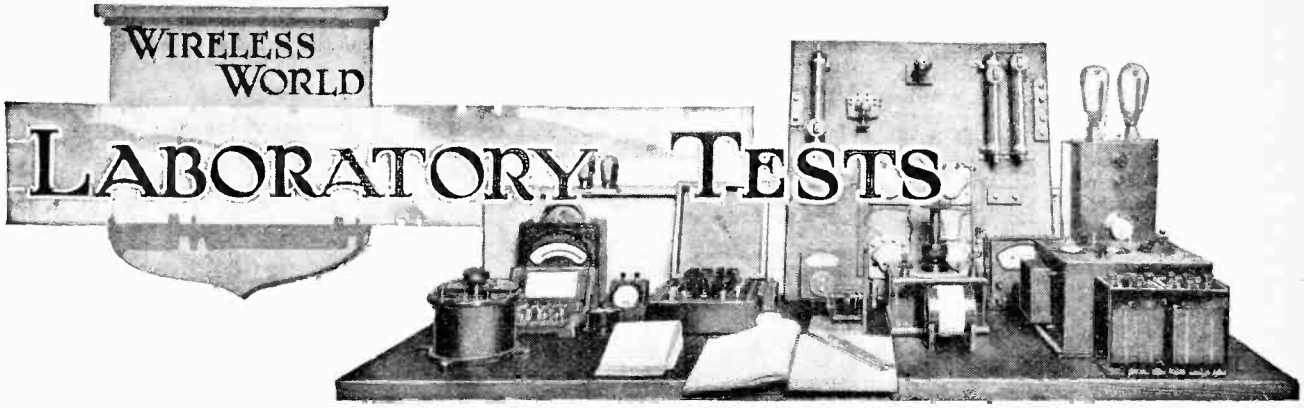
A Pentode Demonstration.

The general public was well represented at the last meeting of the Edinburgh and District Radio Society on November 5th, when Mr. F. E. Henderson, of the General Electric Co., Ltd., lectured on "Osram Screened Grid and Pentode Valves." The lecturer gave a convincing demonstration with a Pentode valve in the power stage, though it was discovered that a cone speaker of high resonance gave better results with an ordinary valve.

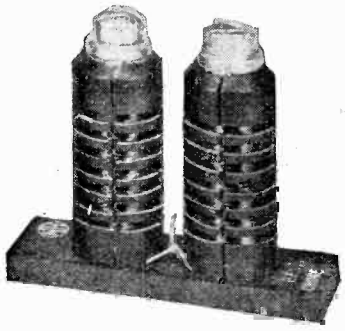
Hon. Secretary: Mr. E. I. Robertson, 10, Richmond Terrace, Edinburgh.



A Review of Manufacturers' Recent Products.

McMICHAEL BINOCULAR CHOKE.

Although of conventional appearance, the McMichael binocular choke is quite unique inasmuch as an iron core is used for the purpose of increasing inductance.



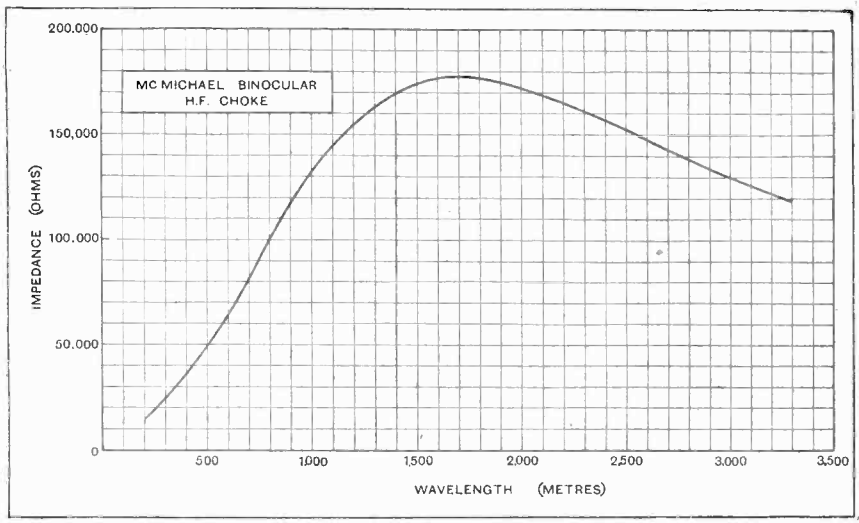
McMichael Binocular Junior H.F. choke; D.C. resistance 270 ohms.

The makers have had wide experience of the use of iron-cored H.F. circuits, and their latest application of this principle would appear to have many points in its favour. In the first place the D.C. resistance of the winding is reduced to 270 ohms as fewer turns are required to obtain the necessary inductance. Secondly, the field of choke is more compact as the lines are concentrated in the iron. Finally, the coupling between the two sections of the choke is increased and there is no trace in the impedance curve of the objectionable kink usually associated with binocular chokes.

It would appear that the H.F. resistance is above the average, for the peak value of impedance does not exceed 178,000 ohms. This property is no disadvantage as the 1,600 metre wavelength is quite close to resonance and the choking effect is correspondingly increased. In general the choke should not be used for wavelengths above 1,700 metres unless the external circuit capacity exceeds 8 micro-mfd. Turning to the medium broadcast waveband we find that the choking effect is well up to standard. Actual values are as follow :—

Wavelength (metres).	Impedance (ohms).
200	13,500
500	48,200
1,600	176,000

The choke is unusually compact, the overall dimensions being $2\frac{1}{8}$in. × $1\frac{7}{8}$in. × $\frac{3}{4}$in. It is made by Messrs. L. McMichael, Ltd., Slough, and the price is 4s.



Impedance curve of McMichael Binocular Junior choke; external capacity 8 micro-mfd.

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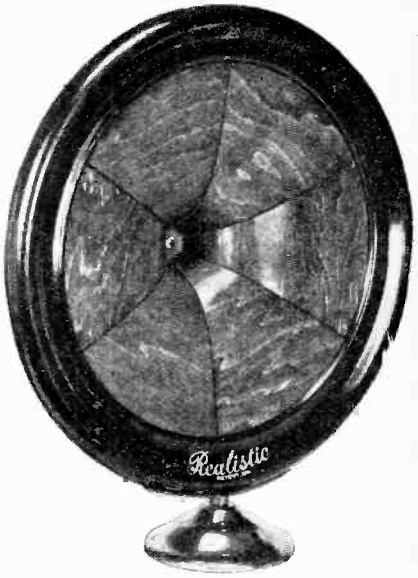
"REALISTIC" LOUD SPEAKER.

This instrument is notable for the ingenious construction of the diaphragm, which is entirely constructed of thin veneer wood. The sections are joined together to form a flared cone which is comparatively rigid at the centre and increases in flexibility towards the periphery. It is claimed that the rigid centre gives good reproduction of the high notes, and that the flexible edge ensures correct balance in the lower register. The middle register is also well reproduced, as was proved by a test on a high-quality amplifier. The diaphragm is driven by an adjustable movement, which gives good sensitivity when correctly adjusted.



"Realistic" loud speaker with flared diaphragm.

The price is £3 10s., and the makers are Messrs. W. H. S. Vincent, 72, Penton Street, Islington, London, N.1.

"CYLANITE."

This substarce is made in the form of sheets 1/32in. in thickness, and presents the appearance of highly polished ivory. When used to cover the fronts of ebonite, metal or three-ply panels it should greatly enhance the appearance of a receiving set. It can be engraved quite easily, and can be used for translucent dials and in a variety of ways which will at once occur to the minds of home constructors. The price of this material, which is obtainable from Messrs. Marsh and Wright, 5, Royal Arcade, Weymouth, is 2s. per square foot.

o o o o

A POCKET SOLDERING OUTFIT.

The "Soldometa" pocket soldering outfit costs 2s. 6d., and is made by Messrs. Elmesan (London), Ltd., 66, Victoria Street, London, S.W.1. It contains a miniature soldering iron with detachable handle, a tin of "Soldo" soldering compound, a tin of flux, a stick of solder, a small fuel tray, and a supply of "Meta" solid fuel. The latter is a pure white organic chemical which burns with a flame similar to methylated spirits and leaves no ash. The fuel is sold in the form of bars, and one-quarter of a bar is sufficient to heat up the iron and make several wiring joints 100 bars cost 2s 9d.

"Soldometa" pocket soldering outfit.

The "Soldo" compound consists of a mixture of granular solder and flux, and it was found possible to tin the iron, which was not previously clean, by merely heating it and dipping it in the compound.

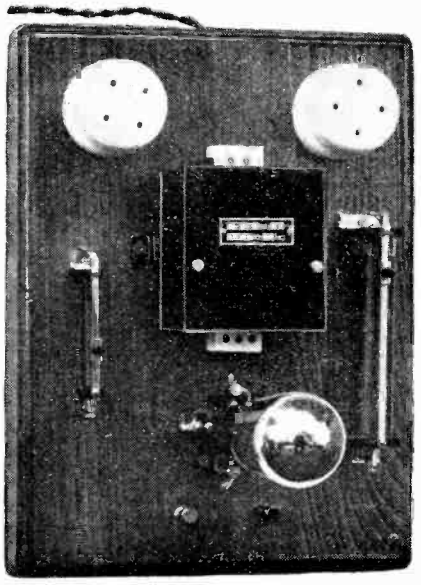
The complete outfit measures only 3in. × 4in. × ¾in., and is easily carried in the pocket.

o o o o

THE BRAYTON TRICKLE CHARGER.

It is still thought by many people that in order to charge H.T. accumulators from A.C. mains it is necessary to incur an expenditure of several pounds in the purchase of a suitable charger, the greater part of this cost being entailed by the necessity of a power transformer of suitable design. It is, however, possible to construct a trickle charger in which the only transformer used is one of the small, inexpensive type for the sole purpose of lighting the filament of the rectifying valve. The actual rectifying circuit is in direct connection with the mains, thus effecting a saving in the price of a power transformer; this in no way detracts from the efficiency of a charger.

The "Brayton" instrument, which is of this type, is actually sold as a set of parts, but since they are all mounted ready for attachment of a few simple connections, one is practically buying a complete instrument.



The "Brayton" Trickle Charger.

A point worthy of note is that, owing to the provision of a variable wire-wound resistance, the charging current can be smoothly varied, and, moreover, arrangements are made so that some resistance is always in circuit, thus safeguarding the rectifying valve.

The price of the instrument complete, except for the addition of a few wires, is only 30s. In addition, an ordinary half-wave rectifying valve is required, although quite good results may be obtained by the use of an ordinary small power valve. On actual test, the figures for charging rate and mains consumption, as given by the makers, were found to be accurate.

The manufacturers are Messrs. P. M. Braidwood, Somerset Road, New Barnet.

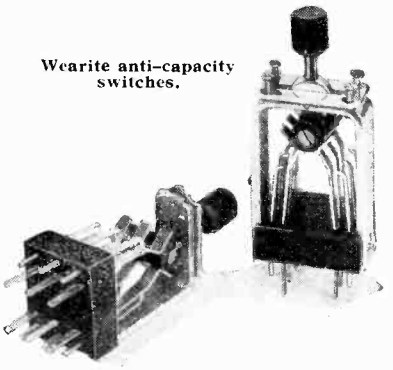
o o o o

WEARITE ANTI-CAPACITY SWITCHES.

It will be seen from the photograph that the design of these switches follows well-tried practice. The switch lever is provided with ebonite rollers, which serve to push over the contact blades and hold them in position. The contact blades and points are rigidly fixed in a high-quality machined ebonite block, which entirely insulates them from the U-shaped frame. A soldering tag is fixed to the frame for earthing if necessary.

No special metal is used at the contact points, but the movement of the blades gives a slight wiping action, which ensures a perfect contact. The construction of the switches as a whole is exceptionally robust, and unfailing reliability over long periods is assured.

Wearite anti-capacity switches.



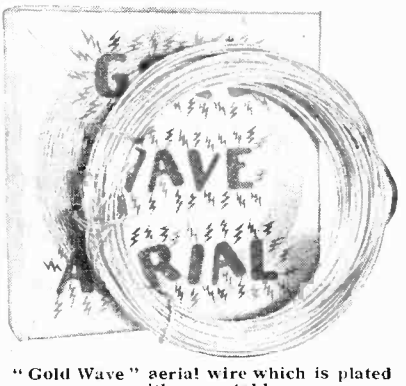
The switches with U-shaped frames are made in two- and three-position types, with from two- to five-way contacts, and the prices range from 6s. to 12s. A modified type with L-shaped frame is made in the two-position form only, with contacts from one-way to four-way. The prices of this type are lower, and range from 3s. 6d. for the one-way to 6s. for the four-way switch. The makers are Messrs. Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17.

o o o o

GOLD WAVE AERIAL.

This aerial, which is of American origin, is made up of seven strands of 24 S.W.G. wire. The base metal alloy is made from electrolytically deposited metals of the purest quality, and each strand is heavily plated with pure gold, which effectively prevents corrosion.

The aerial should prove a boon to coastwise listeners who are troubled with corroded aerial wires due to the salt in suspension in the atmosphere. It is also probable that there will be an improvement in the amount of background noise when this aerial is used for short-wave reception, as there is less possibility of electrolytic action among the strands.



"Gold Wave" aerial wire which is plated with pure gold.

The price of the 100ft. aerial is 12s. 6d., and the agents in this country are Messrs. Horace Soley and Co., Ltd., 3, Jewin Street, London, E.C.1.

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.

RANGE V. QUALITY.

Sir,—A cat may look at a king, but whether it may suggest the addition of milk to the monarch's diet is not on record. It seems to me that your diet is painfully lacking in metaphorical milk. Week after week you describe for us sets which will receive, under favourable conditions, the characteristic noises of the kangaroo in its native surroundings. Razor-sharp-tuning is becoming such a fetish that presently we shall receive nothing but the tuning note, and be thankful to get that, without using condensers geared a million or so to one.

Before making my suggestions let me hasten to say, before half the readers of *The Wireless World* say it for me, that I do not know what I am talking about. But it does seem to me that the ideal in sets is one which will receive the local station and Daventry with a sufficiently large factor of safety and, at the same time, with the best possible quality available at the present day. By the operation of one switch I should like to render such a set sufficiently selective and sensitive to receive a mere two or three foreign transmissions.

Surely this can be done. It cannot be necessary to lose all our high notes by sharp tuning and then to deceive ourselves by deliberately removing the bass.

May I ask whether you cheat yourself at Patience?

Chadwell Heath, R. W. BLOUET.
October 24th, 1928.

[Patience is not one of our hobbies!—Ed.]

PICTURE BROADCASTING.

Sir,—It is surprising to me that the B.B.C. should decide for or against any form of picture broadcast without consulting the public which finds their funds.

I suggest a referendum on the following lines:—

"Do you, as a subscriber to wireless services, desire the B.B.C. to include broadcast of:—

(1) Still pictures?

(2) Television?

Personally I think it is wasting our money to transmit pictures, however perfect, the like of which can be bought in evening papers at one penny per dozen.

Television may have imperfections at present but is obviously the eventual home requirement, and the B.B.C. should remember that amateurs have taught them many a lesson—why not let them have a chance at improving television reception?

London, N.3. E. J. CRAMPTON.
October 20th, 1928.

VALVE CHARACTERISTICS.

Sir,—With reference to the common practice of valve manufacturers to publish the impedance values for their valves with zero H.T., I should like to suggest that it would be far more useful to constructors and experimenters if the impedance figures were given for some definite value and grid bias.

It is, of course, possible to use the same valve under various conditions of H.T. and grid bias, but there are certain average conditions which apply in the majority of cases for which impedance values might usefully be given. For example, a first L.F valve is quite commonly operated with about 100 volts on its plate and 3 volts negative bias, so that if the impedance of such a valve were given for this condition, and also if the same valve is suitable for use as a grid leak rectifier, with 2 volts positive bias, the impedance values would be a real value, whereas now they are only useful for very rough guidance to differentiate between one type of valve and another.

This difference in valve impedance between operating and static conditions probably accounts for the valve impedance figures given by certain manufacturers with their performance curves not agreeing with the published characteristics of the same valves.

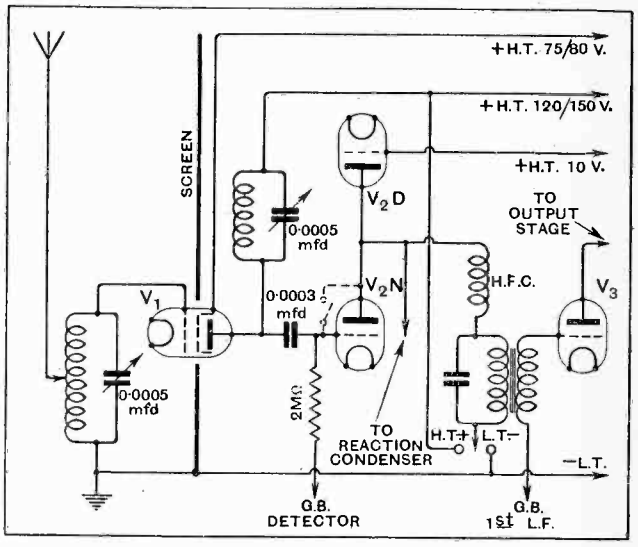
It has been suggested that the reason why valve characteristics are not published under the H.T. and grid bias conditions normally used is that the variations in the characteristics of individual types are then far greater than they are when measured with zero bias.

Perhaps this matter may be of sufficient interest to your readers to throw some light upon it. J. BAGGS.

DIODE AS RECTIFIER.

Sir,—With reference to Mr. J. W. Stacey's letter in *The Wireless World* of October 10th, I am in entire agreement on the merits of the diode as a rectifier.

Unfortunately, it is only suitable when preceded by one H.F. stage, for the local station, so I have constructed my set to use diode, anode-bend or leaky-grid rectification by a very simple arrangement, as will be seen from the diagram.



To use anode bend or detector a suitable valve is inserted into valve-holder V2N (normal), and the primary of the L.F. transformer is plugged into the socket connected to +H.T.

No valve is placed in valve-holder V2D (diode), but even if one was accidentally placed in it no harm would be done.

The grid bias is adjusted for anode bend or leaky grid as required. To use diode rectification, the valve is removed from V2N. The primary winding of the L.F. transformer is plugged into the socket connected to −L.T., and the grid and plate sockets of valve-holder V2N are shorted by means of a plug made of two valve legs in a piece of ebonite ⅛in. apart and connected together (or in a piece of metal).

The valve is then inserted in valve-holder V2D.

No reaction is possible when using the valve as a diode, but this is unnecessary, as at 100 miles (Salisbury) from 5GB and 5XX both come through at ample strength, using screened grid H.F. diode (R.C.C. type valve), L.F. (D.E.L. 610 type), and push-pull, using L.S.5A. with 300 volts H.T.

Needless to say, all filaments are connected in parallel, as usual, with the usual 35 ohm. variable resistance in filament of screened grid valve for volume control.

All who try this will (or should) be delighted with the results, and at any time the set can be used without alteration as a normal long-distance receiver. J. B. KELLAR.

Salisbury.
Oct. 15th.

5SW—AN APPRECIATION.

Sir,—I wish to express appreciation of the programme regularly received here in North Brazil on short-wave from 5SW.

At Manãos, 1,000 miles inland and situated near the River Amazon, as well as the seaports we call at, three valves are sufficient to work a reed-drive cone speaker at moderate volume. The other officers and I are disappointed that no news items are broadcast, but expect that this is due to the restrictions of newspaper concerns.

The extra two hours' programme after midnight of gramophone records means that we can now listen until 9 p.m. here instead of 7 p.m. The strength of signals does not vary much during the evening programme, but the 12.30 p.m. to 1.30 p.m. transmission is practically unreadable on any day.

I shall not "grouse" about there being no broadcasting on Saturdays or Sundays, as the transmissions are still experimental, but can only hope that a daily service will soon be in full swing. A. H. MASON.

Manãos, Brazil.
Oct. 8th, 1928.

5GB.

Sir,—What about 5GB? Reading the correspondence of Mr. E. Baynes with the greatest astonishment, I should like to tell you the reverse of the matter. 5GB is called here in Holland "The standard of comparison," as it is coming in almost faultless. I am listening on two types of loud speakers, one of the balanced armature type with 17in. cone, and the other a moving-coil instrument made to *Wireless World* specifications. But I can hardly find a mistake in the transmission of 5GB. It is still better than 5XX. Hilversum is a clear station, it is true, but often unsuitable for moving-coil work. The studio in which the Hilversum concerts are given is a small concert hall. Only trio and speech is given in a draped studio. My circuit is a screened-grid H.F. valve, anode-bend detector, one-stage resistance, and one transformer-coupled L.F. with Philips R.C.C. and transformer, and a super-power valve in last stage. I hope to be able to help you in finding out the cause of it, which is, I think, of local atmospheric nature. J. A. C. WIGMAN.

Amsterdam-C, Holland.
October 29th, 1928.

WHY IS IT?

Sir,—I think most of us will agree with "Watt Sisname's" letter "Why Is It?" in your issue for October 31st, but what can be expected when the country is flooded with blue prints of more or less camouflaged Det. 2LF circuits with high-sounding names, reaction on aerial being, of course, *ad lib* (very much so).

I have by me as I write one of these blue prints which claims for the circuit 49 stations on the loud speaker, using an indoor aerial! Excellent. I presume the quality of reception is not strained but droppeth as the gentle rain from Heaviside's.

But surely somewhere there must be *one* more lone voice calling, and when constructors with good outside aerials go all out to make it the half century, the result can be heard to perfection on any good moving-coil speaker within range.

All this after *Wireless World's* excellent and long-continued work on neutralised circuits.

I don't think the man who oscillates really deserves "Watt Sisname's" creosote treatment; it seems to me he is deliberately encouraged to do so for advertisement purposes.

Birmingham. T. W. TURBERVILLE.
Nov. 1st, 1928.

CONTROL ROOM.

Sir,—You will earn the gratitude of all by continuing to press for the suppression of the individual who mars many musical items. His performances are as distressing as those of the organist whose foot is for ever pumping the swell pedal.

T. A. CLEMENTS.

Fortis Green, N.2.
Nov. 1st, 1928.

SHORT-WAVE RECEPTION.

Sir,—This morning at 7.30 I picked up 2ME (Sydney) on 28.5 metres at amazing strength—R8 easily—no fade, not even high speech. I held it for an hour and heard a test with AGB (Germany) and the children's corner from 2FC and market reports.

It was evening in Australia, of course. I wonder if you can do anything to get them to broadcast on this wave length when the test matches are on. It beat anything I have ever had from 3LO by miles, and I was using the *W. W.* Empire set, of course, only that I have now added another valve, resistance-coupled. I shall be interested to hear if this has been reported by anyone else. W. J. COLLINS GARRARD.

Ipswich.
October 15th, 1928.

TRANSMISSION QUALITY.

Sir,—I should like to raise the question among your readers as to the relative quality of the B.B.C.s transmissions from 2LO and 5XX.

My experience is that the high notes are very much weaker relative to the low ones in 5XX's transmissions than in 2LO's, and that on nine days out of ten the sibilant sounds in speech are almost absent in Daventry's output—and by no means *always* present in 2LO's.

Now, I want to know whether my receiver is at fault or whether the variations are commonly experienced by other listeners?

For 5XX I use two tuned circuits, one of which is decidedly flat, and no reaction, so it does not seem likely that I am losing my high notes from too sharp tuning.

If the difference is really in the two transmissions, surely something ought to be done about it, for if the frequency characteristic of the amplifier is "cooked" to suit Daventry, reproduction is all wrong from 2LO, and *vice versa*. Thus one cannot get good reproduction from both stations.

Crowborough, Sussex. A. K. GORDON.
October 26th, 1928.

STANDARDISATION.

Sir,—The letter from "H. L. S." published in your issue of October 3rd is most timely. He has, however, only touched the fringe of matters. Lack of standardisation in form or nomenclature is exhibited in many other components. Take low frequency transformers for example. We have some with terminals close to baseboard, and others which attempt to make the grid to anode leads soar to unknown heights; we are snowed under with different ratios which may mean anything (very little is said about primary impedances and maximum anode current permissible).

Those who have wondered what capacity the average fixed condenser has *when screwed to the baseboard* must be legion! The same applies to grid leaks which have lost their original transfers.

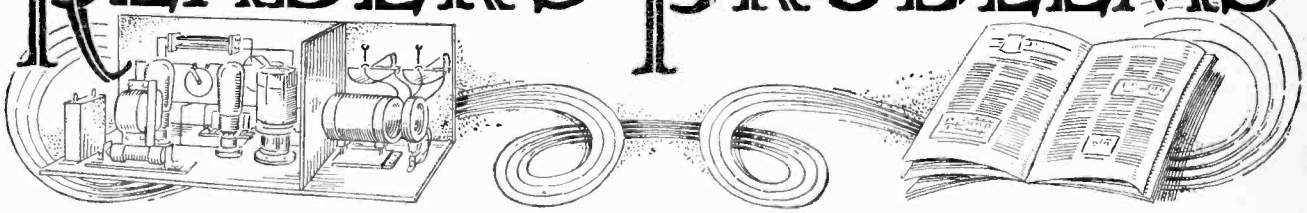
Variable baseboard resistors are now quite common, but how often is the value in ohms visible or engraved deeply enough to withstand constant usage?

I have given up wondering whether H.F. chokes are going to be made to lie down or stand up; the position at present seems to be stalemate. I suppose the classic example of absence of uniformity was the design of the early S.G. H.F. valves, now happily rectified. As for those unfortunate enough to possess special valve holders suitable for these, well—a good idea would be to soften the ebonite and use it as a cap to stop the humming of antimicrophonic valves!

W. A. E. ROWETT.

St. Austell, Cornwall.
October 9th, 1928.

READERS' PROBLEMS



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

The Service is subject to the rules of the Department, which are printed 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.

Doubtful Detection.

The detector valve of my receiver seems to function equally well whether the lower end of the grid leak is connected to L.T.−, L.T.+, or left free. Does this indicate that something is wrong, and, if so, how should I proceed to trace the trouble?

We expect you will find a leakage across your valve holder, or possibly the valve itself is soft. As far as the first is concerned, you should be able to test with a pair of phones and a dry battery, while the valve may be tested in the manner described on several occasions in this journal.

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Anode Bend for Volume.

Your advice as to the best type of detection for my projected receiver would be appreciated. I intend to concentrate on reception of the local station (only two miles away), from which I get very loud signals, as my aerial is a good one. For this purpose I am limiting myself to two valves; is it a fact that the anode-bend rectifier will give much greater volume than the leaky grid method?

J. A.

Situated as you are, it is more than possible that the H.F. voltage developed across a tuned aerial coil will amount to six volts or more. Under these conditions, it is certain that a properly arranged bottom-bend detector will deliver a greatly increased audio-frequency voltage to the L.F. amplifier, as compared with the other method.

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Bias for A.C. Valves.

An indirectly heated A.C. valve is used as an anode-bend detector in my four-valve receiver; as I should like to make provision for exact adjustment of its grid bias, will you please tell me how a potentiometer may be connected? As alternating current is used for heating, it will clearly be impossible to use the conventional method applied to ordinary valves. L. S. R.

We suggest that the method shown in Fig. 1 will be the most convenient for you. As you will see, a potentiometer in conjunction with a single dry cell is used to bridge the gaps between tappings on the grid bias battery.

Although the current taken from the potentiometer cell will only amount to

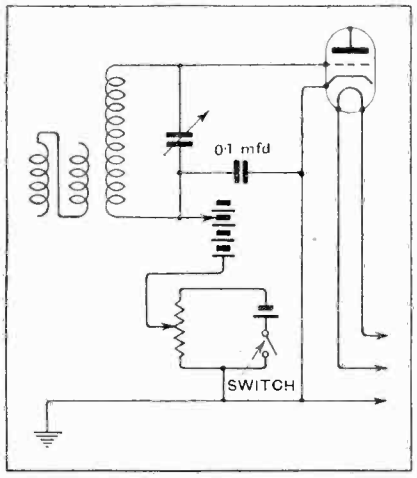

Fig. 1.—Detector grid bias of an indirectly-heated valve may be critically adjusted by adding a potentiometer and dry cell.

a few milliamps, it is desirable to fit a switch in the position shown in order to prevent wastage.

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.

Very possibly you will find it more convenient to connect two cells instead of one across the potentiometer, as by these means you will obtain a wider range of control.

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An Excessive Resistance.

In accordance with a suggestion made in your journal some time ago, I have been trying to use my voltmeter as a milliammeter. I find, however, that when it is connected in the H.T. negative lead signals are distorted, and a high-pitched whistle is produced. Can you explain this effect?

W. R.

At the time the suggestion to which you refer was published a large number—perhaps the majority—of moving-coil voltmeters used by amateurs had a resistance of about 60 ohms per volt. Even this comparatively low value renders them unsuitable for current measurements in many instances, although very useful indications can be obtained in some circuits. Nowadays many voltmeters have a resistance of 200 ohms per volt, which is, of course, an advantage as far as their normal function is concerned, but they are generally not suitable for measuring milliamperes In your particular case the trouble is undoubtedly due to the fact that the resistance of the meter, being common to the anode circuits of all the valves, is acting as an inter-stage coupling, and is producing low-frequency reaction.

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A Dangerous Substitution.

My two-valve reflex receiver has given good results for two years, but I am now thinking of trying to improve matters by fitting more modern valves. Which type do you recommend? The set comprises a dual valve followed by a leaky grid detector. R. C. J.

Circuits of the kind you describe are apt to lack stability when used with valves having infinitely better characteristics than those for which they were originally designed, and we would hesitate to recommend you to attempt to improve matters by fitting ultra-efficient modern valves. It will be safest to choose types with characteristics not widely differing from those specified by the designer.

Volts Wanted.

I have just completed an eliminator for my four-valve set (which works excellently when supplied with H.T. from batteries). Results with the eliminator are altogether disappointing; it is impossible to get signals even from my nearest station, which is forty miles away, at reasonable loud speaker strength. I notice, however, that immediately after switching off the H.T. supply the strength of signals rises momentarily almost to a normal level. Can you suggest what is likely to be wrong?
B. C. R.

We think it certain that your eliminator is not delivering a sufficiently high voltage to the anodes of some of (or possibly all) the valves. When you switch off the mains it is quite possible that the collapse of the magnetic field in your smoothing chokes will give rise to a momentary increase in voltage. We recommend you to measure the voltage outputs available; a simple method of doing this was discussed in an article entitled "The Eliminator Output," in our issue of May 2nd.

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Selectivity and the Potentiometer.

I seem to remember having read that the potentiometer used for adjusting the bias of an anode-bend detector will serve to increase the selectivity of the set. Is this correct, and, if so, how is the method applied?
W. St. H. E.

The statement to which you refer is correct as far as it goes, but the operation of a potentiometer cannot be regarded as a certain cure for poor selectivity, although it is often very helpful when a desired transmission is heard through a background of signals from a nearby station. In these circumstances the right procedure is to increase the negative potential of the detector grid beyond the point which gives best rectification until the local signals disappear. Provided that the amplitude due to the required signals is sufficiently great, these will still be heard, but at reduced strength.

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A Safety Production.

I noticed a statement in a wireless textbook to the effect that it is advisable to connect the negative end of the H.T. battery to the positive L.T. terminal, in order that the pressure of the latter battery may be applied to the anodes. Looking through my back numbers of "The Wireless World," I find that this plan is followed only in one receiver (the "Everyman Portable"). Is there any reason why one should not take advantage of the few extra volts obtainable from the L.T. battery in this way? W. S.

At the time when H.T. batteries were much more expensive than they are now, and when lower anode voltages were commonly applied, it was desirable to obtain "free" voltage wherever possible, and it was for this reason that the plan was recommended. Its principal disadvantage is that an accidental short-circuit or misconnection is more likely to result in damage to the valve filaments than is the other arrangement, where L.T.− is connected to H.T.−.

With reference to the lightweight portable receiver you mention, it seems probable that the small gain in voltage resulting from the other form of connection is justified in this particular case.

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A Grid Circuit Modification.

Will you please show me how a gramophone pick-up may be connected to the "Kilo-Mag Four" receiver, preferably by the use of a plug and jack? H. A. H.

A pick-up may best be connected to this receiver by inserting it in the grid circuit of the detector valve. The connections of a jack are as shown in Fig. 2; of course, the pick-up will be joined

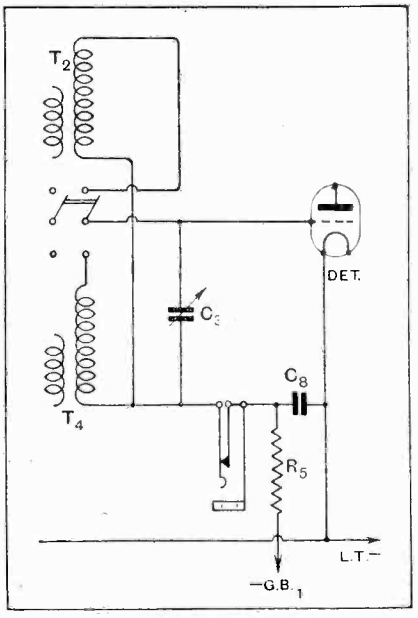

Fig. 2.—Adding a gramophone pick-up to the "Kilo-Mag Four."

to a plug. When using the receiver for gramophone reproduction, the value of grid bias applied to the detector valve must be halved, as it now becomes an L.F. amplifier.

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Range of the "A.C.3."

I am considering the construction of the "A.C.3" receiver described in your issue of September 5th, and would be obliged if you could tell me how many stations should be received here. I am ten miles from the local station. C. T.

We fear that it is impossible to give a definite answer to questions of this sort, in the lack of an intimate knowledge of your local receiving conditions. If these conditions are good, we think that you ought to be able to receive the majority of transmissions, which are sufficiently free from interference; the set in question can fairly be described as highly sensitive, as it includes a high magnification H.F. stage. Although there is but one L.F. amplifier, a valve of high efficiency is used in this position.

Its selectivity should be sufficient to prevent undue "spreading" of your local station.

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A New Valve.

Is the P.M.4DX valve suitable for use as a detector in the "Megavox Three" receiver? R. B.

Yes, this valve replaces the P.M.4D, which was originally recommended, and is equally suitable.

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Anode Resistances and Short Waves.

I am going to make a detector-L.F. set for short-wave reception, and should be glad to know if it would be possible for me to use an existing R.C. unit, in which the anode resistance has a value of 0.25 *megohm.*
F. T. R.

As a short-wave set of the kind you propose to make will inevitably include grid circuit detection, and will rely mainly for its sensitivity on reaction, we consider that a coupling resistance of the large value proposed would be unsuitable. We recommend you not to exceed some 100,000 ohms as a maximum.

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Flat Tuning.

My "Standard Four" receiver is giving very fair results, but selectivity is somewhat less than that of a friend's receiver in which the same circuit arrangement is used. I notice that the tuning of the aerial-grid circuit is much sharper than that of the H.F. coupling; this seems to be in opposition to what one would expect, and I am wondering if the transformer is likely to be faulty. L. F. L.

Except when using an H.F. valve of comparatively low impedance, it is to be expected, as you say, that the coupling circuit will be more sharply tuned than the other. As you suggest, the effect observed may be due to a fault in the transformer, and you should assure yourself that there are no faulty connections or leakages across its terminals; also you should check the connections of the detector bias battery and assure yourself that you are not applying a positive potential to the grid. Under these conditions the set would work, but not very efficiently, and tuning would be flat, due to the flow of grid current.

○○○○

Crystal and Pentode.

Do you think it would be possible to obtain good loud-speaker signals by using a pentode valve as an L.F. amplifier after a crystal detector? I live only two miles from 5SC and get excellent results with phones.
P. R.

Yes, a pentode valve coupled to the output of a crystal detector by means of an L.F transformer (which may have a fairly high step-up ratio) should give signals of good quality and ample volume. You should not forget to "earth" the filament circuit of the valve.

The Wireless World AND RADIO REVIEW

(16th Year of Publication)

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

CONTENTS OF THIS ISSUE.

THE WIRELESS OPERATOR.

THE tragic disaster which has recently befallen the *Vestris*, and the heroic behaviour of the wireless operators, raises once more the question of the status and remuneration of the seagoing operator.

The position of wireless operator on board a modern liner is one which requires not only considerable technical knowledge, but, especially in time of disaster, may call for the most exacting service which it is possible for a human being to perform. In the history of modern navigation, both in time of peace and war, the wireless operator has set an example at least as fine as has been recorded in any other calling in life. The world is always ready to extol heroic deeds, but as soon as the first thrill experienced with the news of the heroism of a wireless operator whose ship has been involved in disaster is over, the hero is soon forgotten and the status of operators, both as regards pay and rank, still remains, with comparatively few exceptions, so unattractive that the choice of such a career is by no means popular. We know that serious difficulties stand in the way of effecting any radical improvement in the pay and status of the operator; but is it not time that something should be done to make so honourable a calling more attractive, and so ensure that in the future, as in the past, positions of such responsibility shall continue to be filled by men possessed of the same qualities as have been displayed by so many heroes in the past?

o o o o

EMPIRE BROADCASTING.

ON Sunday, November 11th, a permanent Empire short-wave broadcasting service was inaugurated by the transmission of a speech by H.R.H. the Prince of Wales through the Kenya short-wave station, 7LO, at Nairobi. It is reported that regular programmes will be transmitted from now on under the direction of the British East African Broadcasting Company, to whom we offer our congratulations on their enterprise.

We also learn that the League of Nations is about to recommence its experimental short-wave transmissions, and the choice of a short-wave station competent to perform the service has fallen upon the Dutch transmitter at Kootwijk, arrangements having been made to connect the station by landline with a studio in the League of Nations Secretariat in Geneva.

Thus development of the use of short waves for long-distance broadcasting proceeds abroad, but in England, in the absence of evidence to the contrary, we are left to assume that 5SW stagnates and has made no real progress since first the station was opened more than twelve months ago.

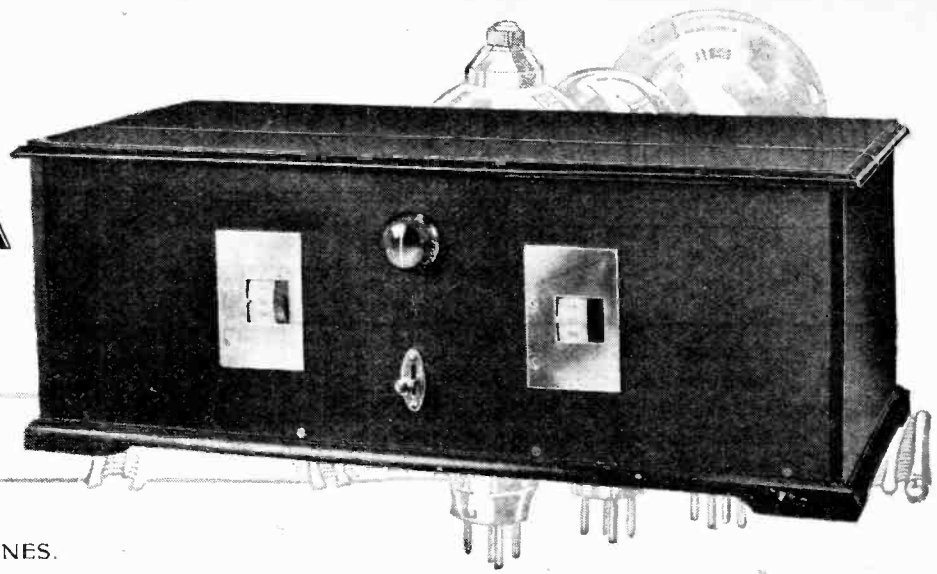
o o o o

MAINS SUPPLY UNITS.

WE are very pleased to be able to correct an impression given by a recent announcement in the daily Press, that the Middlesbrough Electricity Supply Corporation was encroaching upon what we regard as the legitimate activities of the wireless industry in arranging to design and manufacture its own battery eliminator for wireless purposes.

We have now been informed on good authority that this is not the course which the Corporation is adopting, but that the eliminators, although designed under the direction of the Corporation, are being supplied by a well-known manufacturer of wireless and electrical apparatus. The outfits are being purchased by the Corporation at standard trade prices and, under these circumstances, we take this opportunity of again expressing, as we did in our issue of November 7th, our appreciation of the enterprise of the Corporation in undertaking this service, which we consider sets a good example to other Electricity Supply authorities.

THE EUROPA III



By F. H. HAYNES.

A Post-Exhibition Receiver.

A POPULAR receiver to meet home receiving conditions and incorporating attractive features by way of new apparatus from the recent exhibitions has been the objective in designing this set. In spite, perhaps, of a campaign in support of quality reception for moving-coil loud speaker reproduction, there would seem to be an insatiable desire for that class of set which will tune in stations at every few degrees' movement of its dials. New valves of super-efficiency make possible the production of a simple receiver that will give loud speaker results from most European broadcasting stations, and it is around three selected valves that this set has been built. They are the P.M.14, a screened grid H.F. amplifier which has an impedance of 230,000 and a magnification factor of 200; the Marconi, or Osram, H.L.610 with an impedance of 30,000 and a magnification of 30, and the power valve P.625, which has an impedance of 2,400 and a magnification of 6, possessing a mutual conductance of the extraordinary high value of 2.5 with a permissible grid swing of 42. It is such figures as these that account for the enormously improved performances of this season's receivers. Components have been selected for their merit in relation to price.

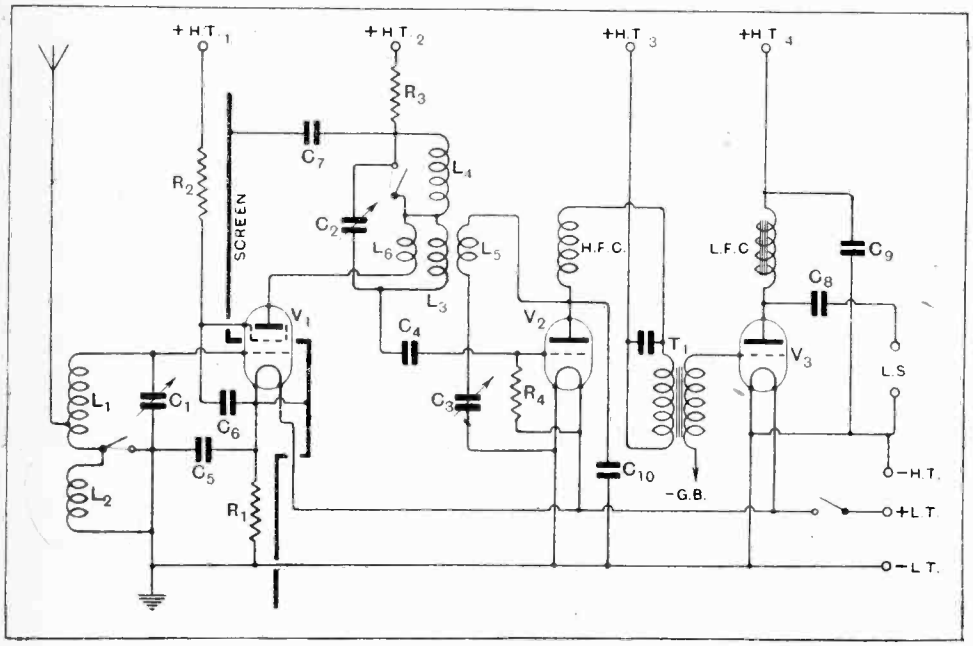
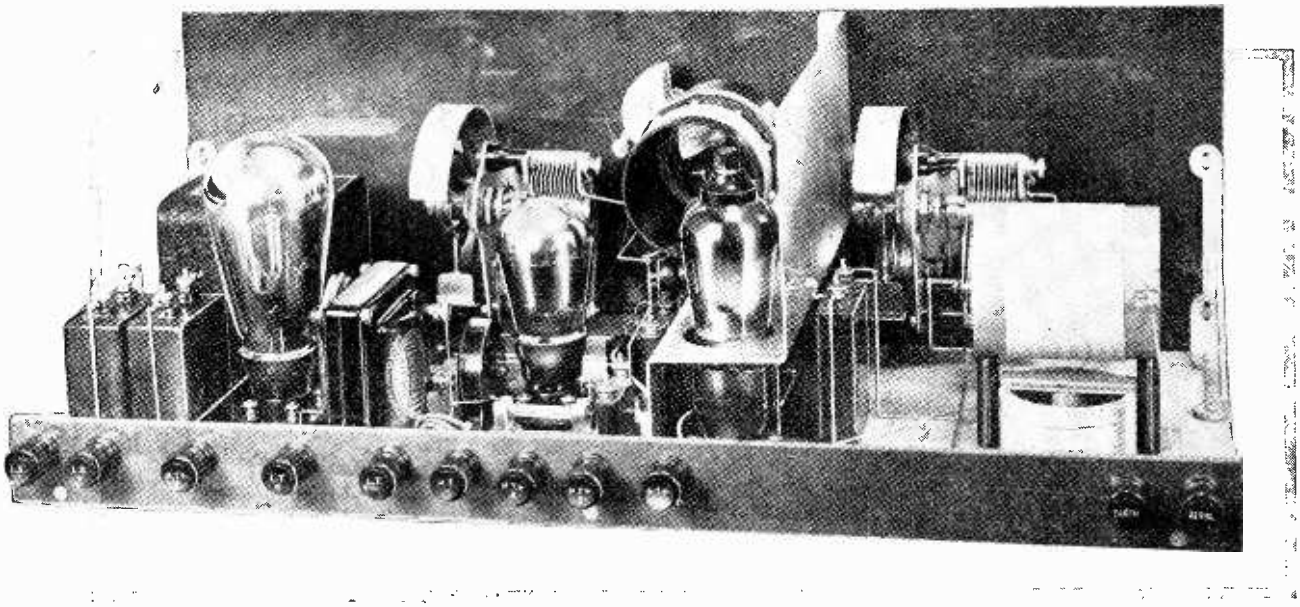


Fig. 1.—Reception on both broadcast and long-wave bands is provided by two single-pole switches arranged to short circuit loading coils. Reaction is associated with the H.F. intervalve transformer. L_1, L_2, aerial circuit transformer and loading coil; L_6, H.F. transformer primary; L_3, tuned transformer secondary; L_4, tuned anode coil for long-wave reception; L_5, reaction winding; C_1, C_2, 0.0005 mfd.; C_3, 0.0001 mfd.; C_4, 0.0003 mfd.; C_5, 1 mfd.; C_6, C_7, 0.05 mfd.; C_8, C_9, 2 mfds.; C_{10}, 0.0001 mfd. The transformer is supplied with the condenser shown across its terminals. R_1, 24 ohms; R_2, R_3, 600 ohms; R_4, 2 megohms.

Although it has been the aim to assemble the receiver from entirely standard components, it has been necessary to make up the coils used in the H.F. circuits. The aerial inductance consists of a solenoid coil combined with a multi-layer honeycomb winding in a manner that when the latter is short-circuited the performance of the remaining coil is in no way impaired. Thus, a very simple switch action changes from

The Eurora III.—

broadcast band to long wave, the switch having two contacts and a short-circuiting piece. Better selectivity combined with a gain in signal strength is obtained on the broadcast band by including only a portion of the aerial coil, instead of the whole of it in the aerial circuit. Full constructional details of this aerial coil are given in an accompanying drawing. To avoid the making of tapped holes the countersunk-headed 6B.A. screws are driven into $\frac{3}{32}$in. holes in the ends of the short ebonite rods which support the bakelised former. A clamp for the long-wave coil is made from a strip of ply wood serving as a bridge and secured to a small upright piece of wood. This aerial coil is mounted on its own separate ply wood base, and is well worth the trouble of making carefully. Three small strips of tinplate secured to the former with 6B.A. screws and



Rear view showing the assembly of the apparatus. To avoid duplication of apparatus normally associated with the battery eliminator, separate H.T. terminals are brought out from all anode circuits.

nuts serve as double-ended tags for terminating the single layer coil.

Transformer for S.G. Valve.

The H.F. intervalve coupling is a transformer. The reason for this is that a simple tuned anode possesses poor selectivity, and particularly is the lack of selectivity in evidence when the tuned anode is followed by a leaky grid detector. The sensitiveness of a leaky grid detector to weak signals and its non-proportional output to stronger ones causes it to pass on even a comparatively weak interfering signal on an adjoining wavelength, the presence of which arises from the use of an unselective tuned circuit. With anode-bend detection the poor selectivity of the tuned anode is not so apparent, but anode-bend detection is too insensitive for our present purpose. The H.F. valve with regard to radio-frequency potential bridges the ends of the coil forming its anode circuit, and although with an impedance as high as 230,000 ohms, as possessed by the screened grid valve, it may at first be thought to introduce only slight damping in the tuned circuit, it does in fact rule out any advantage one might hope to gain by the use of a really efficient coil. Another consideration in favour of a transformer coupling, apart from the gain in selectivity, is the lack of stability sometimes experienced with a tuned anode coupling. This ready tendency to oscillate arises from the same cause as that existing in an H.F. amplifier where no steps are taken to neutralise the capacity coupling present between the plate and grid of the H.F. valve. Plate-to-grid capacity is not entirely absent in the screened grid valve, and the high magnification gives rise to a sufficient out-of-phase potential difference occurring across the electrodes to bring about regeneration. By means of a transformer coupling, the H.F. potential fed back across the valve is sufficiently reduced to maintain stability, as the potential existing across the ends of the primary may be less than that set up across a tuned anode coupling. Thus, in obtaining better selectivity, the H.F. amplifier is rendered more stable by the adoption of the transformer. From experiments with several forms of windings a good transformer results when primary and secondary are tightly coupled inductively, when there is a minimum of capacity coupling between the windings, the actual turns ratio which will vary with the arrangement of coils not being more than 2 to 1. This transformer with the P.M.14 gives a voltage amplification in excess of 30. A minimum of capacity coupling is desirable in order to avoid the existence of a path by which low-frequency currents can gain access to the detector grid from the H.T. supply. Low-frequency oscillation trouble so commonly met with in multi-valve receivers is now generally prevented by the use of feed resistances, so that the alternating signal currents are not permitted to circulate through the common resistance path of the H.T. supply. The

LIST OF PARTS.

1 Baseboard, 21 × 9 × ⅜in. of 5-ply wood.
1 Bakelised board panel, 21 × 7 × ⅛in. (Pertinax or Paxolin).
1 Terminal strip of bakelised board, 21 × 1½ × ⅛in.
1 Pair panel brackets. (Keystone, Peto Scott).
1 Aluminium screen, No. 16 gauge (from makers of metal cabinets).
1 Aerial coil former, 3 × 2½in. diameter (Pirtoid. H. Clarke & Co., M/c., Ltd.).
1 H.F. transformer former, 3½ × 2½in. diameter (Pirtoid, H. Clarke & Co., M/c., Ltd.).
1 Variable condenser, 0.0001 mfd., for reaction (Midget, Dubilier).
2 Variable condensers, 0.0005 mfd. (Utility, Thumb Control Type 191, Wilkins & Wright).
1 L.F. choke (Type DY.11, 28/14 henrys, R. I. & Varley).
1 L.F. transformer (AF4, Ferranti).
1 Grid leak, 2 megohms (Loewe Radio Co., 4, Fountayne Road, London, N.15).
1 Porcelain grid leak holder (Bulgin, 9/11, Cursitor Street, Chancery Lane, London, E.C.1).
1 Condenser, 1 mfd. (T.C.C.,).
2 Condensers, 2 mfds. (T.C.C.,).
2 Condensers, 0.05 mfd. (T.C.C., upright type).
1 Condenser, 0.0003 mfd. (T.C.C., upright type).
1 Condenser, 0.0001 mfd., (T.C.C., upright type).
3 Valve holders, rigid type (Whitley Boncham & Co.).
1 H.F. choke (Burndept).
1 Fixed value filament resistance, 24 ohms ("Peerless" Varistor, Bedford Electrical Co.).
2 Loading coils with pin bases removed (Type L.200, Igranic Electric Co.).
1 S.P.D.T. switch (Utility, W190/1, Wilkins & Wright).
1 D.P.D.T. switch (Utility, W190/2, Wilkins & Wright).
1 Connecting rod for above, 7in. between centres of holes (Wilkins & Wright).
2 Resistances, 600 ohms (Wright & Weaire).
11 Ebonite shrouded terminals (Belling & Lee).
Small quantities of wire for H.F. transformers, screws, etc., ⅜in. ebonite rod, soldering tags.
1 Cabinet, 21 × 7 × 9in.
Approximate cost of parts (excluding valves and cabinet), £7 5s.

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.

coupling condenser of a tuned anode or an appreciable capacity between the primary and secondary windings of a H.F. transformer creates a condition whereby fluctuating potentials present in the H.T. supply may be diverted to take a route through this capacity to the grid of the detector in sufficient value to introduce the dangers well known to exist by stray interstage coupling.

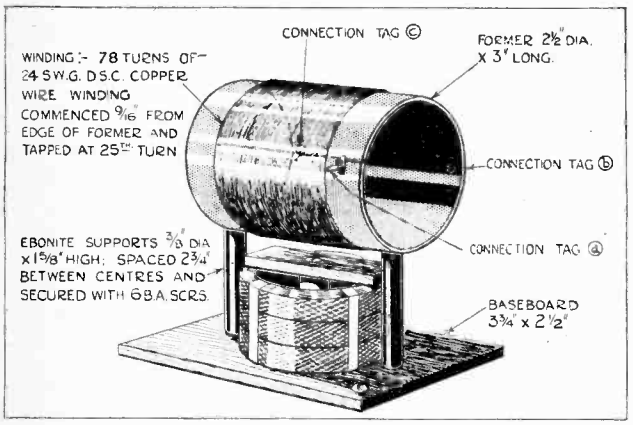


Fig. 2—Constructional details of the aerial transformer. The loading coil is an L.200 duolateral with its pin connector removed.

For simplicity of switching and wiring, the H.F. intervalve coupling becomes a tuned anode on the long wavelengths. Instability does not result, as the feed back across the valve capacity is reduced with the lower frequency.

The advantages of a critically controlled amount of regeneration cannot be omitted from a set that is to possess maximum sensitiveness; in fact, the voltage gain of the H.F. stage is, on weak signals, multiplied by three or more times by its aid. Quite a small amount of feed back associated with the detector valve anode circuit gives rise to a greatly increased signal voltage across the H.F. transformer secondary. Incidentally, the evidence creeps in here that the screen of the valve is not completely effective, for the H.F. voltage rises also in the aerial transformer, a very beneficial condition provided it is not taken too far. With the H.F. stage gain now substantially controlled within the scope of 300 per cent., or more, by the use of reaction one need scarcely pay heed to the potentials set up in the aerial coil by the incoming signal. Measurement reveals that the local station may deliver an H.F. potential of more than a volt to the grid of the H.F. valve. 5GB may produce a potential of some tenth of this value at a distance of seventy miles, yet, apart from these two stations, the twenty, or more, distant transmissions which are to be received produce only a few millivolts. Thus with the H.F. gain and the benefit of reaction an input of 10 millivolts from

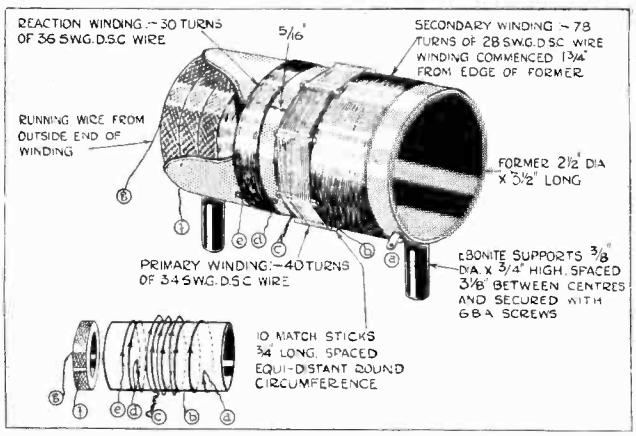


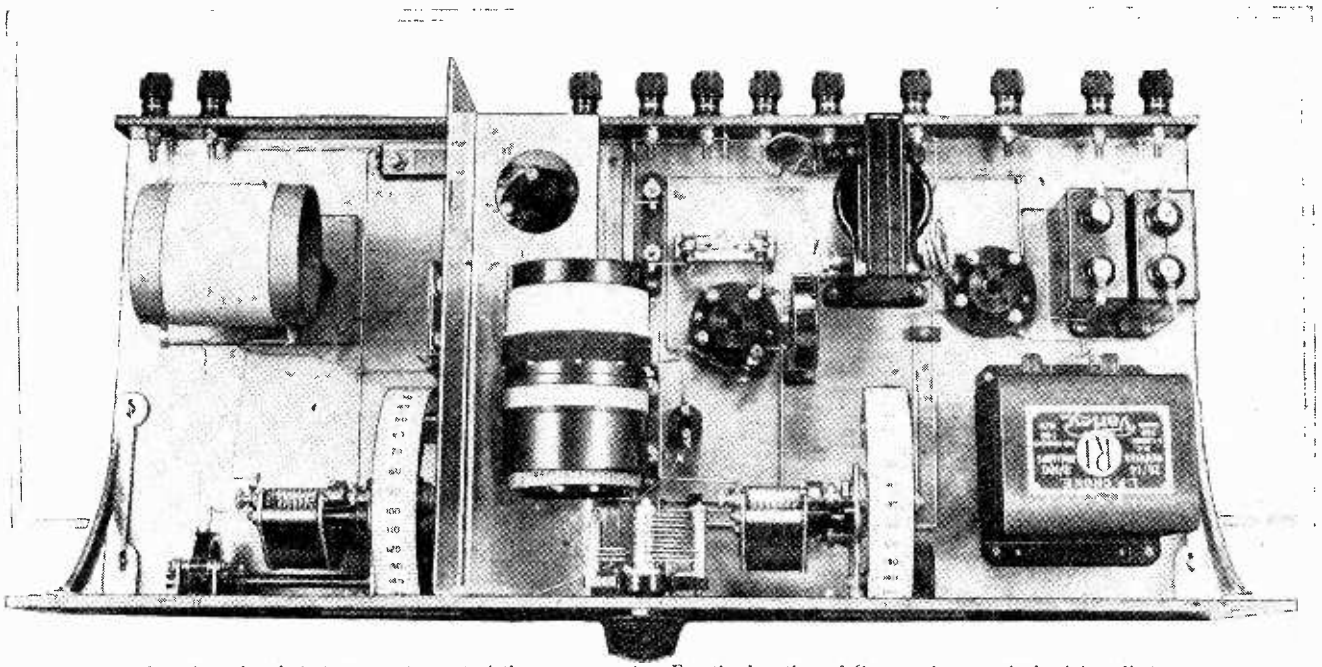
Fig. 3.—Reacting H.F. intervalve transformer for use with the screened grid valve. The relative directions of the windings need to be carefully followed.

The Europa III.—

the aerial transformer will fully load the leaky grid detector by passing on to it a potential approaching a volt.

Volume Control and Reaction.

For local station and Daventry reception amplification is modified by the avoidance of reaction, and, in the case of a receiver of this class, by detuning. Increasing the potential applied to the screen grid will, of course, reduce the amplification. For these sufficient reasons a volume control, as such, is not provided. Moreover, if a battery eliminator is used means may be available for critically controlling the screen grid potential and so giving the necessary control of volume.



Plan view showing the arrangement of the components. For the location of C_{10} see the practical wiring diagram

The capacity-controlled reaction is produced by a fine wire winding at the earth potential end of the transformer windings. It couples with the long-wave coil which exactly fits into the end of the bakelised former. It is most important that the direction of winding adopted shall be exactly as shown in each case and the ends connected up as indicated in the diagrams, avoiding, in particular, a reversal of the loading coil or reaction. The ten pieces of matchstick supporting the transformer primary are held in position with an elastic band before winding. The ends of primary and secondary are terminated by passing in and out through holes pierced in the former and are twisted and soldered together at one end ready for joining to a wire extending from a top contact of the switch. Primary and secondary are in the same direction, that is, from the soldered end the first turn of the primary overlaps the first turn of the secondary both spiraling away in the same direction. The finishing end of the secondary is terminated on a tag, while the finishing end of the primary is wound into a cut previously made in one of the pieces of match stem. A good method of terminating the reaction winding is that of laying a thin paring of match under the winding and around which the ends may be looped.

Several plates have been removed from the reaction condenser so that the capacity change shall be as slow as possible while maintaining a sufficient maximum. Actually it is left with three fixed plates without reducing the number of moving plates, and the constructor will probably find that this amount of capacity reduction, too, meets his requirements. See that the plates do not short-circuit as the H.T. battery potential is across them. On the score of economy it was hoped when proportioning the reaction circuit to dispense with the H.F. choke coil, but for uniform reaction effects on both long and short waves a choke is required to ensure the circulation of H.F. currents through the reaction coil, while a small bridging condenser is still needed to afford an alternative path and permit of the detector valve functioning correctly when the reaction condenser is at zero.

The L.F. stage is quite orthodox, and makes use of a $3\frac{1}{2}$ to 1 ratio transformer and a choke filter output. Assuming that the leaky grid detector is dealing with a peak voltage of 1, as mentioned earlier, and has over a limited range a linear output, then the peak voltage which will be applied to the P.625 valve is 1 multiplied by the voltage magnification of the valve times the percentage modulation, times the transformer ratio. With 20 per cent. modulation—reaction may reduce this figure—the factors become $30 \times \frac{20}{100} \times 3.5$, which gives 21, or a total voltage swing of 42, thus adequately loading the output valve.

(To be concluded.)

BROADCASTING BY WIRED WIRELESS.

Methods of Distributing Signals to Subscribers' Lines.

(*Concluded from page 679 of last week's issue.*)

IN the system of wired-wireless broadcasting suggested in the Western Electric Company's patent, programmes from, say, three points are brought into a central main distributing station. From the central distributing station the programmes are relayed to various telephone exchanges and introduced into the subscribers' lines for local distribution or are transmitted over the trunk lines to more distant exchanges. Before entering each distributing centre the currents are amplified in the usual manner, so that the currents on the trunk lines are at normal strength, and sufficient energy is available for supplying all the subscribers' circuits.

Various arrangements capable of being used in the collecting system at the main broadcasting station are illustrated in Fig. 6. Transmission of the programmes originating at the microphones T_1, T_2, and T_3 may take place on ordinary telephonic frequencies or on carrier-wave frequencies. For example, the microphone T_3 is shown transmitting to the main distributing station over the line L_3 at ordinary telephonic frequencies.

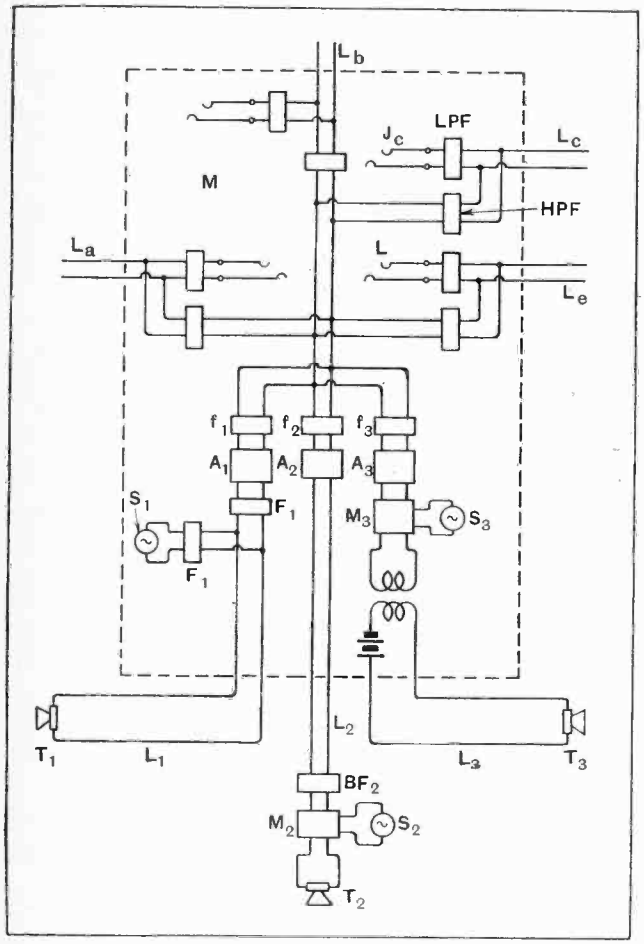
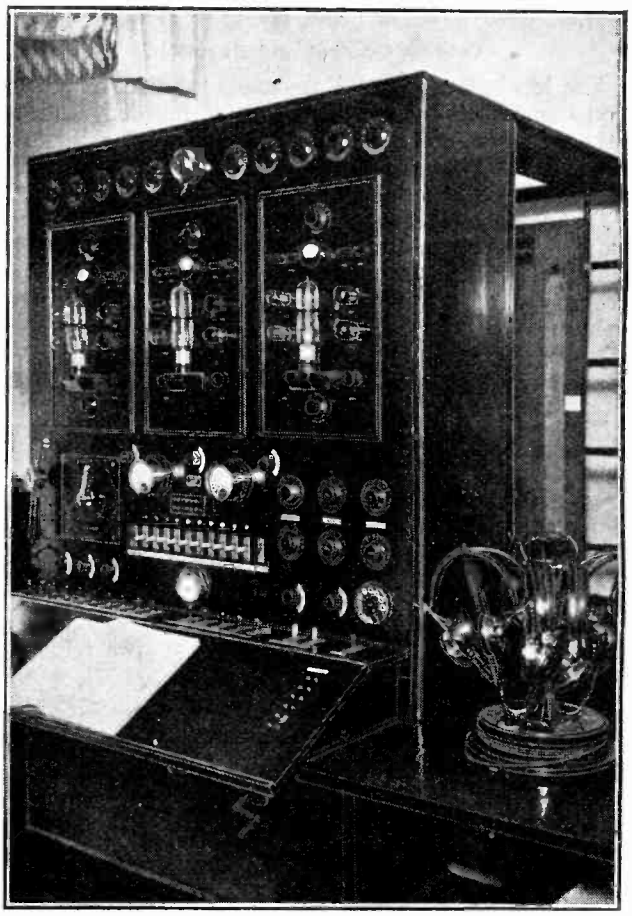


Fig. 6.—The circuit arrangements used in the collecting system at the main broadcasting station.



Speech amplifier used in connection with distribution over subscribers' telephone lines at a Continental opera house.

Suppression of One Side Band.

At the distributing station M the band of frequencies received from T_3 is modulated by a carrier wave from the valve generator S_3. The modulator is represented in the figure by M_3. In the case of the microphone T_2 the modulator M_2 is supplied by carrier frequency wave from S_2, and, if desired, one of the side-bands produced is suppressed by the band pass filter BF_2, so that the same total width of band is transmitted by the line L_2 as L_3. With microphone T_1 the carrier frequency is shown supplied to the line L_1 by a generator S_1 and filter F_1 installed at the central station, one side-band being suppressed by the filter F_1. Here the microphone varies the amplitude of the carrier frequency, and combines within itself the functions of an ordinary telephone transmitter and a modulator.

The signals due to the three programmes from T_1, T_2, T_3, after being brought into the central station, are

Broadcasting by Wired Wireless.—

amplified by amplifiers A_1, A_2, A_3, and are selectively imposed on an outgoing line L by means of the band filters f_1, f_2, and f_3. The line L carries the programme to the various local telephone exchanges through lines such as L_a, L_b, L_c, etc. If the central broadcasting distributing station is made part of a telephone exchange, the various lines L_a, L_b, L_c, etc., would be terminated in jacks to allow of interconnection in the usual way. Thus, suppose the line L_c to an outside exchange terminates in a jack J_c, one branch from the line is connected to the broadcasting "bus" line L, through a high pass filter (HPF), and a low pass filter (LPF) is introduced between the jack and this connection. As we have seen already, the high pass filter will allow the carrier frequencies from L to reach the exchange line L_c, but prevents telephonic frequencies from reaching L. Similarly, the low pass filter permits ordinary telephonic frequencies to be transmitted to the jack, but at the same time prevents the carrier frequencies being transmitted to it.

Various means of coupling the lines carrying the programmes to individual subscribers are shown in Fig. 7. In one case the lines included in a cable are connected to the secondaries of a multi-wound transformer, of which the primary is included in the line from the central broadcasting station. Between the transformers and the jacks on the exchange switchboard condensers are inserted across the subscribers' lines. These condensers, if they are of the right value, will short-circuit the high-frequency carrier currents with respect to the jacks, so that if a given circuit is connected to another for ordinary telephony purposes the high-frequency currents carrying the broadcast matter will not be transmitted to the other circuit. Another method of coupling suggested is shown at the top right-hand corner of Fig. 7, and consists in gathering the subscribers' lines into a composite cable made in the form of a coil, which is coupled to a coil carrying the broadcast matter. A modification of this method is shown on the left where leads from a composite coil are bridged across each line. Suitable condensers are introduced in each connection to the coil to prevent short-circuiting the ordinary telephone lines, and chokes are provided instead of condensers to prevent the carrier frequencies reaching the jacks. A further modification is also shown, where conductive instead of inductive connections are provided to the several lines, chokes and condensers being introduced to separate the higher frequency from the lower frequency currents. The simple schemes for using chokes and condensers for separating the currents of various frequencies assume that the carrier frequencies are sufficiently high compared with ordinary telephone frequencies to permit separation by the simple methods described. As we have already seen, this at the present stage of development of wired-wireless is not likely to be the case, and therefore the more complicated and expensive filters of the types already described would have to be used.

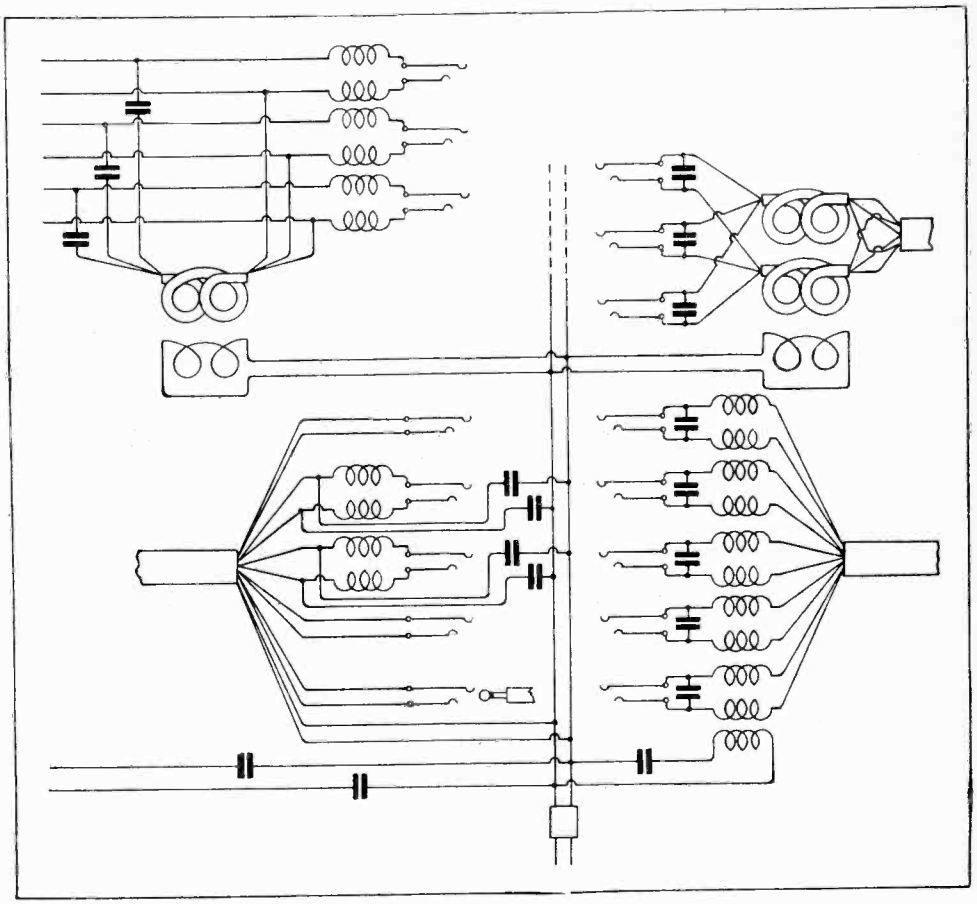


Fig. 7.—Various methods of coupling the lines carrying the programmes to individual subscribers are here shown.

Probably in the case of short-distance subscribers an ordinary separate circuit for the broadcast matter could be provided more economically. As privacy is not required, many subscribers could be included on such a special circuit.

As regards arrangements for the reception of carrier frequencies it is possible to select the frequencies by simple tuning methods provided the range employed is sufficiently wide for discrimination to be obtained in this way. If, on the other hand, the frequency bands

Broadcasting by Wired Wireless.—

used are nearer together, it would be necessary again to employ filters for each class of broadcast matter. In Fig. 8 three band filters, BF_1, BF_2, BF_3, are shown intended for dealing with three broadcast channels.

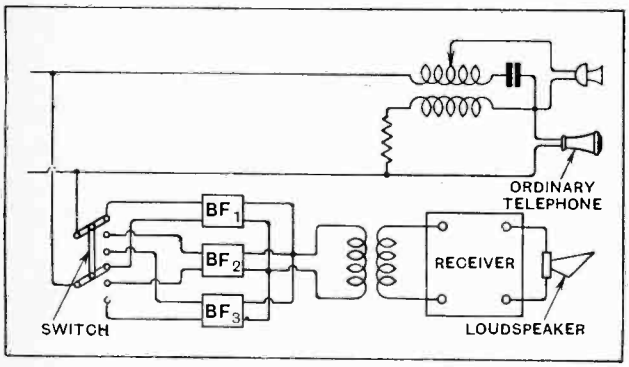


Fig. 8.—A receiver with three band filters intended for dealing with three broadcast channels.

These are coupled by a transformer to an ordinary wireless receiving set with the usual detector and low-frequency amplifier connected to a loud speaker. If only one side-band is transmitted, a valve oscillator would also be necessary to reintroduce the carrier wave eliminated at the transmitting station. In order to prevent the carrier frequencies reaching the subscribers' ordinary telephone transmitter, receiver, and ringing arrangements, a low pass filter is introduced.

Using the Power Mains.

Many of the complicated and expensive filters necessary for the introduction of carrier-wave broadcasting on to a telephone system are unnecessary if a power or lighting system is used for the wire network. The same transmission arrangements from the central broadcasting station to the power system can be used—suitable condensers being introduced to prevent the lighting currents interfering with the carrier currents. The apparatus associated at the receiving end with an ordinary alternating current lighting system is shown in Fig. 9. In this figure T is the usual step-down transformer, B is a cut-out box, and C the house-meter. An ordinary power load of lamps is shown on the right of the figure. The broadcast receiver is connected between C and B, and, as before, three band pass filters (BF_1, BF_2, BF_3) are employed. The necessary filament and high-tension current for the receiver can, of course, be obtained from the mains, if desired, in the ordinary way. As the sub-station transformer T is designed for low-frequency currents it may be necessary to bridge the windings by condensers C_1, C_2, but probably the self-capacity of the windings would provide a path for the high frequency. The inductance of the coils of the meter C would also probably be sufficient to prevent high-frequency currents reaching the lighting load circuits.

As already stated, very few experiments have been made with wired-wireless broadcasting, and little has yet been done with multi-plex carrier-wave telephony over cables as distinct from overhead lines. Cables introduce a considerable transmission loss, especially with higher frequencies. They also introduce large irregularities in the impedance characteristics of the line which affect the amount of amplification necessary for efficient working.

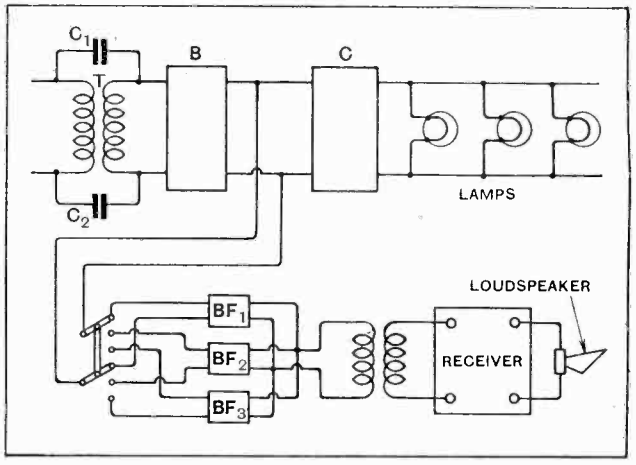


Fig. 9.—When an ordinary alternating current lighting system is employed the associated apparatus that has to be installed for reception is shown in this diagram.

The limitation of the frequencies which can be employed at present for wired-wireless without interference with ordinary wireless communications also presents a difficulty to be overcome. With the little practical experience available it is impossible to say that wired-wireless is likely to become at present a feasible adjunct to ordinary broadcasting, but the overcrowded state of the ether and the increasing demands upon it may, in the future, cause energy to be directed to any means by which the amount of broadcast matter can be increased. O. F. B.

CATALOGUES RECEIVED.

Aneloy Products, Eton Works, East Dulwich, London, S.E.22. Illustrated leaflet giving characteristic curves of the new L.S.680 output valve with a mutual conductance of 3mA./volt and maximum dissipation of 10 watts.

Elmesan (London), Ltd., 66, Victoria Street, London, S.W.1. Illustrated leaflets describing "Meta" solid fuel for heating soldering irons.

A. F. Bulgin & Co., 9-10-11, Cursitor Street, Chancery Lane, London, E.C.4. Illustrated 54-page catalogue of "Deckorem" components, including a manual for home constructors.

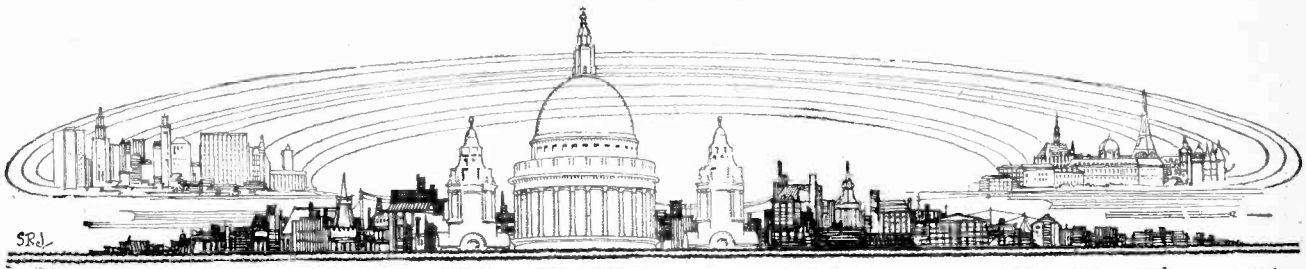
Philips Lamps, Ltd., 145, Charing Cross Road, London, W.C.2. Illustrated leaflet describing the Philips Type 2007 loud speaker.

Baker's Selhurst Radio, 89, Selhurst Road, South Norwood, London, S.E.25. "A New Hobby for Wireless Enthusiasts and Experimenters," an illustrated catalogue of moving-coil loud speaker parts.

Lisenin Wireless Co., Connaught House, 1a, Edgware Road, London, W.2. Illustrated 16-page catalogue of terminals and other components.

Ormond Engineering Co., Ltd., 199-205, Pentonville Road, King's Cross, London, N.1. Complete illustrated catalogue for 1929 containing full particulars of Ormond condensers, receivers, and wireless components.

The Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17. Leaflet No. 1032, describing Benjamin radio products for 1928-29.



CURRENT TOPICS

Events of the Week in Brief Review.

MAGNETIC WIRELESS.

The Tavistock Board of Guardians has opposed the introduction of wireless into the casual ward of the local institution because it might attract too many "casuals."

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AMERICA'S WIRELESS FAMILY.

According to the National Broadcasting Company of America, there are now 9,640,348 families in the United States using wireless receivers. The total audience is estimated to be 41,453,496.

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MAN-MADE STATIC.

Listeners who are troubled by electrical interference in their neighbourhood will be interested in an important decision given in a Dresden court last week, when it was held that sufferers from disturbance of this kind are entitled to take legal action to restrain the nuisance.

Legislation against electrical interference with wireless reception is long overdue in this country. Candidates for the next Parliament would do well to note this fact when preparing their election addresses.

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ANTARCTIC SEARCH FOR BLIND SPOTS.

A special type of oscillograph known as the "osiso," is about to be used by the Byrd Antarctic expedition in an endeavour to secure data regarding radio blind spots in Polar regions, says a New York message. The "osiso," which is stated to be capable of registering time variations almost to a millionth of a second, will be employed in tests to determine the time taken by a wireless signal to return to earth after reflection from the Heaviside Layer. Attempts will be made to confirm the theory that the Layer touches or approaches the earth at the North and South Poles.

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A GOOD LOAD.

Nearly 500 pairs of headphones and six loud speakers are operated from a new wireless set installed in Deptford Hospital.

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ONLY A TECHNICAL OFFENCE.

Major W. O. Prichard, of Brampton Brian, summoned for operating a crystal set without a licence, informed the Wigmore Bench that the omission was entirely due to an oversight on his part. The aerial was connected to the front of his house, which adjoined the post office, and he contended that the post office staff should have sent him notice that a licence fee was due. Mr. Morris (for the post office) said that if defendant had taken out one licence he would have received an intimation when it expired.

The Justices held that a technical offence had been committed and imposed a fine of one shilling.

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WIRELESS ON TRAINS.

Passengers on certain trains on the Hungarian State Railways now find on each seat a hygienically sealed wrapper containing headphones. For a fee of 6d. an hour they can listen to programmes from the nearest broadcasting station.

During a recent test on the Budapest-Vienna express excellent reception was obtained throughout the run. The popularity of this innovation has been such that the railway authorities have decided to instal wireless receivers on as many trains as possible.

At one time it was believed that British railways might adopt a similar means of relieving the tedium of long journeys. The belief has now been successfully stamped out.

WIRELESS FEVER IN FRANCE. The recent Paris radio show has stimulated popular interest in broadcast reception. The photograph, taken in Paris a few days ago, shows an advertisement model of a well-known set.

WIRELESS ON THE "VESTRIS."

The three wireless operators on board the *Vestris*, which foundered off the coast of America last week, worthily upheld the traditions of the wireless service. At the time of going to press it is greatly feared that the senior operator, Mr. Michael Joseph O'Loughlin, has lost his life; Messrs. Macdonald and Verchere, second and third operators respectively, have been saved.

Reports from New York state that the wireless gear was in operation for three hours on the main plant, and that the emergency plant was in use almost up to the time when the ship sank. The apparatus consisted of a Marconi 1½-kW. set with emergency gear, a C.W. long-wave transmitter for special service, and a valve receiver.

The saving of 200 lives from the ill fated vessel can be directly attributed to the heroic operators and their installation.

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A POWERFUL BEAST.

"Two-valve receivers incorporating the Loewe double-grid two-stage valve 2 h.p. will also be available. . . ."—*The Sphere*.

A reader claims that he will improve on this when he builds his 40 h.p. o.h.v. super-het.

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NEW CALL SIGNS IN "S.A."

As from January 1st next, writes a Bloemfontein correspondent, the call signs of the three broadcasting stations in the Union of South Africa will be as follows:—Capetown, ZTC; Johannesburg, ZTJ; Durham, ZTD.

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MAINS TRANSFORMER DESIGN.

Owing to an unfortunate drafting error, the ordinates on the graph shown in Fig. 4 on page 630 of our issue of November 7th last show an unduly high loss for "Stalloy" transformer iron. The units for "Watts lost per lb" should be divided by 6.45 to give the correct iron loss.

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NEXT YEAR'S R.A.F. DISPLAY.

The Air Ministry announces that the tenth Royal Air Force Display will be held at Hendon aerodrome on Saturday, July 13th, 1929. The International Aero Exhibition will open at Olympia on July 16th.

TRANSMITTERS' NOTES AND QUERIES.

New Signal-Strength Code.

There seems to be considerable divergence of opinion on the comparative merits of the "R" code to which we have become accustomed, and the new code which will supersede it when the new international regulations come into force. The "R" code deals mainly with the strength of signals after they have become clear and readable, whereas the new code will subdivide the weak or otherwise illegible signals into more classes. This seems the better plan, as, after all, when once a signal becomes "very good, perfectly readable," it is only a question of amplification whether its actual strength is R5 or R9. The present, not uncommon, practice of reporting strength as R5/R7 without specifying the type of receiver or the degree of amplification is of no value for comparison. Perhaps the most convenient method would be for amateurs to agree on some code indicating the receiver used, the number of valves employed, and the ultimate strength of the signals received. This, however, would be no easy matter if accurate and standardised comparison is to be achieved, as so many factors must be taken into account, such as the size and height of the aerial and the particular circuit used.

The new code is, in fact, more concerned with readability than strength, and signals which might be reported "R6" under the old code could easily be only "3"—"readable but with difficulty"—if atmospherics were bad.

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Nationality Prefixes.

We do not yet know what changes will be made in the nationality prefixes of some foreign countries in order to conform with Article 14 of the regulations, which specifies that private experimental stations shall use "the letter or letters indicating the nationality, and a single figure followed by a group of not more than three letters." England, France, Italy, and Norway will be unaffected, excepted for dropping the Continental "E," as they will have the unfettered use of "G," "F," "I," and "LA" respectively. Spain, we believe, will continue to use EAR, but may have to modify the distinguishing figures, though we feel sure she will certainly be loth to give up EAR 14, which, by a graceful act, has been reserved perpetually in memory of the late Senor Alfredo Liaño.

The matter is, we understand, still under discussion in Sweden, and it is probable that the old call letters will be retained, but with the insertion of a figure after the "SM" to denote the geographical district. Germany will be no longer able to use "K," while Belgium, Denmark, Finland, and several other European countries will have to relinquish the prefixes to which they have become accustomed.

"Or Other Approved Type."

The question of wavemeters for use by transmitters under the new regulations is still somewhat undecided. The laboratory type of crystal-controlled wavemeter is expensive, and there appears some considerable doubt what "other approved type" will satisfy the Postmaster-General. Those answers which we have seen to direct enquiries addressed to the Post Office are either negative and intimate the wavemeter that may *not* be used, or they are discouraging; for example: "Where an experimenter has access to a wavemeter of the multi-vibrator type this will be considered satisfactory." It is not every amateur who is fortunate enough to have access to a costly standard wavemeter.

We understand that the R.S.G.B. is taking up the matter and is issuing a circular to its transmitting members showing how a comparatively inexpensive crystal oscillator can be made to check their wavemeters.

Club News.

Field Days in Pictures.

Films showing field days held in 1926 and 1928 were the chief items of interest at a recent meeting of the Newcastle-upon-Tyne Radio Society, at which Mr. W. R. Pape, the chairman, gave an expert demonstration of amateur cinematography.

Hon. Secretary: Mr. W. W. Pope, 7, Kimberley Gardens, Jesmond, Newcastle-on-Tyne.

FORTHCOMING EVENTS.

WEDNESDAY, NOVEMBER 21st.

North Middlesex Radio Society. At 8 p.m. At St. Paul's Institute, Winchmore Hill. Discussion on "Selectivity."

Tottenham Wireless Society. At 8 p.m. 10, Bruce Grove, N.19. Lecture: "Picture Broadcasting," by Mr. F. H. Haynes, Asst. Editor of "The Wireless World."

Muswell Hill and District Radio Society. At 8 p.m. At Tollington School, Tetherdown, N.10. Demonstration by Messrs. Celestion Radio Co.

Edinburgh and District Radio Society. At 8 p.m. At 117, George Street. "Loud Speakers."

THURSDAY, NOVEMBER 22nd.

Leyton and Leytonstone Radio Society. At 8 p.m. At Grove House, High Road, Leyton. Discussion: "H.F. versus Detector with Reaction."

MONDAY, NOVEMBER 26th.

Newcastle-upon-Tyne Radio Society. At 7.30 p.m. At 11, Saville Row. Lecture by Mr. A. E. Dees (of Messrs. S. G. Brown, Ltd.).

Holloway Radio Society.—At 7.30 p.m. At Holloway County Secondary School, Hilldrop Road, N.7. "Dubilier Condensers."

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

Amplion "Lion" Demonstrated.

The new Amplion "Lion" loud speaker was dealt with in a lecture and demonstration given to Mr. P. K. Turner, of Messrs. Graham Amplion, Ltd., at the meeting of the Muswell Hill and District Radio Society on November 7th. After indicating faults inherent in the ordinary reed-driven type of instrument, Mr. Turner explained in detail the ingenious manner in which these defects had been obviated in the "Lion."

Hon. Secretary: Mr. G. S. Sessions, 20, Grasmere Road, N.10.

Wireless Progress and the War.

At the meeting of the Bristol and District Radio Society held on Friday, October 26th, Mr. H. de A. Donisthorpe, of the General Electric Co., Ltd., lectured on "Radio Progress and the Effect on Thermionic Valves." The lecturer pointed out that the War was responsible to a very large extent for the rapid progress made during the last fourteen years. Enumerating some of the present day applications of the thermionic valve, the lecturer mentioned automatic fog signalling apparatus, the Fultograph, Noctovision, Television, and Phonofilms.

"The Manufacture, Care and Maintenance of Accumulators" was the title of a comprehensive lecture given by Mr. H. C. Mayer, of Messrs. Joseph Lucas, Ltd., at a meeting of the Society on November 2nd. At the conclusion of the lecture, Mr. Mayer presented an H.M.G high tension accumulator for ballot among the members.

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

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400 Per Cent. Membership Gain.

November 1st marked the commencement of the new session of Slade Radio (Birmingham). Meetings are held in the Parochial Hall, Broomfield Road, Erdington, and an attractive programme has been prepared for the coming winter. The membership of the Society now numbers ninety, showing an increase of about 400 per cent. this year. It is expected that there will be a considerable influx of new members in the near future. The Society has opened a new experimental station.

Hon. Secretary: Mr. H. Clews, 52, St. Thomas Road, Erdington, Birmingham.

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The Diode Rectifier.

Mr. F. E. T. Clark lectured on the "Diode Rectifier" at a meeting of the South Croydon and District Radio Society on November 6th. The lecturer stressed the advantages of this system of rectification, particularly in purity of reception obtained from it. The characteristics of the rectifier were illustrated clearly on the blackboard. In the following discussion some contention arose regarding the question whether the loss of volume entailed was outweighed by the rectification properties of the valve.

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

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Transmission and Reception Demonstrated.

A demonstration of short-wave transmission and reception provided an interesting evening for members of the Kentish Town and District Radio Society at the last meeting. An attractive programme has been arranged for the winter season, and new members will be cordially welcomed. Meetings are held every Friday at 8 p.m. at the Carlton Road Schools, Kentish Town. Communications should be addressed to the Hon. Secretary, Mr. A. H. Sartain, at the above address.

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An Evening of "Lecturettes."

"Lecturette Night" proved a popular feature at the last meeting of the North Middlesex Radio Society. The subject chosen was "My Own Set." The first speaker, Mr. Tagent, described a four-stage rectifier he had constructed on the "Unit" system, comprising (1) H.F. panel, (2) detector stage, (3) and (4) resistance and transformer L.F. stages respectively. Mr. H. A. Green followed with a description of his three-valve receiver, embodying the "Schnell" circuit. Mr. R. Kirlew then gave details of a Quartz-crystal oscillator he was constructing and gave a short account of the method of arriving at suitable circuit values and of the way in which the crystal controlled the frequency of the circuit. This was particularly interesting in view of the fact that the Postmaster-General now requires all transmitters to be equipped with a crystal-controlled wavemeter.

Hon. Secretary: Mr. E. H. Laister, "Endcliffe," Station Road, N.21.

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A Good Year.

At the annual general meeting of the South Woodford and District Radio Society it was reported that at the Society's meetings during the year more than thirty talks and demonstrations had been given. The retiring officers were re-elected *nem. con.*, with Mr. J. E. Nickless (2KT) as president.

Hon. Secretary: Mr. E. J. Turbyfield, 48, Alexandra Road, South Woodford, E.18.

A Review of the Apparatus which gained first place in its respective class in our Olympia Show Competition Ballot.

THE result of the Ballot in *The Wireless World* Olympia Show Competition has already been announced in our issue of November 7th. The purpose of the competition was to ascertain what were the best products in various classes exhibited at the Olympia Show, as decided by voting.

As a reminder to our readers, we repeat that in the Ballot we divided the apparatus into seven separate classes, and also invited entrants to vote for what they considered to be the outstanding single exhibit at the Show. The definitions given to the various classes were as follows :—

(1) Complete receivers of five valves or more; that is to say, receivers exclusive of loud speaker and batteries, unless these should happen to be incorporated as a part of the receiver.

(2) Complete receivers or amplifiers of four valves or less, similarly defined.

(3) Batteries of all kinds, including accumulators for both high tension and low tension.

(4) Mains supply units, both D.C. and A.C., and including those which provide filament heating circuits.

(5) Loud speakers of all types.

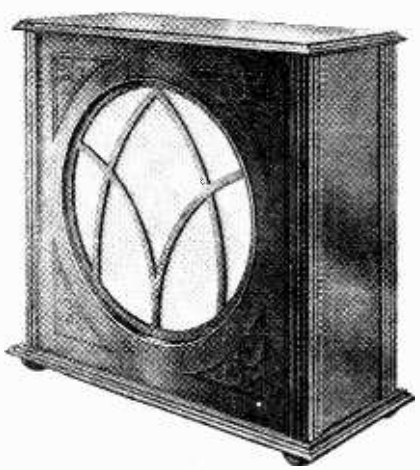
(6) Valves.

(7) Other component parts, including transformers, fixed and variable condensers, tuning coils, valve-holders, resistances, aerial equipment, etc., etc.

In the pages which follow we are illustrating and describing the apparatus which has won first place in its particular class, and we also give a brief reference to the works which have been responsible for the production of the prize-winning receivers and components.

AMPLION "LION" LOUD SPEAKER.
(Outstanding Single Exhibit and Class 5.)

During the past year reed-driven cone loud speakers have been somewhat eclipsed by the amazing advance of the moving coil loud speaker. In spite of the admitted disadvantage of the latter type in that a generous current supply is required to energise the field magnet, it has succeeded because it satisfies the modern demand for superlative quality of reproduction. Previous to the opening of the Radio Exhibition in September that demand was not completely satisfied by the reed-driven cone, not, as we now know, because of any inherent disability in the principle of the reed drive,



The Amplion "Lion" loud speaker in type LC41M cabinet.

but because manufacturers had neglected to apply to the design of this type of speaker the scientific methods which have brought the moving coil to its present state of development.

Messrs. Graham Amplion, Ltd., are to be congratulated on having staged a brilliant "come back" for the reed-driven cone. The achievement is especially noteworthy in that the recovery of lost ground has been made in one leap, whereas the advance of the moving coil speaker was made in small steps.

The thoroughness with which the minutest details have been investigated in designing the "Lion" loud speaker will be fully appreciated when it is pointed out that the following qualities have been separately investigated and achieved in the finished product :—

(1) Displacement of the diaphragm for a given frequency is proportional to the current in the coils instead of being proportional to the square of the current as in the ordinary type of reed movement.

(2) At low frequencies, where the amplitude for a given current is greater than at high frequencies the efficiency of the diaphragm is reduced by circulation of the air round the edges of the cone and the load on the reed is also increased. This is compensated for by a flexible reed which gives a greater amplitude for a given current when the load reaches a given value; normally the reed acts as a rigid unit and the flexibility plays a part only on the lowest frequencies.

(3) Loss of sound-radiating efficiency on the highest notes due to nodal points in the diaphragm is overcome by a careful choice of the angle and material of the cone and by stiffening the centre of the cone over a calculated area.

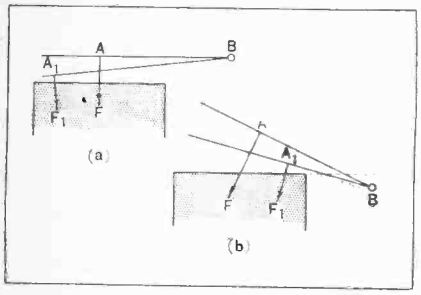
(4) For a given current the amplitude of the reed is inversely propor

Ballot Result.—

tional to the frequency, and there is a wide difference in amplitude between the lowest and highest notes. The peculiar form of construction adopted in the movement allows ample clearance for the development of the full amplitude in low notes without reducing the efficiency for the small amplitudes of the high notes.

(5) The quality of good "attack" is achieved by arranging for a slight "give" between the reed and the cone.

All the above factors are, of course, vital to perfect reproduction, but the arrangement of the reed and magnets by means of which the amplitude is kept proportional to the current at any given frequency is perhaps the most important and fundamental. In the old type of reed movement shown diagrammatically at (*a*) in the accompanying sketch not only is the force acting on the reed increased as the reed approaches



Diagrammatic comparison between the relative positions of the reed and pole piece (*a*) in the conventional reed drive, and (*b*) in the Amplion "Lion" movement.

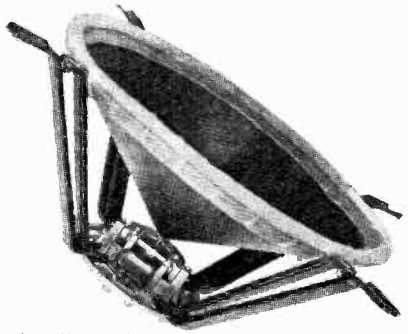
the magnets, but the point of application is moved to the left and the moment of the force about the point B is still further increased ($F_1 \times A_1B > F \times AB$). In the "Lion" movement, (*b*) in the sketch, as the reed approaches the magnet the point of application of the force is brought nearer to B and the moment of the force about B is kept constant ($F_1 \times A_1B = F \times AB$). The incorporation of this principle in a practical design calls, of course, for elaborate calculation, and is by no means as simple as the foregoing explanation would lead one to suppose; in the actual instrument the relative positions of the various parts have to be machined and assembled to an outside limit of $\frac{1}{1000}$ in. For fuller information on these points the reader is referred to the Amplion booklet, WL 37, "Notes on the New Amplion Speaker."

Those who have had an opportunity of hearing the "Lion" during the Show week or subsequently will agree that its position at the head of the voting is well merited, for it gives "moving coil" quality without any of the drawbacks of the moving coil loud speaker, and, although extremely sensitive, will handle the output from a 20-watt amplifier without any trace of chattering.

The D.C. resistance of the winding is 650 ohms and the A.C. impedance at a few typical frequencies is as follows:—

Frequency.	*Impedance (ohms).*
250	1,500
800	3,500
1,000	4,000
2,000	6,500

A valve having an A.C. resistance of 4,000 ohms or less will give excellent results with the smaller cone. It is desirable to use a choke-capacity feed circuit (20 henrys and 2 to 4 mfds), but the loud speaker can be connected directly in the anode circuit provided the steady current through the windings does not exceed 30

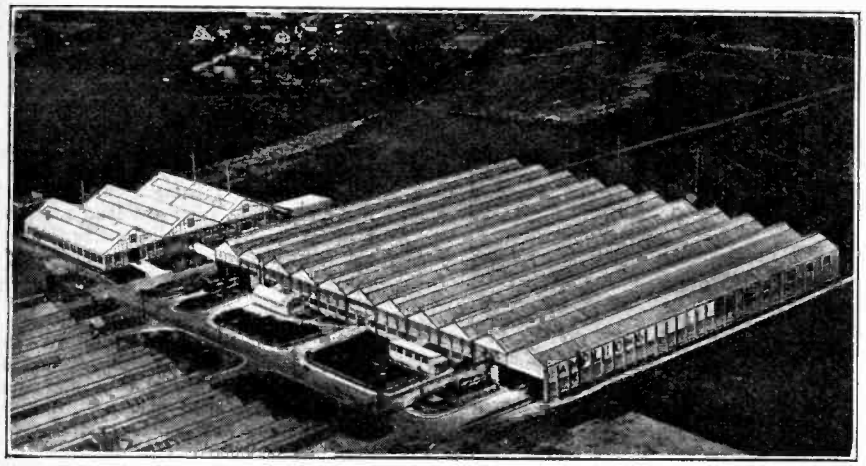


Amplion "Lion" chassis ready for assembling in a cabinet or mounting on a baffle. The cone is supported by the inner spiders on an aluminium ring lined with cotton wool.

or at the most 40 mA. With a pentode output valve a step-down output transformer having a ratio of 4 or 6 to 1 is desirable.

The Amplion "Lion" loud speaker is, we believe, the first new product to emanate from the new works acquired by Graham Amplion, Ltd., at Slough, a district which is rapidly growing in importance as an industrial centre and where the works of several wireless concerns are domiciled.

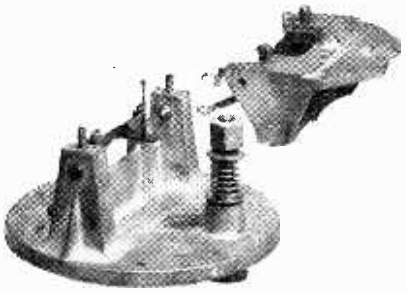
The Amplion works occupy some 140,000 square feet, all housed under one roof, and separated by the width of a road from another block of buildings of 25,000 square feet area, which comprises the offices. The establishment of the



A general view of the new Amplion works at Slough, taken from the air.

Ballot Result.—

works on this site has provided the opportunity for arranging that everything shall be right up to date, and the very most has been made of this opportunity. The works consist of a rectangular building of eleven bays, constructed of steel and reinforced concrete, and the aerial photograph which we reproduce gives a very good impression of the whole. Special attention has been given to the layout of the works, so that every process in manufacture can follow a logical sequence, with the minimum of loss of time in passing on from one stage of production to the next. A fully equipped research and experimental laboratory is a feature of the works, and, in addition to



Amplion "Lion" movement with magnet cradle removed from the pivots.

general offices, the block of buildings separated from the works also houses a most up-to-date drawing office, experimental workshop, which is at the service of the laboratory staff, and an excellent demonstration room which has been so designed that various acoustic effects can be obtained.

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MARCONIPHONE MODEL 53 PORTABLE.

(Class 1.)

The choice of a portable set in the five-valve class is significant. With modern valves sufficient sensitivity is obtained with three or at the most four valves when using an outside aerial, and five valves would appear to be justified only when using a short indoor aerial or a frame. If satisfactory signal strength can be obtained with a frame it is only logical to build the set in portable form, since its range of utility is thereby enormously increased.

The Marconiphone portable is typical of the general trend towards the use of two aperiodic H.F. stages, a practice which has firmly established itself on account of the inherent simplicity of operation. Portable sets with screened grid valves were much in evidence at the Show, but it will be some time before they oust the aperiodic 2-H.F. amplifier.

In the Marconiphone set aperiodic transformers are used in place of the more usual H.F. choke couplings. Separate pairs of transformers are used for long and short waves, and the connections are changed over by means of a long barrel switch operated by a recessed control in the side of the case. This switch also brings into the frame circuit a loading coil on long waves.

The two low-frequency amplifiers following the detector are transformer coupled. A Marconiphone "Ideal" transformer (ratio 2.7 to 1) follows the detector, which is a high-magnification valve, but the transformer between the first L.F. and output valves is of smaller dimensions. H.L.210 valves are used for both H.F. stages and also for the first L.F.; the detector is a D.E.H.210, and the output valve a D.E.P.215.

The sensitivity of the receiver is good, and there is little difficulty in picking up foreign transmission in day-time on the long waves and at night-time on medium waves. The selectivity is particularly good, and with the additional advantage of the directive properties of the frame aerial, alternative programmes can be received when only 2 miles from a main station.

The loud speaker is a modified form of the well-known Marconiphone reed-driven cone, and gives excellent quality up to the maximum output of the D.E.P.215 output valve. The movement is adjustable, and its sensitivity makes the most of the output from the set on long-distance transmissions.

The cabinet is well proportioned and is easy to carry. It weighs 30lb. complete with batteries, and the overall dimensions are 18in. × 16½in. × 7½in. Few portables have a more attractive appearance than the Model 53. The edgewise drum dials set in a narrow white panel give the receiver a distinctive appearance which has attracted very favourable notice.

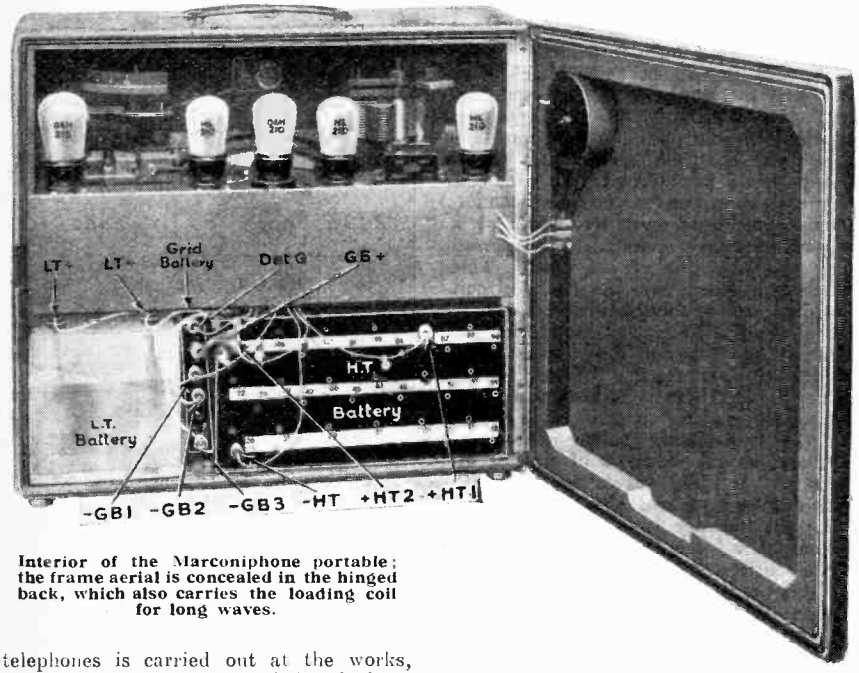
The edgewise drum tuning dials set in the narrow white panel give a distinctive appearance to the Marconiphone Model 53 portable.

The Marconiphone Model 53, therefore, fulfils all the requirements of a portable receiver—sensitivity and selectivity, sound workmanship and reliability, and a neat and attractive appearance.

The Sterling works at Dagenham where Marconiphone apparatus is produced.

Ballot Result.—

Marconiphone receiving apparatus is manufactured at the Sterling Works at Dagenham. The premises cover an area of rather more than 12 acres, and over 3,000 employees are engaged in the production of wireless and telephone apparatus. Everything is developed from the state of raw material, including the construction of all cabinet work required, both for the wireless and telephone equipments. As an example, every detail in the manufacture of a pair of



Interior of the Marconiphone portable; the frame aerial is concealed in the hinged back, which also carries the loading coil for long waves.

telephones is carried out at the works, even including the moulded telephone earpieces, which are produced in company with moulded knobs, dials, and panels.

In the production of wireless receivers the first stage takes shape in the design section, where many different models of the same circuit may be constructed before the final layout is decided upon. The approved model then makes its way to the drawing office, where it is taken apart and each individual item drawn in detail. At the same time, each item is priced and the cost of assembly estimated; the cost having been settled and the drawings completed, the latter are now distributed to the various shops concerned, where the component items are made. As soon as a sufficient number of sets of parts have been supplied to the stores, the work of assembly commences. In general, the assembly is carried out in two or more sections. Taking as an instance the portable receiver, the frame aerial and cabinet are completed in one shop and the actual circuit chassis in another; this chassis, provided it passes a preliminary test, is then fitted into the cabinet, after which it passes through the final works test, which consists of testing it out on broadcasting, and calibrating it for a number of stations. Next the receiver reaches the packing department, where it is prepared for transit with the necessary instruction book for the guidance of the eventual purchaser.

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GECOPHONE "VICTOR 3."

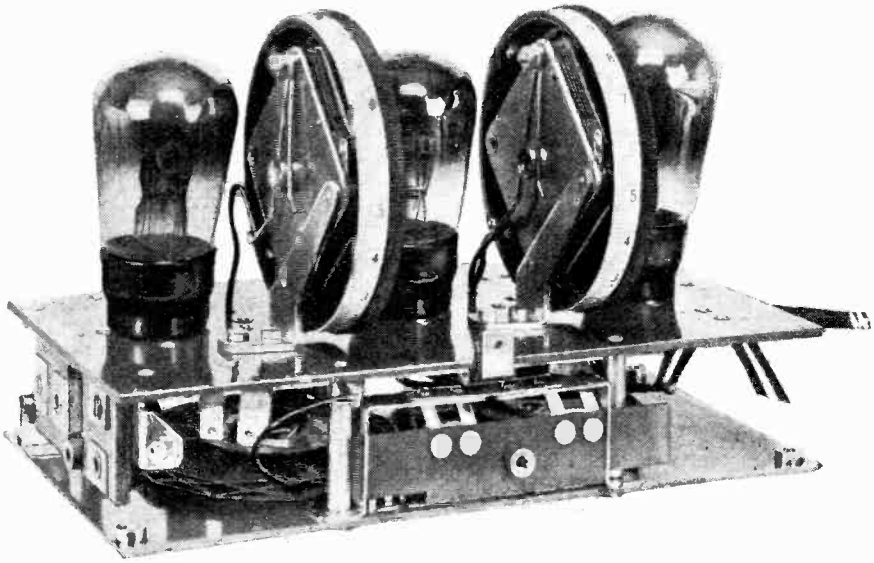
(Class 2.)

The typical British wireless receiver is an aggregate of highly finished units, any one of which could be boxed in an attractive carton and sold as a separate component. For instance, intervalve transformers complete with nickelled terminals and polished cases, and resistance-capacity coupling units in moulded bases with instructions for wiring engraved on the bakelite, are to be found *already wired up* and out of sight underneath panels. Apart from the extra cost, the space occupied by this redundant material frequently enforces a layout which is inimical to the attainment of maximum efficiency from the circuit employed, and the finished receiver is so large and conspicuous that it must be housed in an expensive piece of furniture before it can be installed in a drawing-room.

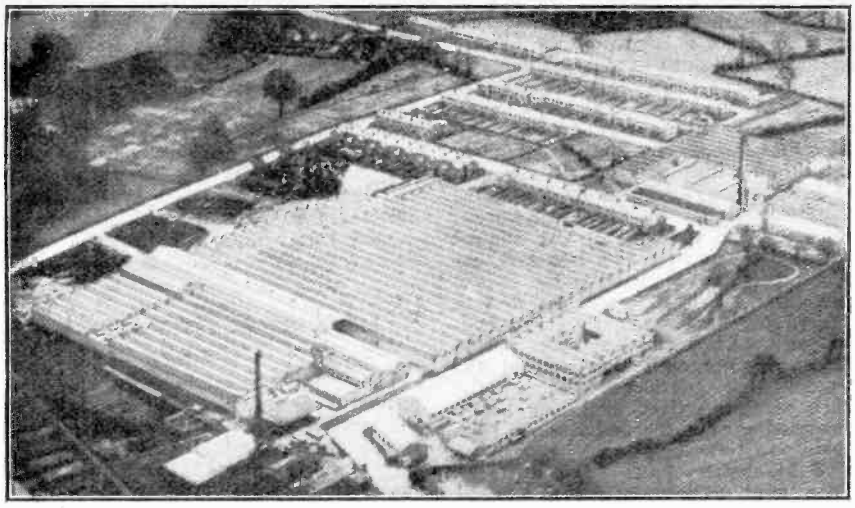
A breakaway from this policy of building sets with parts designed with an eye on the component market has already been made, notably in America, Holland, and Germany. A typical example was reviewed in this journal as far back as June 15th, 1927, when it was pointed out that British manufacturers would have to pay more attention to the design of sets for mass production and to give up the component assembling policy if they were to retain a prominent place in home as well as foreign markets.

In the "Victor 3" we have an excellent example of this new attitude towards set manufacture. With the possible exception of the condensers, there is no component which could be removed from the set and sold separately for incorporation in other receivers. Every part, down to the smallest connection, has been designed solely for the "Victor 3." The result is an instrument measuring only 9¼in. × 5in. × 7¼in., with an interior looking more like an alarm clock than a wireless set, but with a performance quite equal to that of the best three-valve set in a 21in. × 8in. × 8in. cabinet.

The circuit comprises a Reinartz type tuner with capacity-controlled reaction and three wave ranges operated by a sliding switch on the front of the case. Series aerial condensers with alternative sockets for the aerial give three degrees of selectivity. The leaky grid detector is followed by two resistance-coupled



The "Victor 3" removed from its cabinet; note the compact tuning condensers which are mounted inside their drum dials.



Aerial view of the G.E.C. Telephone Works, Stoke, near Coventry.

L.F. stages, the last valve feeding direct into the loud speaker. The tuning and reaction condensers are extremely neat and are entirely self-contained within the drum dials. The use of a solid dielectric between the vanes is responsible for the compact design; the condensers are delightfully smooth in operation and are quite noiseless. The condensers and the valves are the only visible components inside the case; the remainder of the circuit is situated between two parallel

The Gecophone "Victor 3."

paxolin plates spaced only 1½in. apart. The principal materials used in the construction of the chassis are thin sheet paxolin and hard-rolled copper strip; hollow rivets are used instead of screws wherever possible. The container is neat and well finished, the lid and base being of ebonised wood, and the sides of crystalline enamelled metal.

The quality of reception is remarkably good up to the full output of the D.E.P.215 output valve, and under favourable conditions, as regards selectivity, Continental stations can be well received. During an interval in the transmission from 2LO, twelve foreign stations were clearly received on the loud speaker. On the long waves Radio Paris and at least two other stations can be received clear of 5XX.

The "Victor 3" may do for wireless reception what the Morris-Cowley did for motoring, and its progress will be watched with interest by the wireless industry as a whole.

The birthplace of the "Victor 3" is the General Electric Co.'s telephone works at Stoke, near Coventry, where the receiver comes into being alongside a number of other well-known Gecophone radio receivers, loud speakers, and other wireless equipment. The works were opened in 1921 mainly for the production of telephone equipment, and the factory (which is all on one floor) has an area of more than half-a-million square feet, and gives employment to approximately 5,000 people.

The various departments are so arranged that there is a continuous flow of components from stage to stage of manufacture up to the final assembly. Every consideration has been given to the requirements of quantity production, with scientific methods of testing as each process proceeds. In quantity production, especially where wireless apparatus and telephones are concerned, the quality of the materials employed is of cardinal importance, and it has long been the consistent policy of the G.E.C. to control their own production from raw materials as far as possible. The highest grades of ebonite are manufactured at the works, and the output of this material is on so large a scale that it is in excess of their own requirements, and can be supplied to other electrical firms. All cabinet work for Gecophone receivers is produced on the premises with the most up-to-date machinery and appliances. A research department is provided at the factory, which works in close touch with the main research laboratories of the General Electric Co. at Wembley, and although originally the works were constructed chiefly for the production of telephone equipment, the production of wireless apparatus now calls for a very substantial proportion of space at the factory and attention of the research laboratories.

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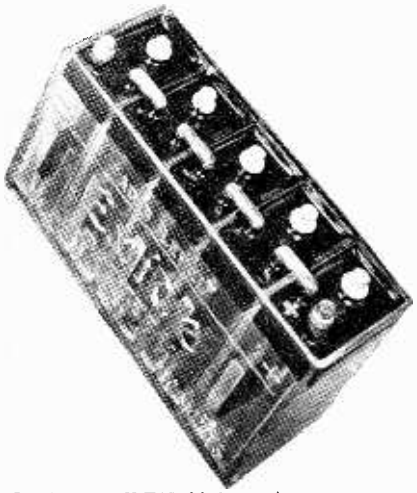
EXIDE WT10 H.T. ACCUMULATOR. (Class 3.)

The increasing demands made by modern power valves in the matter of anode current have brought about a demand for increased ampere-hour capacity in H.T. accumulators. Even if there are local facilities for trickle charging, large cells are an advantage, but when such facilities do not exist they are an absolute necessity.

A section of the Exide works showing the assembling of cells.

Ballot Result.—

In producing the WT10 battery the Chloride Electrical Storage Co., Ltd., have completely satisfied this demand and at a price which compares favourably with batteries of smaller capacity. Each unit contains five cells of 10,000 milliampere-hour (10 ampere-hour) capacity. Thus, on a single charge, 400 working hours would be obtained at a discharge rate of 25 mA. This is somewhat better than the output from a



Exide type WT10 high-tension accumulator unit showing external inter-cell connections.

super-capacity dry battery, and of course the percentage fall of voltage in the case of the accumulator is considerably less during discharge; further, the charge can be renewed at negligible cost. The maximum discharge which can be taken from the WT10 battery is of the order of 250 mA, whereas the largest dry battery is limited to about 30 mA.

The plates in the WT10 are of the "mass" type, and will, therefore, hold their charge when standing for long periods. The glass container is of improved design, and the moulded glass partitions now extend up to the level of the top of the container. The lead bridge pieces are also brought up clear of the sealing compound, and intermediate voltages can be tapped off by means of suitable clips. This form of construction reduces the possibility of inter-cell leakage, yet in no way interferes with the cleaning of the tops of the cells. There is liberal acid space, and each 10-volt unit contains $1\frac{1}{2}$ pints of electrolyte.

The WT10 battery represents excellent value for money, and will stand up to the demands of the most powerful receiving sets and public address systems.

The theoretical principles underlying the operation of storage batteries have undergone very little modification over a great many years, but, nevertheless, the storage battery of to-day, of which the products of the Chloride Electrical Storage Co. are typical of the finest examples, are very different from the products of the early days, for the manufacture of storage batteries has developed stage by stage as a result of concentrated research work, until we have the modern product to compare with its very unreliable and short-lived ancestor.

The Chloride Electrical Storage Co. commenced in 1893 in a very unpretentious way with a works which consisted of a shed, the only outstanding feature of which was a tall chimney. To-day the area occupied by the works at Clifton Junction, near Manchester, has been so extended that the original part is lost amongst the rest and has to be pointed out specially to the visitor.

The Exide batteries were the first to be used for starting, lighting, and ignition purposes in motor cars—that was in 1911—and since then this part of the business has developed enormously. When wireless arrived, and long before broadcasting days, the first message from a ship was transmitted with the help of an Exide battery, and Exide batteries to-day need no introduction to wireless listeners the world over.

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MET-VICK COMBINED ELIMINATOR, MODEL "B." (Class 4.)

Primarily intended for use with a receiver employing Cosmos indirectly heated valves, the eliminator is a complete battery substitute in that it provides the high-tension voltages, together with grid potentials, as well as an A.C. supply of 4 amperes at 4 volts for heating the valves. A half-wave rectifying valve of low resistance and liberal emis-

Met-Vick type "B" mains eliminator.

sion, the S.P.41/U, is stated to maintain a maximum potential of 180 volts when delivering a current of 120 mA. Three output voltages are provided, two fixed and one variable, the various values being obtained by stepping off along a high-resistance potential divider built up of a bank of series parallel connected resistances. These are carried in clips and are moulded as small bars composed of a high-resistance composition. A single grid biasing potential is obtained by taking the H.T. connection from a point some little way along a potential divider from the negative end. A wire-wound resistance bridges the 4-volt A.C. supply, so as to provide a point of zero A.C. potential. The apparatus is assembled on a plywood base with a metal surround and cover, and is given an attractive black crystalate finish. All terminals are shrouded as a protection against shock, and the mains supply is taken to the transformer by flexible lead and lamp adaptor. Separate input terminals are marked off in steps of 10 volts to suit mains supplies of 200-250. Protection against overload is provided by a small pea lamp connected in the primary circuit of the transformer. Excessive current taken on any of the output circuits causes the lamp to glow, and it is burnt out by heavy overload. Smoothing is generous, consisting of a gapped core choke and bank of condensers.

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MET-VICK ELASTIC AERIAL. (Class 7.)

The primary function of this component is to improve the selectivity of the receiver to which it is attached. It is not difficult to understand, therefore, why it has attracted favourable notice, for selectivity is probably the most sought after quality in broadcast reception at the present time. The factors which determine selectivity are for the most part built into the receiver itself and the maximum selectivity of which a set is capable is a constant quantity which cannot be improved without completely rebuilding the H.F. portions of the circuit. It may well happen that a receiver has been purchased, which, although giving perfect satisfaction at first, subsequently is found to be inadequate as regards selectivity when the user tires of the local station and tries to supplement his sources of entertainment by the reception of distant stations. In nine cases out of ten the scrapping of the old set and the purchase of a new one is financially impracticable, and the question arises as to whether the selectivity can be improved by the addition of some external accessory of moderate cost. Of course, if the *sensitivity* of the set is insufficient to pick up the distant stations there is no alternative but to buy a new set; it frequently happens, on the other hand, that the desired stations can be heard but are spoilt by the "spreading" of the local transmitter which superimposes a background of interference. In such circumstances the

Met-Vick elastic aerial unit.

A view taken in the Met-Vick works at Trafford Park.

Elastic Aerial Unit will effect a marked improvement.

It has been previously stated that selectivity is an intrinsic quality of the tuned circuits in the receiver, but there is another factor which is connected with the detector valve and can be controlled externally without structural alterations to the receiver itself. All detectors in common use exhibit this property, which may be summarised by saying that for weak signals the rectified output available for supplying the loud speaker is proportional to the square of the input from the aerial. For strong signals where the modulated fringe of the radio frequency input is carried over the bend on to the straight part of the detector curve the law breaks down and the output is proportional to the input.

The Square Law Detector.

Assuming that the input from the distant station is strong enough to carry well over on to the straight part of the curve and that the background from the local station, although sufficient to cause interference, is weaker and falls on the foot of the curve. If now we reduce the input from the aerial from *both* stations the fall in strength will be proportional in the case of the wanted signal, provided it stays on the straight part of the curve, but the reduction of the unwanted signal will be subject to a square law reduction. To take a concrete example, let us suppose that the wanted signal has an input strength of 32 and the unwanted a strength of 8 or a ratio of 4 : 1. If we halve the input the wanted signal will fall to 16, but the unwanted signal will fall not to 4 but to the square root of 4 (i.e., 2), giving a ratio of 8 : 1 and a consequent reduction of interference from the unwanted station. This explains the improvement in selectivity resulting from the use of a short aerial; it is merely a question of reducing the input to the detector.

The Met-Vick Elastic Aerial Unit is a device for progressively reducing the input from the aerial in order to make full use of selective properties of the detector in differentiating between strong and weak signals. It is really a form of potential divider by means of which any desired fraction of the total energy collected by the aerial may be transferred to the aerial and earth terminals of the set. In this respect its action is analogous to shortening of the aerial both as regards reduction of input and also in diminishing the loading effect of the aerial on the tuning circuits, which also makes for better selectivity. A detailed account of the electrical circuits comprising the Elastic Aerial is outside the scope of this article, but in general the principle of the unit consists of a three-electrode condenser and an arrangement of aperiodic coils. The centre electrode of the condenser is adjustable and moves in the electrostatic field between the two fixed plates. When the moving vane is midway between the fixed plates the energy passed to the receiver is a minimum, an increasing transfer of energy taking place when the vane is moved from this mid-point in either direction.

An Aerial of Any Length.

The neatness and convenience of this method of controlling input needs no emphasis. Instead of laboriously experimenting with aerials of different length to find the best dimensions for perhaps only one set of conditions, it is possible to make all the necessary adjustments at the receiver and to find the equivalent of the best length of aerial for any point on the tuning scale.

The home of the radio products of Metro-Vick Supplies, Ltd., is Trafford Park, Manchester, where the works occupy an area of some 75 acres, within easy access of the Manchester Docks. The main building alone occupies one million square feet, and no fewer than 750 electric motors supply the power required for the machinery of the works. Some idea of the size of the establishment may be gained from the fact that throughout the works and the enclosed land there are ten miles of standard gauge railway line. As soon as broadcasting began, a section of these works was immediately devoted to the manufacture of wireless apparatus, and the first Manchester transmitter, 2ZY, was originally housed in the research department of the works. The works have since then been kept fully engaged with the production of wireless apparatus and receivers, specialising in apparatus operating direct from the electric light mains. The normal number of employees is between 8,500 and 9,000.

Cosmos valves, which are products of the same company, are produced at the Cosmos Works at Enfield, these works being devoted almost entirely to the manufacture of lamps and wireless valves.

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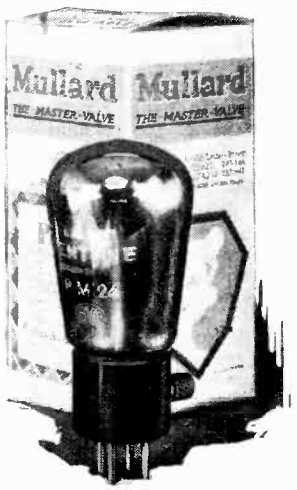
MULLARD PENTODE VALVE.
(Class 6.)

It is seldom that an entirely new component has been standardised in receivers so quickly after its introduction as the



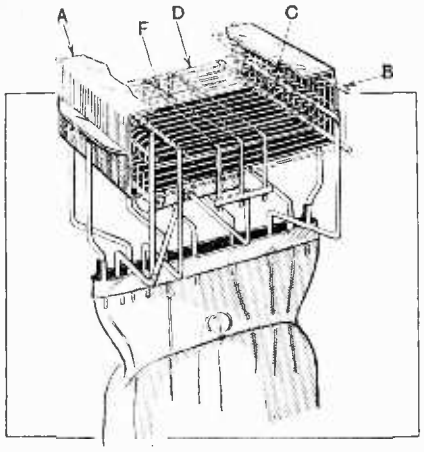
The Mullard Pentode valve P.M.24.

pentode. The thermionic valve undoubtedly exercises more influence on the design of the set than any other accessory; the pentode is no exception, for we find that almost overnight the low-frequency amplifier which we have become wont to regard as necessarily having two valves for adequate loud speaker signals can now give entirely satisfactory volume with one stage of amplification.

Somewhat wild statements as to performance are always rife when new inventions find their way on to the market for the first time; it is therefore important to take stock of the potentialities of the pentode and combine theoretical considerations with the practi

Ballot Result.—
tal experience which we have been able to gain during the last few weeks with this valve in the *Megavox-Three* and the *Pentode-Two* receivers.

The screened grid valve when introduced some eighteen months ago, besides effectively reducing the oscillation bugbear in H.F. amplifiers, contains new



Drawing showing the construction of the Pentode valve.

principles in valve technique—a comparatively high mutual conductance could be maintained with an extremely high magnification factor. With the triode the mutual conductance falls off with increase in magnification factor and an anode voltage change is accompanied by a marked change in anode current, whereas in the tetrode the anode current after a certain point remains substantially the same for change in anode voltage

That Kink in the Curve.

These characteristics were of paramount importance in high-frequency work where very small signal inputs of one or two volts would be anticipated, but as soon as an effort was made to modify the valve to cope with signal voltages of greater magnitude—such as would be created in an L.F. amplifier—a peculiar phenomenon was encountered, as a result of which instability and oscillation occurred. With certain relative applied voltages the screening grid may have a higher potential than the lowest instantaneous potential of the anode so that electrons will reverse their normal direction and an increase in anode voltage will result in a decrease in anode current. The anode characteristic representing this state of affairs shows a "kink" which causes a limitation in linear anode voltage swing. Until this disability was removed there was little chance of combining reasonably large signal handling capacity and power output with the inherent advantages of the H.F. tetrode.

A remedy was found by interposing an earth-connected third grid to form a five-electrode valve or pentode: this extra electrode is placed between the screened grid and the anode and allows the electrons by reason of their velocity to pass in the normal direction to the plate, but reversal of direction to the screening grid, which will periodically be at a higher potential than the plate, will be prevented. The velocity of the electrons trying to return is much less and is adequately reduced by the zero field around the earthed grid.

The earth connection is made internally in the valve to the centre of the filament, so that as compared with an ordinary three-electrode output valve there is only one extra terminal which is normally taken to maximum H.T. positive.

The pioneers in pentode manufacture in this country are Messrs. Mullard, who have to their credit the P.M.24 and the P.M.22. The former valve has a filament consumption of 0.15 amp. at 4 volts, while the maximum anode voltage, which must not be exceeded, is 150, at which a magnification factor of no less than 62 and a mutual conductance of 2.3 mA. per volt is obtained. The two-volt counterpart has very similar constants.

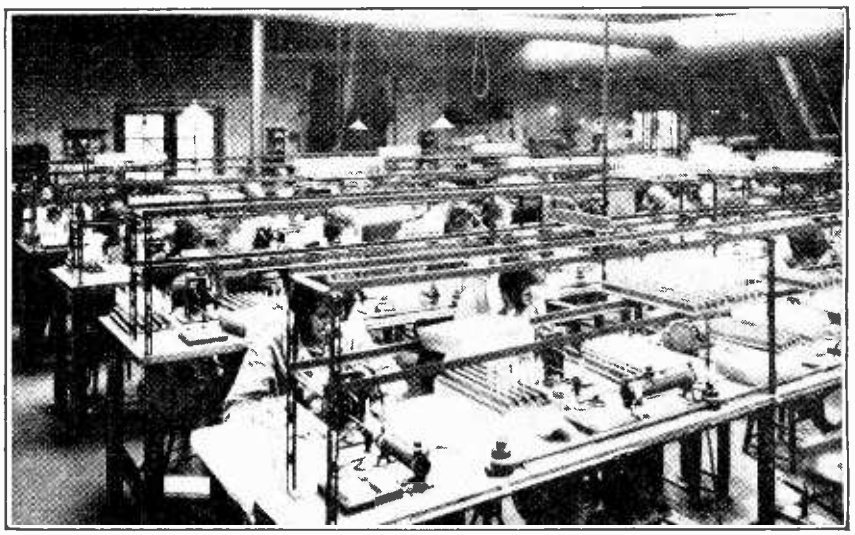
Although the impedance of the pentode is nigh (the P.M.24 is 28,000 ohms), the anode current is perforce heavy, since it is the change of anode milliamperes per given voltage on the grid that fundamentally provides power output for a loud speaker and the milliamperes cannot swing below zero.

The amplitude of grid swing that is permissible with a pentode has been recently dealt with at some length in an article by Dr. N. W. McLachlan,[1] in which it will be seen that curvature distortion begins before the normal grid bias base is filled. Suffice it to say that for all normal domestic purposes the output from a pentode even when restricted to linear conditions is entirely satisfactory from a quality and volume point of view.

From the foregoing it will be evident that the amplification before a pentode valve must not be too great—in fact, there should be no other low-frequency valve embodied in the receiver. It is due to much improved sensitivity that a small signal can produce adequately loud output, and we must regard the limitation of input, which has not appeared before, since output valves have been considerably less sensitive, as all in favour of the pentode.

A stroll around the set manufacturers' stands at Olympia must have revealed to the reader how immensely popular this new valve has become in so short a period of time. Of the three-valve receivers exhibited, a large percentage embodied a pentode in the last stage, because greater volume is obtainable with a considerably reduced number of components.

The Mullard Wireless Service Co., Ltd., was first established in 1920, by S. R. Mullard, M.B.E., M.I.E.E., with a factory in Southfields. Later a small factory was taken in Hammersmith, and in 1922 a larger building was occupied in Nightingale Lane, Balham, where the present premises are situated. Since 1922 the factory has been extended at regular intervals, until now well over 1,000 employees are engaged.



A corner of the Mullard valve works.

Mullard accessories are produced at a separate factory at Mitcham, and it is here that transformers, loud speakers, and H.T. supply units are produced, the Nightingale Lane factory being confined to the production of valves. From small beginnings the progress of the Mullard Company is one of the romances of the radio industry; having been established more particularly for the production of transmitting valves prior to the advent of broadcasting, the extraordinary development of the company may be taken as an example of the possibilities which the radio industry has offered to those who were prepared to make the most of opportunity.

[1] *The Wireless World*, October 31st, 1928.

Broadcast Brevities

NEWS FROM ALL QUARTERS.

By Our Special Correspondent.

The Regional Stations.—How Lyons was Subdued.—Kenya's Example to Britain.—Trouble in Edinburgh.—The Schubert Centenary.—Applause Cards.

The London Regional Station.

Building at Brookman's Park has now reached the skeleton stage. The walls of the main building are now *in situ*, and the next job is to put the roof on. When that is done and the place is weathertight, a move will be made to instal the dynamos and some of the other heavy machinery.

It is expected that the bulk of the constructional work will be completed before the end of January next.

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An Insult to Barkisland!

Although the site of the Northern Regional Station is not yet chosen, there is a certain liveliness in the mountain air over the question of a water supply to the hypothetical station. The Soyland Urban Council has refused to supply Barkisland with the 10,000 gallons of water a day which the broadcasting station would require, but states that it is not influenced in its decision by the possibility that the station might be built in its own territory, as the point is immaterial. This refusal is regarded as "an insult to Barkisland."

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Meanwhile . . . ?

While the world is waiting for Barkisland's reply to Soyland, it is quite possible that the B.B.C. may choose a site several miles away from either of these localities, in which case the world might languish in ignorance of Barkisland's final sentiments on the matter.

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Tact.

A piece of masterly diplomacy at Savoy Hill has removed a heterodyne note which was becoming a nuisance to 5GB listeners. The offender was Lyons (La Doua), which had dropped from its normal frequency of 628 k.c. to something very near 605 k.c., thus trespassing on 5GB's preserve.

On the night of October 29th, when Daventry Experimental was broadcasting "Pelléas and Mélisande," Lyons became more than ordinarily troublesome. A bright idea struck a member of the B.B.C. staff, with the result that a letter was addressed to Lyons pointing out that disturbance had been caused during the transmission of a French opera, and that British listeners were likely to form a mistaken impression of the merits of this beautiful work owing to the said disturbance.

The consequence was: Lyons has now returned to its proper frequency!

FUTURE FEATURES.

London and Daventry (5XX).

NOVEMBER 26TH.—"Caravan," by C. A. Lewis.

NOVEMBER 28TH.—"Samson and Delilah," an opera by Ferdinand Lemaire, English version by Eugène Oudin, music by Saint-Saens.

NOVEMBER 30TH.—St. Andrew's Night Programme.

DECEMBER 1ST.—A Popular Scottish Concert.

Daventry Experimental (5GB).

NOVEMBER 25TH.—Selections from Mendelssohn's "Elijah."

NOVEMBER 27TH.—"The Invention of Dr. Metzler," a play by John Pollock.

NOVEMBER 28TH.—The Annual Meeting of the Hospital Savings Association.

NOVEMBER 30TH. — Bunyan Celebration Speeches.

DECEMBER 1ST.—A Concert of Mediæval Music.

Cardiff.

NOVEMBER 27TH.—A Concert by Victors at the National Eisteddfod Treorchy—1928.

DECEMBER 1ST.—A Wagner Concert.

Manchester.

NOVEMBER 30TH. — "The Jackdaw of Rheims," from "Ingoldsby Legends," by Richard Barham, set to music by Robert Chignell.

Glasgow.

NOVEMBER 29TH.—"What Was That?" a "Memory" Competition by the Station Orchestra.

Belfast.

NOVEMBER 26TH.—"The Man who was Thursday," by Mrs. Cecil Chesterton and Ralph Neill, adapted from the novel by G. K. Chesterton.

Keston *v.* Chelmsford.

The English Test Team did not "come over" well in the B.B.C. relay from Sydney on November 10th. As one newspaper wittily put it, the cricketers were "out first bowl"! Readers may remember that this relay was to provide an efficiency contest between Chelmsford and Keston, the receiver which sent in the better signals to the Savoy Hill control room being chosen for the relay. As a matter of fact, Keston was "returned unopposed." Chelmsford failed to put in an appearance!

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Permanent Empire Short-wave Service.

Unaware, possibly, of B.B.C. opinion on the subject of short-wave broadcasting, the British East African Broadcasting Company has had the temerity to inaugurate a "permanent Empire broadcast service"—I quote their own words—from the plucky little station at Nairobi.

The service was opened by H.R.H. The Prince of Wales on Armistice Day at 10.30 G.M.T., and the station now transmits regular daily programmes from 4 to 7 p.m. G.M.T. on a wavelength of 33.5 metres and a power of 2 kilowatts. A Sunday programme is given from 7 to 8 p.m.

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More Reports Wanted.

Nairobi has received excellent reports of its test transmission from listeners in England, India, Australia. Further reports are warmly welcomed; they should be addressed to the company at Nairobi, Kenya.

The programmes are also sent out on 400 metres with a power of 4 kilowatts.

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Trouble in Edinburgh.

"The B.B.C. are having a very hectic time of it just now with Edinburgh.

"Edinburgh people want London programmes, and the essence of their complaint is that they are getting rather too much from Glasgow."

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Polite Hints to Glasgow.

The above paragraph was written nearly four years ago, and appeared in these columns in the issue of February 11th, 1925. Soon afterwards the Edinburgh folk had the satisfaction of hearing more programmes originating at their own station, with the bulk of the remainder coming from 2LO.

The recent administrative changes in Scottish broadcasting have placed the reins of power in the hands of Glasgow, with the result that Auld Reekie is beginning to fear a return to the old con-

ditions. To prevent anything of the kind, Bailie Philip Smith has stepped into the limelight as the champion of Edinburgh's wireless independence. He declares that if Edinburgh is to be a sub-station of Glasgow, strong protest will be made.

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2LO or 5SC?

This rugged attitude is commendable, but is there any certainty that Edinburgh stands to lose by tapping Glasgow's output? Many Edinburgh people hate the notion of indebtedness to Glasgow for anything musical or artistic, but do they overlook the fact that the London programmes, which they so much desire, involve a long land line and inevitable distortion? Perhaps they have considered this point, and prefer muffled music from London to pure music from Glasgow.

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Landline Distortion.

That they are not all of this persuasion is proved by a letter I have received from an Edinburgh reader, who says: "I have not got a moving coil yet, as I don't think it worth while, so long as we in Edinburgh have to put up with a transmission coming over the landline from 2LO. Sometimes the line is corrected, so that we get occasionally a perfect result, but more often it is woolly in speech. This is very marked at the moment, and is quite a contrast to the speech which we had from our local studio earlier this evening. . . . Unfortunately, 2EH closes down as a *studio* from to-day (October 31st)."

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Framing the Protest.

The closing down of the Edinburgh studio is the whole cause of the trouble. It follows upon the reorganisation plans which are already taking effect in preparation for the regional scheme. All the relay stations are losing their separate identity in order to serve as distributing points for programmes from the main station in the regional group. In the case of Scotland, Glasgow is the fountain-head, and will shortly be the main source of supply for Edinburgh, Dundee, and Aberdeen. So it looks as if Bailie Philip Smith had better begin framing his protest.

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The Schubert Centenary

The B.B.C. is commemorating the centenary of Schubert's death, which occurred on November 19th, 1828, in a number of broadcasts of his music extending over the next six weeks.

The Foundations of Music series this week consists of piano duets by Schubert, played by Berkeley Mason and Victor Hely-Hutchinson.

At the Queen's Hall, on November 23rd, the second half of the B.B.C. Symphony Concert will consist of Schubert's Symphony No. 5 in B flat, and an arrangement by Liszt of the Reitermarsch in C. On November 24th the Wireless Military Band will broadcast from the studio some of Schubert's works specially arranged by Gerrard Williams for military band performance.

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A Schubert Miscellany.

The memory of Schubert will also be honoured in The Foundations of Music series throughout December. Next week they will consist of his violin and piano works, played by Winifred Small and Maurice Cole; in subsequent weeks these recitals will include Schubert's miscellaneous piano items played by Harold Craxton, songs by George Parker, piano sonatas played by James Ching, and piano duets by Ethel Bartlett and Rae Robertson.

SIR HARRY LAUDER, who gave a farewell broadcast on November 8th, photographed on the s.s. Tamaroa on his departure last week for New Zealand. His luggage included the 5-valve McMichael portable set seen in the picture.

Manners to Music

WEAF, New York, has got ahead of the B.B.C. with a talk on "Etiquette," with appropriate music.

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No More Radio Applause?

The radio applause card is nearly extinct, according to an American broadcasting authority, who states that it is being killed by radio advertising. I gather that the man who has to sit through a recital of the merits of somebody's dried prunes or pickled pork or artificial meat feels entitled to the scraps of entertainment that follow without any obligation to give thanks.

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Filling in the Card.

Probably the stereotyped nature of these applause cards was against them. One secured a stack of, say, fifty applause cards, each of which bore a glowing tribute on these lines: "To the . . . . . Station:—Dr. Sirs, We sure enjoyed yr. program of . . . . . and we guess special mention is due to . . . . . We'll say he/she was the cat's pyjamas. Sgd. (Mr., Mrs. or Miss . . . . .)" After filling in about the twenty-fourth of these forms the listener suffered from a vague feeling of irritability, a sort of unconscious urge towards the self-expression denied him on the form. (There was no room for parenthetical remarks, as the margins of the forms were filled with exhortations to buy So-and-So's Dry Batteries.)

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Cards of Criticism Needed.

No one seems to have thought of printing cards of criticism. ("We sure shuddered last night, etc.") These would have had a wide appeal, and I am not sure that they would be a failure to-day, even over here.

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Sir Harry Lauder's Towel.

A correspondent applauds Sir Harry Lauder's idea of putting a wet towel over the microphone to give a cameo effect to the voice. "I think there should be a wet towel in every studio," he writes, "though I don't think that the microphone should always be the sufferer."

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"Alice Through the Looking-glass."

Cecil Lewis, who is producing his own translation and adaptation of Max Mohr's play, "Caravan," from 2LO and 5XX on November 26th, is to adapt "Alice Through the Looking-glass" for broadcasting on December 18th and 21st. The music is by Victor Hely-Hutchinson.

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"L.G." to Broadcast.

Mr. Lloyd George will broadcast from 5GB on November 30th, when he is to speak at the Bunyan Tercentenary celebrations at the City Temple.

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Broadcasting a Scottish Festival Service.

The twenty-fifth annual Scottish Festival Service at St. Columba's Church of Scotland, Pont Street, will be relayed to 2LO and 5XX on December 2nd. The service will start with the National Anthem, and an address will be given by the Rev. Archibald Fleming, the minister.

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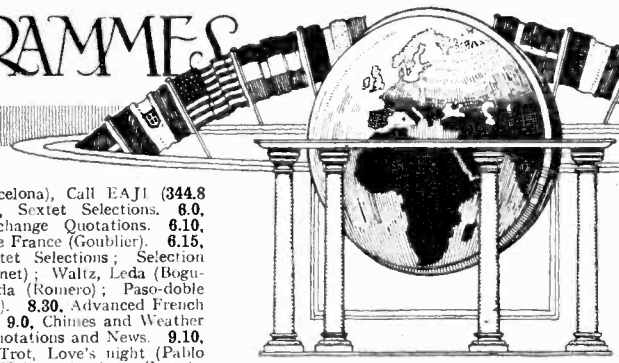
Scots Programme for England.

On several occasions Aberdeen has supplied programmes of Scots Variety for broadcast from the English stations as well as those North of the Tweed. Another of these programmes, "Ayont the Grampians," will be relayed to the English stations on December 3. The Buckie Ladies' Choir is travelling to Aberdeen to take part, and the City of Aberdeen Police Pipe Band is to perform on this evening for a wider audience. The soloists, Minnie Mearns (contralto), W. M. Johnston (tenor) and Paul Askew (viola), are all Aberdeen artists, and so is Mrs. MacFarlane, of "Ragbag Lane," who will uphold the lighter side of the entertainment. The programme also includes selections by the Station Octet and a short play by Rae Elrick presented by the Aberdeen Vaudeville Players.

PROGRAMMES FROM ABROAD



SATURDAY, NOVEMBER 24th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (**344.8 metres**); 1.5 kW.—**5.30,** Sextet Selections. **6.0,** Market Report and Exchange Quotations. **6.10,** Sextet Selection, Marche de France (Goublier). **6.15,** Sacred Music. **6.25,** Sextet Selections; Selection from La navarraise (Massenet); Waltz, Leda (Bogumil); A Night in Granada (Romero); Paso-doble from Don Quixote (Demón). **8.30,** Advanced French Lesson, by Prof. Martin. **9.0,** Chimes and Weather Report. **9.5,** Exchange Quotations and News. **9.10,** Orchestral Concert: Fox-Trot, Love's night (Pablo Navarro); Selection from Molinos de viento (Luna); Waltz-Boston, Ideal (José Balart); A travers les longs jours (Elgar); Mazurca, La brujula (Cotó); March, The Elite (Bidgood). **10.0,** Programme relayed from **Madrid,** EAJ7.

BERGEN (**370.4 metres**); 1.5 kW.—**5.30,** Programme for Children. **6.0** Programme for Girls. **7.0,** Orchestral Concert. **7.50,** Topical Talk. **8.0,** Editor Freddy Bernhoft, Talk: Christmas in the French Foreign Legion. **8.30,** Recitations and Ballads by the Actor Victor Ivarson. **9.0,** Weather Report, News and Time Signal. **9.15,** Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) (**1,250 metres**); 40 kW.—**3.0,** Educational Talk by Fritz Westermann. **3.30,** Programme from **Hamburg. 4.30,** Talk by Herr. Th. Kotzur. **5.0,** "Coal and Light"—Dialogue by Siegfried Böhm. **5.30,** Elementary Spanish Lesson. **5.55,** Dr. Elias Hurwicz, Talk: Russia. **6.20,** Genealogical Talk by Herr B. A. Hasse-Faulenorth. **7.0,** Programme from **Voxhaus.**

BERLIN (Voxhaus), (**484 metres**); 4 kW.—**2.30,** Chess Talk by Herr E. Nebermann. **3.0,** Dr. Paul Frank, Talk: Medical Hygiene. **3.30,** Harry Gondi, Anecdotes of German Humour. **4.0,** Orchestral Concert: Overture to Ombre et Clarté (Gabriel-Marie); Waltz Fantasia (Glinka); Träume (Wagner); Selection from Pique Dame (Tchaikovsky); Melody from Friederike (Lehár); Burlesque (Södermann); Aus Mozarts Reich (Urbach); Canzonetta, Second Movement from the Concerto for Violin Op. 35 (Tchaikovsky); Tin Soldiers (Kockert); Followed by Advertisement Notes. **5.30,** Talk: Germany's Architectural Masterpieces—Cologne Cathedral. **6.0,** Armin T. Wegner, Talk: The Country and Cities of the Caucasus—Baku, the City of the Black Towers. **6.30,** Dr. Wende, Talk: The Development of German Industrial Legislation and its Coming Phases. **7.0,** Variety Programme. **8.0,** Georg Kaiser Recital, followed by Weather Report, News, Time Signal, Sports Notes and Dance Music. **11.0** (approx.), Close Down.

BERN (**411 metres**); 1.5 kW.—**3.0,** Orchestral Concert. **3.30,** Programme for Children by Frau Kipfer. **4.0,** Orchestral Concert. **6.29,** Time Signal and Weather Report. **6.30,** Popular Concert: Readings, Accordion Selections, Jodelling and Quartet Songs. **8.0,** Orchestral Concert. **8.45,** News and Weather Report. **9.0,** Concert of Light Orchestral and Vocal Music. **9.40,** Dance Music. **11.0** (approx.), Close Down.

BRESLAU (**322.6 metres**); 4 kW.—**3.0,** Review of Books. **3.30,** Concert: Festival Overture (Leutner) Liebesnacht (Schmalstich); Waltz, Wiener Kinder (Jos. Strauss); Week-end in Schlaraffenland (J. Armandola); Aragonaise from Le Cid (Massenet); Ballet Scene (Luigini); Selection from The Tales of Hoffmann (Offenbach); Intermezzo, Indische Gaukler (Siede); Waltz, The Wedding of the Winds (Hall); March, Per aspera ad astra (Urbach); **5.0,** Talk by Georg Hallama. **5.25,** Talk in Esperanto by Alfred Hanuschke. **5.35,** Talk by Herr Dankelmann. **6.20,** Shorthand Lesson. **6.50,** Talk: The French Revolution. **7.15,** "Lilion"—Play (Franz Molnár). **9.0,** News. **9.15,** (approx.), Close Down.

BRÜNN (**441.2 metres**); 3 kW.—**3.30,** Programme for Children. **4.30,** Talk, The Principles of Music. **4.45,** German Talk. **5.15,** Weekly Wireless Review. **6.0,** Orchestral Concert: Overture to Orpheus in the Underworld (Offenbach); Selection (Nedbal); Gavotte Louis XV (Galimberti). **6.30,** Dramatic Programme relayed from **Bratislava** (300 metres). **9.0,** Programme from **Prague.**

BRUSSELS (**508.5 metres**); 1.5 kW.—**5.0,** Orchestral Concert from the Palace Hotel Restaurant. **6.0,** Elementary English Lesson. **6.25,** Intermediate English Lesson. **6.45,** Pianoforte Recital. **7.0,** Selection of Columbia Gramophone Records. **7.15,** Radio-Chronique. **8.0,** Concert by the Orchestra of the Conservatoire Royal, relayed from **Liège**: The Heroic Symphony (Beethoven); Topical Talk; Concerto for 'Cello (Schumann); Variations for 'Cello (Tchaikovsky); Triptique symphonique (Rasse); followed by News, Esperanto Announcements and Orchestral Music from the Palace Hotel Restaurant. 10.0 (approx.), Close Down.

BUDAPEST (**556.6. metres**); 20 kW.—**3.0,** Legal Hints, followed by Time Signal, Weather Report and News. **4.10,** Talk on the Bulgarian Nation and Kindred Races. **4.45,** Selections by Tzigane Orchestra. **5.50,** Talk: Old-fashioned and Modern Fire Brigades. **6.30,** Relay from the Opera House. **9.30,** Weather Report and Gramophone Selections.

CRACOW (**566 metres**); 1.5 kW.—**4.10,** Mr. J. Anisfeld, Talk: The Influence of the Development of Technique on Mankind. **4.35,** Talk by Mr. J. Regula. **5.0,** Programme relayed from **Warsaw. 6.0,** Miscellaneous Items. **6.25,** Reading in English by Mr. Jean Stanislawski. **6.55,** Time Signal from the Observatory. **7.0,** Agricultural Report. **7.5,** News and Announcements. **7.30,** Programme relayed from **Warsaw. 9.0,** Programme from **Warsaw. 9.30,** Concert from a Restaurant. **10.30** (approx.), Close Down.

DUBLIN, Call 2RN (**319.1 metres**); 1.5 kW.—**1.30,** Weather Report and Gramophone Concert. **7.20,** News. **7.30.** Selections by Val Vousden (Entertainer). **7.45,** Irish Lesson by Seamus O'Duirinne. **8.0** Schubert Memorial Concert, relayed from Rathmines Town Hall: Station Symphony Orchestra, Overture to Rosamunde; Selection of Schubert's Religious Songs by P. J. Duffy (Baritone), (a) Litanei, (b) Pax Vobiscum, (c) Die Allmacht. Station Symphony Orchestra, Symphony No. 3 in D Major; Soprano Solos by Elizabeth Mellor; Address by Maestro A. G. Viani; Station Symphony Orchestra. Overture to Alfonso und Estrella; The Erl King by P. J. Duffy (Baritone); Station Symphony Orchestra, Ballet Music from Rosamunde; Soprano Solos by Elizabeth Mellor; Station Symphony Orchestra, (a) Menuetto, (b) Polonaise; Baritone Solos by P. J. Duffy, (a) Wiegenlied, (b) Serenade, (c) Du bist die Ruh'; Station Symphony Orchestra, (a) Marche Militaire, (b) Soldier's Song. **10.20,** "That Walks by Night": Play by Dorothy Day and Company. **10.30,** News, Weather Report and Close Down.

FRANKFURT (**428.6 metres**); 4 kW.—**3.35,** Orchestral Concert of Opera Music. In the Interval, Announcements. **5.10,** Reading by Herr O. W. Studtmann. **5.30,** Talk. **6.0,** Answers to Correspondents. **6.15,** Lesson in Esperanto by Herr W. Wischoff. **6.45,** Talk on the Occasion of the Seventieth Birthday of Selma Lagerlöf, by Dr. Hanna Szass. **7.15** Robert Koppel Programme, followed by Dance Music from **Voxhaus. 11.30** (approx.), Close Down.

HAMBURG, Call HA (in Morse) (**394.7 metres**); 4 kW.—**9.15 a.m.,** News. **10.0 a.m.,** Programme of Gramophone Records. **11.10 a.m.,** Weather Report. **11.15 a.m.,** Exchange Quotations. **11.30 a.m.,** Concert relayed from **Hanover** (297 metres). In the Interval at **11.55 a.m.,** Time Signal. **12.10,** News. **1.40** Exchange Quotations. **2.30,** Review of Books. **3.0.** Illustrated Music Talk, by Dr. Wilh. Heintz. **3.30.** Programme of Recitations, Songs and Orchestral Selections. **4.30,** Request Programme. **5.30,** Talk from **Voxhaus. 6.0,** Senator Hirsch, Talk: The Christmas Atmosphere in the Handicraft of Lower-Saxony. **6.25,** Baurat Böttcher, Talk: Werner von Siemens on the History of Electro-technics. **6.55,** Weather Report. **7.0,** Concert of Marches: Entry of the Gladiators (Fucik); Florentine March (Fucik); Victoria March (v. Blon); Hail Europe (v. Blon); King Cotton (Sousa); El Capitan (Sousa); Germanentreue (Blankenburg); Mit Siegespalmen (Blankenburg); Salve Imperator (Fucik); Husarenvedette (Fucik); Unter der Freundschaftsflagge (v. Blon); Unter dem Siegesbanner (v. Blon); Manhattan Beach (Sousa); The Liberty Bell (Sousa). Festjubel (Blankenburg); Elbtalgruss (Fucik); Durch Kampf zum Sieg (v. Blon); The Star-spangled Banner (Sousa); The Gladiators' Farewell (Blankenburg). **9.30,** Weather Report, News, Sports Notes and Programme Announcements. **9.45** (approx.), Selections by the Kuban Cossack Chorus. **10.50,** North Sea and Baltic Weather Report.

HILVERSUM (**1,071 metres**); 5 kW.—**11.40 a.m.,** Police Announcements. **12.10** Concert of Trio Selections. **1.40,** Orchestral and Organ Concert from the Tuschinski Theatre, **Amsterdam. 3.40,** Italian Lesson. **4.40,** German Lesson. **5.30,** Orchestral Concert: Overture to Zampa (Hérold); Waltz, Mon Rêve (Waldteufel); Potpourri, Notenregen (Urbach); Si vous l'aviez compris (Denza); Selection from No, No Nanette (Youmans). **6.30,** French Lesson. **7.25,** Police Announcements. **7.40,** Concert and Talk arranged by the Workers' Radio Society. **10.10,** Concert relayed from the Royal Cinema, **Amsterdam. 11.15** (approx.), Close Down.

HUIZEN (**340.9 metres**); 4 kW.—Transmits on 1,870 metres from 5.40 p.m.—**12.10,** Concert of Trio Selections. **2.40,** Programme for Children. **5.10,** Concert of Gramophone Selections. **6.30.** Catholic Bulletin. **6.40,** English Lesson. **7.10,** Lesson in Dress-making. **7.40,** Talk by Mr. Haastert. **8.0,** "Le Moulin de Sanssouci"—Historical Comedy in Three Acts (Härting).

KALUNDEORG (**1,680 metres**); 7 kW.—Programme also for **Copenhagen** (337 metres).—**6.30 a.m.,** Morning Gymnastics. **10.0 a.m.,** Weather Report. **12.15,** Educational Talk. **2.0,** Programme for Children. **2.30,** Orchestral Concert: In the Interval, Recitations by Gudrun Lohse. **5.50,** Weather Report. **6.0,** News and Exchange Quotations. **6.15,** Time Signal. Carl Gad, Talk: Modern Foreign Authors—Jacob Wassermann. **7.0,** Chimes from the Town Hall. **7.2,** Carl Gad reads from the Novel "The Maurizius Case" (Wassermann). **7.30,** Concert of Copenhagen Street Songs of the 19th Century: Talk by August Gyldenborg; Songs (Oehlenschläger), (a) Bag grönklaedte Bakker, (b) Den lykkelige Modebutik i Vimmelskaftet, (c) En flunkende ny Theater-Vise, (d) Fra Ministeriet Hall's Dage; Mit eget Kompagni (Bögh); Hvad er Men'sket uden Mont (Rantzau); Hertugen af Choiseul Praslin (Recke); Followed by News. **8.45,** Concert of Light Music: Neapolitan March (Gastaldon); Pompadour Waltz (Jespersen); Selection from Die Räuber (Offenbach); Indian Intermezzo, Malomba (Jessel); Palisander Polka (Bentzen); Serenata (Cajani); Selection from Un bon garçon (Yvain); Silver Wedding March (Ryming). **9.45,** Dance Music by the Orchestra of the Industri Restaurant. **11.0,** Chimes from the Town Hall. **11.15** (approx.), Close Down.

KATTOWITZ (**422 metres**); 10 kW.—**2.45,** Financial Report. **3.0,** Concert of Gramophone Selections. **4.10,** Music Lesson by Prof. F. Sachse. **4.35,** Children's Letter Box. **5.0,** Programme for Children. **6.0,** Announcements. **6.30,** Talk. **6.56,** Time Signal and Agricultural Report. **7.5,** Mr. K. Rutkowski, Talk: Impressions of a Journey to Greece. **7.30,** Programme from **Warsaw. 9.0,** Weather Report and News. **9.30,** Dance Music.

KAUNAS (**2,000 metres**); 7 kW.—**3.0,** Concert of Lithuanian Music. **3.45,** Talk by Mr. Z. Kuzmickis. **4.15,** Talk for the Agriculturist, by Mr. Strazdas. **4.45,** Announcements. **5.30,** News. **6.0,** Weather Report. **6.30,** "Cavalleria Rusticana"—Opera (Mascagni), relayed from the National Opera House

LAHTI (**1,522.8 metres**); 35 kW.—**4.0,** Orchestral Selections: March (Blankenburg); Selection from Coppelia (Delibes). **4.30,** Talk. **5.15,** Orchestral Selections: Danza delle ore (Ponchielli); Tannhäuser (Wagner); Slavonic Dance No. 10 (Dvorak). **5.40,**

Programmes from Abroad.—

Talk. **6.0,** Accordion Selections by Mr. J. Homan. **6.20,** Concert: Orchestral Selection, Rhapsody No. 12 (Liszt); Recitation by Martta Wittenberg; Orchestral Selections, Fantasie Hongroise (Padouk); Recitation by Martta Wittenberg; Orchestral Selection from The Last Waltz (Strauss); Song; Orchestral Selection, Overture to William Tell (Rossini). **7.45,** News in Finnish and Swedish and Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres), and **Münster** (250 metres).—**10.10 a.m.,** Talk: The Choice of Careers. **11.10 a.m.,** Gramophone Selections. **12.5,** Concert: Overture to The Two Hussars (Doppler); Waltz, Die guten alten Zeiten (Strauss); Loewe Mosaik (Ralf); Two Movements from Carmen (Bizet); Serenata (Onesti); Dance Suite from The Nutcracker Ballet (Tchaikovsky); Viennese Waltz Song (Ettinger); Potpourri, Webers Blütenkranz (Schreiner). **1.30,** Hints for the Housewife. **2.40,** Talk on Legal Questions by Dr. Jost. **3.5,** Meta Brentgen, Talk for Women on Commercial Callings. **3.30,** Josef Denbeck, Talk: The Blind in Public Life. **4.0,** Dr. E. Huber, Talk: Old Babylon. **4.20,** English Lesson by Prof. F. Hase. **4.45,** Chamber Music: Sonata for 'Cello and Pianoforte Op 11, No. 3 (Hindemith); Sonata for 'Cello and Pianoforte (Honegger). **5.30,** Herr Liertz, Talk: Providing a Town with Water and Electricity. **6.15,** Dr. Kraus, Talk for Workers, Welfare Problems of Large Cities. **6.40,** Prof. Leyen, Talk: Universal Fairy Tales of the World. **7.0,** Popular Programme. **9.30** (approx.), News, Sports Notes, Business Announcements, Orchestral Selections and Dance Music. **12.0 Midnight** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—**3.30,** Concert by the Station Orchestra: Children's Symphony (Romberg); Overture to The Nuremberg Doll (Adam); Little Grandmother (Lange); Children's Corner (Bizet); Doll's Minuet (Mello); The Toy Shop (Jessel); Doll's Gavotte (Stolz); Children's Song March (Lindemann). **4.45,** Wireless News and Talk. **5.20** Weather Report, Time Signal and Labour Exchange Report. **5.30,** Programme from **Voxhaus. 6.0,** Josef Greff, Talk: Psycho-Analysis. **6.30,** Dr. Fritz Reuter, Talk: Music as a Profession. **7.0** Concert by the Dresden Madrigal Society. **8.15,** Walter Niemann reads from his own Works. **9.0** News, Sunday Programme Announcements and Sports Notes. **9.30,** Programme of Gramophone Records. **11.0** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 **(375 metres);** 3 kW.—**7.0,** Chimes and Sextet Selections: Selection from Alma de Dios (Serrano); Selection from Aida (Verdi); Selection from Boccaccio (Suppé), Interlude by Luis Medina. **8.0,** Dance Music relayed from the Alcázar. **8.25,** News. **9.45,** Market Prices Report. **10.0,** Chimes, followed by Selections from (a) "Carceleras": One Act Musical Play (Peydró—Text by Ricardo de la Vega), (b) "Doloretes" (Vives and Quislaut—Text by Carlos Araiches). **12.25 a.m.** (Sunday), News. **12.30 a.m.** (approx.), Close Down.

MILAN Call 1MI **(549 metres);** 7 kW.—**6.55** Time Signal, Wireless Notes and Announcements. **7.15,** Talk by Mr. G. Ardau. **7.25,** News. **7.30,** Time Signal. **7.32,** Variety Concert: Overture to Heimkehr aus der Fremde (Mendelssohn); G. M. Ciampelli, Talk: The History of Æsthetics of Music; French Songs, (a) Si, vous voulez que je vous chante, (b) Ce fut en mai, (a) Marcabru, Villanelle; Pianoforte Solo, Variations sérieuses (Mendelssohn); Soprano Solo from Manon (Massenet); Reading by Angelo Sodini; Quintet Selection, I dispettosi amanti (Parelli); French Songs, (a) Pastourelle (d'Arras), (b) Calendamayo (de Vacqueiras), (c) A l'entrada del tens Clar (Germain Deprès); Pianoforte Solos, (a) Fuga (Porpora-Censi), (b) Passacaglia (Handel-Censi); Soprano Solo, Due rispetti (Wolf Ferrari); Quintet Selection from Boris Godounoff (Moussorgsky). **9.55,** News. **10.0,** Music by the Tzigane Orchestra from the Fiaschetteria Toscana. **10.45** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Böden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres), **Sundsvall** (545.6 metres).—**10.15 a.m.,** Running Commentary on the departure of "M. S. Kungsholm" on her maiden voyage to America. **4.0,** Concert of Light Music. **5.0,** Programme for Children. **5.30,** Cabaret Programme relayed from **Göteborg. 6.30,** Talk: Work and Workers. **6.45,** Schubert Pianoforte Recital: Impromptu in A Flat Major, Op. 90; Impromptu in A Flat, Op. 142; Moment musical in F Minor; Impromptu in E. Flat Major. **7.0,** Concert by Military Band: March, Graf Zeppelin (Teike); Fantastic Overture (Foroni); Torch Dance (Meyerbeer); Valse romantique (Heinecke); Suite No. 2 on Swedish motive (Löfgren); Mazurka (Sala); March, National Emblem (Bagleny). **8.0,** Topical Talk. **8.45,** Dance Music. **12.30 a.m.** (approx.) (Sunday), Close Down.

Saturday, November 24th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

NAPLES, Call 1NA **(333.3 metres);** 1.5 k.W.—**3.45,** Weather Report and News. **3.50,** Reading. **3.58,** Chamber of Commerce Report. **4.0,** Concert of Variety Music. **4.30,** Time Signal. **4.35,** Foreign Report. **7.30,** Wireless Notes. **7.40,** Announcements. **7.50,** News. **7.58,** Harbour Notes. **8.2,** Programme of Neapolitan Music from the Works of De Leva, M.E. Murolo, Talk: Thoughts on the Art of De Leva; Suite for String Instruments Sera di luna, (a) Adagio, (b) Pastorale, (c) Burlesca-Preludio; Reading from the Novel "L'usciere" by the Author, Murolo; Soprano Solos, (a) Romance from La Camargo, (b) Triste aprile, (c) Voce trai campi, (c) Serenata a Pierrot, (d) Bocca dorata; Recitations by E. Murolo of Neapolitan Poems: Uocchie assassine, Lacreme amare, Pastorale, E Spingule francese. **9.50,** News. **9.55,** Calendar and Programme Announcements. **10.0** (approx.), Dance Music from the Trocadero. **10.30** (approx.), Close Down.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredrikstad** (434.8 metres). **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres) and **Rjukan** (448 metres).—**5.0,** Programme for Children. **6.0,** Children's Birthday Greetings. **6.15,** Weather Report, News and Agricultural Prices. **6.30,** Talk: The History of the Postal Administration. **7.0,** Time Signal. **7.2,** Book Talk by M. Charles Kent. **7.30,** Orchestral Concert of Light Music: Spanish Dance (Moszkovsky); Melody; Minuet (Boccherini); Sunshine on the Sea (Curtis); Troikafahrt (Tchaikovsky); Träumerei and Cradle Song (Schumann); A Love Letter in G Major (Königsberger); Selection from A Thousand and One Nights (Blyle); Valse infidèle (Mackeben); Ballet Music from Sylvia (Delibes). **8.30,** Weather Report and News. **8.45,** Topical Talk. **9.0** Songs and Revue. **9.30,** Dance Music by the Orchestra of the Grand Hotel. **10.30** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT **(458 metres);** 0.5 kW.—**5.0,** Pasdeloup Concert. **6.30,** Radio Journal de France. **8.0,** Sports Review. **8.30,** Programme relayed from Lille (264 metres), followed by Dance Music from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL **(2,650 metres);** 5 kW. **5.0,** Pasdeloup Concert. **7.10,** Weather Report.—**7.30,** "Le Journal Parlé."

PARIS (Petit Parisien) **(340.9 metres);** 0.5 kW.—**8.45,** Gramophone Selections, Talk, News and Announcements. **9.0,** Concert: Overture to Die Fledermaus (Strauss); Selection from The Huguenots (Meyerbeer). **9.25,** News. **9.30,** Symphony Music: Andante from the Concerto for Flute and Orchestra (Mozart); Presto from the Seventh Symphony in A (Beethoven). **10.0,** News and Concert: Orchestral Suite from Carmen (Bizet); Bruyères des Préludes (Debussy); March from Tannhäuser (Wagner).

PARIS (Radio-Paris), Call CFR **(1,750 metres);** 6 kW.—**12.30,** Concert of Gramophone Selections: Overture to Coriolanus (Beethoven) by the Orchestra of the Concert Hall, Amsterdam; Fire Magic from Siegfried (Wagner) by the Bayreuth Festival Orchestra; Les vieilles de chez nous (Levadé) by M. Lucien Fugère; Song of the Black Hussars; Berceuse (Gretchaninoff), by M. Rogatchewsky; Septuor (Saint-Saëns); Pianoforte Solo, Military March (Schubert); Chilly Pom Pom Pee, by Ray Starita and his Ambassadors Band; Fox-Trot, Les Ailes (Zamecnick), by the Cliquot Club Eskimos; Laugh, Clown, Laugh! (Giomto) by Grigoras Dinicu and his Tzigane Orchestra; Fox-Trot, Good News, by Fred Rich and his Orchestra; Tango, Alma Criolla (Lucchesi) by the South American Orchestra, J. M. Lucchesi; News in the Intervals. **2.0,** Market Prices and Religious Information. **3.45,** Concert arranged by the Rosati. News in the Intervals. **7.0,** Agricultural Report. **7.45,** Talk arranged by the Union des Grandes Associations Françaises: The Colonial Exhibition of 1931, followed by Market Prices. **8.0,** Programme for Children. **9.0,** Concert: Melodies and Dance Music by the Joss Ghislery Symphonians; News in the Intervals.

POSEN (344.8 metres); 1.5 kW.—**3.0,** Talk. **3.30,** Musical Selections. **4.15,** Soprano Recital of Italian Songs: Il mio bel foco (Marcello); Se non fosero (Perti) Tre giorni son che Nina (Pergolese); Pur dicesti (Lotti); Airs from Italian Opera; Vorrei morir (Tosti); Amore amor (Tirindelli); Primavera (Tirindelli). **4.45,** Talk on Scouts. **5.0,** Programme from **Warsaw. 6.0,** English Lesson by Dr. Arend. **6.25,** Mr. Herniczek, Talk: After the Football Season. **6.50,** Talk by Mme. Sabina Swidzinska. **7.15,** Finance Report. **7.30,** Programme from **Warsaw. 9.0,** Time Signal and Miscellaneous Items, by Mr. J. Warnecki. **9.20,** News and Weather Report. **9.30,** Cabaret Programme. **11.0,** Concert arranged by La Maison Philipps. **1.0 a.m.** (approx.), (Sunday), Close Down.

PRAGUE (348.9 metres); 5 kW.—**3.10,** Talk for Women. **3.20,** Talk. **3.30,** Orchestral Concert. **4.30,** Talk. **5.0,** Programme for Children. **6.30,** Dramatic Programme relayed from **Bratislava** (300 metres). **9.0,** Time Signal and News. **9.25,** Dance Music from the French Restaurant Sramota.

ROME, Call 1RO **(447.8 metres);** 3 kW.—**4.30,** Vocal and Instrumental Concert. **6.50,** Time Signal, Wireless Notes and Announcements. **7.10,** Sports Notes, News, Exchange Quotations and Weather Report. **7.29,** Time Signal and Topical Talk. **7.45,** "Suor Angelica"—Opera (Puccini), followed by Acts 1 and 2 of "Mephistopheles"—Opera (Boito). In the Interval, Review of Art and Literature by Lucio D'Ambra. **9.50,** News. **10.0,** Close Down.

SCHENECTADY, Call 2XAD and 2XAF **(21.93 and 31.4 metres);** 30 kW.—**11.58,** Weather Report. **12.0 Midnight** Statler's Pennsylvanians from **New York. 12.30 a.m.** (Sunday), Musical Selections from the Hotel Sagamore, **Rochester. 1.0 a.m.,** Musical Selections from the Hotel Onondaga, **Syracuse. 1.30 to 4.0 a.m.,** New York Relay. **1.30 a.m.,** "The Park Bench." **2.0,** Symphony in Brass. **3.0 a.m.,** Lucky Strike Programme. **4.0 a.m.,** Time Signal and Dance Music from the Hotel De Witt Clinton, **Albany. 5.0, a.m.** (approx.), Close Down.

STAMBOUL (1,200 metres); 5 kW.—**3.30,** Concert **4.30,** Market Report. **5.15,** Concert of Turkish Music. **7.30,** Weather Report and Time Signal. **7.40,** Orchestral Concert: The Third Symphony (Beethoven); Song; Symphonic Poem, Antar (Rimsky-Korsakoff). **9.0,** News and Close Down.

STUTTGART (379.7 metres); 4 kW.—**2.15,** Concert by the Station Orchestra: Overture to Das Spitzentuch der Königin (Strauss); Andante from the Sonata in F. Minor (Brahms); Liebestreue (Brahms); Selection from Frauenliebe und Leben (Schumann); Selection from Boris Godounoff (Moussorgsky); Mit dem Püppchen (Moussorgsky); Wiegenlied (Humperdinck); Selection from Hansel and Gretel (Humperdinck). **3.35,** Programme from **Frankfurt. 5.0,** Talk relayed from **Freiburg** (577 metres). **5.30** Talk from **Voxhaus. 6.0,** Book-keeping Lesson by Dr. Wolff. **6.30,** Concert from the Works of Mozart: Overture and three Contredanses; Selection from Mithridates; Symphony; Lieder; Divertimento. **7.30,** Time Signal and Sports Notes. **7.45,** Variety Concert, followed by Humorous Swabian Programme. **10.30,** Dance Music from the Pavillon Excelsior.

TOULOUSE (Radiophonie du Midi) **(391 metres);** 3 kW.—**12.45,** Concert. **8.0,** Exchange Quotations and News. **8.30,** Two Operas (Verdi), (a) "Aida," (b) "La Traviata." **11.0,** North African News. **11.15** (approx.), Close Down.

VIENNA (517.2 metres); 15 kW.—**2.30,** "Horribilicribifax"—Farce in Five Acts (Gryphius). **4.30,** Chamber Music, The Trout Quintet (Schubert). **5.10,** Selections from the Works of Reinhold Sternbach (Died August 9th 1926), by Maria Gutmann. **5.40,** Dr. Rudolf Krassnig, Talk: Welfare Legislation. **6.10,** "Die schöne Müllerin"—Song Cycle (Schubert-Müller). **7.20,** Orchestral Concert from the Works of Suppé, Czibulka and Hellmesberger, followed by Phototelegraphy Transmission.

VILNA (435 metres); 1.5 kW.—**2.10,** Concert of Gramophone Selections. **3.10,** News in Lithuanian. **3.30,** Announcements. **3.45,** Talk for Women by Mme. Ela Buncler. **4.10,** Reading of Poems. **4.35,** Programme from **Warsaw. 5.0,** Programme from **Warsaw. 6.0,** News. **6.30,** Programme from **Warsaw. 7.0,** Art Talk by Prof. Jules Klos. **7.30,** Programme from **Warsaw.**

WARSAW (1,111 metres); 10 kW.—**4.10,** Educational Talk by Dr. B. Suchodolski. **4.35,** Prof. H. Moscicki, Talk: The History of the Nation. **5.0,** Programme for Children. **6.0,** Miscellaneous Items. **6.30,** "Radio-Chronique," by Dr. M. Stepowski. **6.55,** Time Signal. **7.0,** Agricultural Report. **7.5,** News and Announcements. **7.30,** "Lilac Time"—Operetta (Schubert). **9.0,** Aviation Notes and Weather Report. **9.5,** News. **9.20,** Police Announcements and Sports Notes. **9.30,** Dance Music from the Oaza Restaurant. **10.30,** (approx.), Close Down.

ZURICH (588 metres); 1 kW.—**6.0,** Chimes from the Zürich Churches. **6.15,** Time Signal and Weather Report. **6.17,** Request Programme by the Yodel Double Quartet. **7.45** (approx.), Symphony Concert relayed from **Basle** (1,010 metres). **9.0,** Weather Report and News. **9.10** Gramophone Selections of Dance Music.

Programmes from Abroad.—

BARCELONA (Radio-Barcelona), Call EAJ1 (344.8 metres); 1.5 kW.—**11.0 a.m.**, Chimes relayed from the Barcelona Cathedral, followed by Weather Report for Europe and Forecast for North-East Spain and Aviation Route Conditions. **1.30**, Selections of Light Music by the Iberia Trio with Gramophone Records at intervals. **2.45 to 6.0**, No Transmission. **6.0**, Opening Signal and Stock Exchange Quotations. **6.10**, Concert by the Station Orchestra. In the Interval from **7.0 to 7.20**, Weekly Transmission of the Catalonian Agricultural Institute at San Isidro. **8.40**, Sports News. **9.0** (approx.), Close Down.

BASLE (1,010 metres); 1.5 kW.—Programme relayed from **Bern.**—**7.0**, Concert. **9.0**, Sports Notes, Late News Bulletin and Weather Report. **9.15** (approx.), Close Down.

BERGEN (370.4 metres); 1.5 kW.—**9.30 a.m.**, Relay of Morning Service and Sermon. **11.30 a.m.**, Weather Report and Forecast and General News Bulletin. **7.0**, Concert by the Station Orchestra. **7.20**, Organ Recital, by Kantor Karsten Solheim. **7.50**, Topical Talk. **8.30**, Musical Programme. **9.0**, Weather Report and Forecast, Late News Bulletin and Time Signal. **9.15**, Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen), (1,250 metres); 40 kW.—**7.55 a.m.**, Garrison Church Chimes from **Potsdam.** **8.0 a.m.**, Recital of Music and Address relayed from **Voxhaus** and followed by Berlin Cathedral Chimes. **10.30 a.m.** (approx.), Concert relayed from **Voxhaus.** **1.30 to 2.25**, Three Talks for Farmers, relayed from **Voxhaus.** **2.30**, Stories for Children, relayed from **Voxhaus.** **3.30**, Programme of Music from **Voxhaus.** **5.0 to 7.0**, Programme of Talks followed by relay of another German Programme. **9.15**, Late News Bulletin and Sports News. **9.30**, Light Music. **11.30** (approx.), Close Down:

BERLIN (Voxhaus), (484 metres); 4 kW.—**7.55 a.m.**, Garrison Church Chimes relayed from **Potsdam.** **8.0 a.m.**, Choral and Instrumental Concert and Address, followed by Berlin Cathedral Chimes. **10.30 a.m.** (approx.), Concert. **1.30 to 2.25**, Three Talks on Agriculture. **2.30**, Children's Half Hour. **3.0**, Talk. **3.30**, Light Music, followed by Advertisements. **5.40 to 7.0**, Three Talks. **7.0**, Concert. **9.15**, Weather Report and Forecast, Time Signal, Sports News and Late News Bulletin. **9.30**, Dance Music. **11.30** (approx.), Close Down.

BERN (411 metres); 1.5 kW.—**9.30 a.m. to 10.30 a.m.**, Religious Address. **12.0 Noon**, Time Signal and Weather Report and Forecast. **12.5**, Concert. **6.29**, Time Signal and Weather Report. **6.30**, Reading or Talk. **7.0**, Concert. **8.45**, Sports Notes, Late News Bulletin and Weather Report, followed by Musical Programme. **9.35** (approx.), Close Down.

BEZIERS (158 metres); 0.6 kW.—**8.30**, General News Bulletin and Sports Notes. **8.45**, Concert arranged by "La Maison Relin-Missoles." Gramophone Records of Light Music. **10.30** (approx.), Close Down.

BRESLAU (322.6 metres); 4 kW.—Programme relayed by **Gleiwitz** (329.7 metres).—**8.15 a.m.**, Chimes relayed from Christ Church. **10.0 a.m.** (approx.), Morning Concert. **1.0**, Ten Minutes for the Amateur Gardener. **1.10**, Talk or Literary Programme. **1.35**, Chess Talk. **2.0**, Stories for Children. **2.30**, Agricultural Notes. **7.15**, Recitations by the well-known Elocutionist, Käthe Graber. **9.0**, Late News Bulletin. **9.30**, Dance Music. **11.0** (approx.), Close Down.

BRUSSELS (508.5 metres); 1.5 kW.—**5.0**, Orchestral Concert relayed from the Palace Hotel. **6.0**, Children's Corner by Bonzo and Sylvia of the Théatre des Enfants. **6.30**, Concert by the Radio Belgique Trio. **7.30**, "La Radio Chronique." **8.15**, Orchestral Concert with Solos on the occasion of the Fifth Anniversary of Radio Belgique: Basque Rhapsody (Gabriel Pierné) rendered by the Grand Orchestre conducted by M. René Tellier. **10.10**, Late News Bulletin. **10.30** (approx.), Close Down.

BUDAPEST (556.6 metres); 20 kW.—**8.0 a.m.**, News from the Press and Talk for Women. **9.0 a.m.**, Relay of Morning Service and Sermon. **11.30 a.m.** (approx.), Concert. **3.15**, Concert. **6.30** (approx.), Concert or Relay of an Opera. **9.30**, Programme of Tzigane Music. **10.30** (approx.), Close Down.

COLOGNE (283 metres); 4 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Langenberg** (468.8 metres), and **Münster** (250 metres).—**6.45 a.m.**, Boxing Instruction by Dr. Ludwig Bach. **7.5 a.m.**, Weekly Summary in Esperanto by Alfred Dormanns. **7.15 a.m.**, Instruction on the Lute and Guitar by Olly Wirtz-Koort. **7.35 a.m.**, Esperanto Lesson by Alfred Dormanns. **8.0 a.m.**, Church Chimes. **8.5 a.m.**, Evangelical Recital with Address. **12.0 Noon**, Concert. **3.30**, Concert of Orchestral Music. **6.0**, Talk. **6.45**, Sports News. **7.0**, Choral Concert of Schubert's Church Music. Mass in G Major followed by Late News Bulletin, Sports News and Musical Programme. **11.0** (approx.), Close Down.

SUNDAY, NOVEMBER 25th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

CORK, Call 6CK (400 metres); 1.5 kW.—**8.30**, Concert of Vocal and Instrumental Music: Programme Items by the Cork Municipal School of Music Choral Society, conducted by Herr Aloys Fleischmann, with the collaboration of J. V. Keohan (Tenor), Master Gerard Shanahan (Pianoforte), Elizabeth Mellor (Soprano), and the Station Sextet. **11.0**, National Anthem and Weather Report and Forecast. **11.15** (approx.), Close Down.

CRACOW (566 metres); 1.5 kW.—**9.15 a.m. to 10.45 a.m.** Relay of Cathedral Service. **10.56 a.m.**, Relay of the Fanfare from the Notre Dame Church, followed by Time Signal and Weather Report. **1.0 and 1.20**, Two Talks on Agriculture. **1.40**, "La Chronique Agricole," by Dr. St. Wasniewski. **2.15**, Concert relayed from **Warsaw.** **7.30**, Concert devoted to the works of Richard Strauss. Tennyson's poem "Enoch Arden," with incidental music by Madame Lena Meyerhold and Mr. Casimir Meyerhold. **9.0**, Programme relayed from **Warsaw.** **9.30**, Light Music relayed from a Restaurant. **10.30** (approx.) Close Down.

DUBLIN, Call 2RN (319.1 metres); 1.5 kW.—**8.30 to 11.15** (approx.), Programme relayed from **Cork.** **8.30**, Concert of Vocal and Instrumental Music. Programme arranged by the Choral Society of the Municipal School of Music (Conductor: Herr Aloys Fleischmann), followed by Pianoforte, Soprano and Tenor Solos and Selections by the Station Sextet. **11.0**, National Anthem and Weather Report. **11.15** (approx.), Close Down.

FRANKFURT (428.6 metres); 4 kW.—Programme relayed by **Cassel** (252.1 metres).—**7.30 a.m. to 8.30 a.m.** (approx.), Recital and Address. **12.0 Noon**, Transmission arranged by the Wiesbaden Agricultural Institute. **7.30**, Musical or Literary Programme. **9.30** (approx.), Dance Music. **11.0** (approx.), Close Down.

HAMBURG, Call HA (in Morse), (394.7 metres); 4 kW.—Programme relayed by **Bremen** (272.7 metres), **Hanover** (297 metres), and **Kiel** (254.2 metres).—**7.25 a.m.**, Time Signal. **7.30 a.m.**, Weather Report and Forecast and General News Bulletin. **7.50 a.m.**, Current Economic Questions. **8.15 a.m.**, Morning Concert with Instrumental and Vocal Items. **9.55 a.m.** (for **Kiel** only), Service and Sermon relayed from the University Church, **Kiel.** **10.0 a.m.**, Technical Talk. **1.0**, Programme for Children by Funkheinzelmann. **2.0**, Concert of Light Music. **6.30**, Talk arranged by the Hamburg School of Physical Training. **6.40**, Sports Notes. **6.55**, Weather Report and Forecast. **7.0**, Concert or Play. **9.30**, Weather Report and Late News Bulletin, followed by Popular Concert. **10.50** (for **Hamburg, Bremen** and **Kiel**), North Sea and Baltic Weather Report. **11.0** (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—**12.40**, Light Music by the Wireless Trio. **2.10**, Concert relayed from the Amsterdam Concert Hall. **3.40**, Concert. **7.40**, General News Bulletin and Sports News. **7.50**, "Tiefland," Opera by d'Albert. **11.0** (approx.), Close Down.

HUIZEN (340.9 metres); 4 kW.—Transmits from 5.40 on 1,870 metres.—**8.5 a.m. to 9.0 a.m.**, Relay of Morning Service and Address. **10.0 a.m.**, Divine Service. **12.10**, Trio Concert. **1.10**, Talk. **1.40**, Talk. **2.10**, Concert. **4.40**, Relay of Church Service from Hoogeveen (on 1,870 metres), Sermon by the Minister, the Rev. A. Meijers. **7.30** (approx.), Orchestral Concert. **10.25**, Choral Epilogue, conducted by Mr. Jos. H. Pickkers. **10.40** (approx.), Close Down.

KALUNDBORG (1,680 metres); 7 kW.—Programme also for **Copenhagen** (337 metres).—**9.0 a.m.**, Divine Service relayed from **Copenhagen.** **10.30 a.m. to 10.40 a.m.** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **12.0 Noon to 12.25**, Lesson in German, arranged by "Radiolytteren." **12.30 to 12.55**, French Lesson, arranged by "Radiolytteren." **5.50** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **6.0**, News from the Press. **6.15**, Time Signal. **6.30** Talk. **7.0**, Town Hall Chimes from **Copenhagen.** **7.5**, "Hostgildet," Musical Play in One Act by Thomas Thaarup, Music by J. A. P. Schulz. **10.0**, Dance Music relayed from the Palace Hotel, **Copenhagen.** In the Interval at **11.0**, Town Hall Chimes, relayed from **Copenhagen.** **11.30** (approx.), Close Down.

KATTOWITZ (422 metres); 10 kW.—**9.15 a.m.**, Relay of Morning Service. **11.0 a.m.**, Time Signal and Weather Report and Forecast. **11.10 a.m.**, Popular Concert by the Kattowitz Radio Quartet: The Fifth Symphony in C Minor (Beethoven). **1.0**, Religious Talk. **1.20 and 1.40**, Agricultural Talks. **2.0**, Weather Report and Forecast. **2.15**, Concert relayed from **Warsaw.** **5.0**, Orchestral Concert. **7.30**, Orchestral Concert. **9.0**, Weather Report and Forecast, Press Review and Sports News. **9.30**, Concert of Light Music. **10.30** (approx.), Close Down.

KAUNAS (2,000 metres); 7 kW.—**12.0 Noon**, Relay of Programme from the War Museum on the occasion of the Tenth Anniversary of the Formation of the Lithuanian Army: President Antanas Smetona will deliver an Address in Honour of those who fell in the cause of Lithuanian Independence. **6.15**, Orchestral Concert with Soloists. **9.30** (approx.), Close Down.

KÖNIGSBERG (303 metres); 4 kW.—Programme relayed by **Danzig** (272.7 metres). **8.0 a.m.**, Morning Recital of Choral and Instrumental Music with Address. **10.0 a.m.** (**Königsberg** only), Weather Report and Forecast. **10.15 a.m.**, Concert by the **Königsberg** Station Orchestra. **11.55 a.m.**, Time Signal relayed from **Nauen**, followed by Weather Report. **3.30**, Orchestral Concert. **7.0**, "A Drama of Love and Death," by Romain Rolland, Dramatic Scenes from the French Revolution. Produced by Walter Ottendorff. **9.15**, Late News Bulletin and Sports News, followed by Silent Night for reception of Foreign Stations.

LAHTI (1,522.8 metres); 35 kW.—Programme also for **Helsingfors** (375 metres). **8.0 a.m.**, Relay of Morning Service. **9.50 a.m.**, News from the Press. **10.0 a.m.**, Concert. **10.50 a.m.**, Weather Report and Time Signal. **11.0 a.m.**, Relay of Morning Service in Swedish. **3.0**, Musical Programme. **4.0**, Talk. **4.25**, Concert by the Station Orchestra. **5.40**, Selections by the Station Orchestra, "La Poupée," by Audran. **6.0**, Recital of Music. **7.45**, Late News Bulletin given in Finnish and Swedish. **9.0** (approx.), Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres), and **Münster** (250 metres).—**6.45 a.m.** The Art of Self Defence. **7.5 a.m.**, Review in Esperanto of the week's programmes, by Alfred Dormanns. **7.15 a.m.**, Music Lesson by Olly Wirtz Koort. **7.35 a.m. to 7.55 a.m.**, Talk in Esperanto by Alfred Dormanns. **8.0 a.m.**, Relay of Church Chimes. **8.5 a.m.**, Evangelical Recital of Choral and Instrumental Music and Address. **11.0 a.m.**, Organ Recital by Professor Hans Bachem: Prelude and Fugue in E Minor (Dietrich Buxtehude). **12.0 Noon**, Musical Programme. **3.30**, Orchestral Concert. **7.0**, Concert or Play, followed by Late News Bulletin, Sports News and Light Music. **11.0** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—Programme relayed by **Dresden** (275.2 metres).—**7.30 a.m.**, Organ Recital relayed from the University Church, Leipzig. Organist: Ernst Müller. **8.0 a.m.**, Choral and Instrumental Concert. **2.0**, Selections of Light Music. **4.0**, Concert. **5.30**, Talk. **6.30**, A German Requiem based on the Words of the Holy Scriptures, by Johannes Brahms, executed by the Leipzig Symphony Orchestra under the direction of Alfred Szendrei and the Leipzig Oratorio Society. **9.0**, Sports News. **9.30**, Dance Music relayed from **Berlin.** **11.30** (approx.), Close Down.

LYONS (Radio Lyon), (291 metres); 1.5 kW.—**7.45**, "Le Journal Parlé," and News from the Press. **8.0**, Concert of Instrumental Music. Pianoforte Solos by Madame Ducharne of the Lyons Conservatoire and 'Cello Solos by M. Testanière. Scènes Alsaciennes by Massenet. **9.0** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (375 metres); 3 kW.—Programme relayed by **Salamanca** (EAJ22) (405 metres).—**11.30 a.m.**, Municipal Band Concert relayed from El Retiro (weather permitting). Conductor: Maestro Villa. **2.0**, Chimes and Time Signal. **2.5**, Concert by the Station Orchestra, with interlude by Luis Medina. **3.30 to 7.0**, No Transmission. **7.0**, Relay of Chimes followed by Sextet Music; Selections from "La Verbena de la Paloma" (Breton). **8.0**, Dance Music by the Palermo Orchestra relayed from the Alkazar. **8.30 to 10.0**, No Transmission. **10.0**, Chimes and Time Signal. **10.5**, Military Band Concert. **12.0 Midnight**, Chimes followed by Dance Music from the Alkazar by the Palermo Orchestra. **12.30** (approx.) (Monday), Close Down.

MILAN, 1MI (549 metres); 7 kW.—**9.0 a.m.**, Opening Signal and Lesson in English. **9.30 a.m. to 10.0 a.m.**, Recital of Sacred Music. **11.30 a.m.**, Time Signal and Concert by the Station Quartet. **12.30 to 3.0**, No Transmission. **3.0**, Opening Signal. **3.5**, Concert by the Station Quintet. **4.15**, Tzigane Music relayed from the Fiaschetteria Toscana. **5.0 to 6.55**, No Transmission. **7.30**, Time Signal, followed by "L'Amico Fritz," Opera by Mascagni. **10.45** (approx.), Close Down.

Sunday, November 25th.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

Programmes from Abroad.—

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Boden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (290.9 metres), **Ostersund** (720 metres) and **Sundsvall** (545.6 metres).—**10.0 a.m.**, Relay of Morning Service from a **Stockholm** Church. **4.55, Stockholm** Town Hall Chimes. **5.0**, Divine Service relayed from **Stockholm**. **8.15**, Late News and Announcements and Weather Forecast. **9.10**, Concert by a String Orchestra, relayed from **Göteborg**. **10.30** (approx.), Close Down.

MUNICH (535.7 metres); 4 kW.—Programme relayed by **Augsburg** (566 metres), **Kaiserslautern** (277.8 metres), and **Nuremburg** (241.9 metres).—**2.0**, Musical or Literary Programme. **4.30**, Violin and Pianoforte Recital. Violin Solos by Professor Leo Petroni. Herr Richard Staab at the Piano. **9.0** (approx.), Late News Bulletin. **10.30** (approx.), Close Down.

NAPLES Call 1NA (333.3 metres); 1.5 kW.—**9.0 a.m.**, Concert of Sacred Music. **3.45**, Programme for Children. **4.0**, Vocal and Orchestral Concert. **4.30**, Time Signal. **7.30**, Topical Talk. **7.50**, Bulletin of the Naples Harbour Authorities. **8.02**, Orchestral Concert, Selections from "The Flying Dutchman," by Wagner. **9.0**, Sports Notes. **9.55**, Calendar and programme announcements for the next day. **10.0** (approx.), Close Down.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (590 metres), **Riukan** (448 metres).—**9.50 a.m.**, Carillon. **10.0 a.m.**, Service relayed from the Garrison Church. **6.15**, Weather Report and Forecast and Press News followed by Literary or Musical Programme. **8.30**, Weather Report and News from the Press. **8.45**, Talk on Current Events. **10.30** (approx.), Relay of Dance Music from the Hotel Bristol. **11.0** (approx.), Close Down.

PARIS (Ecole Supérieure), Call FPTT (458 metres); 0.5 kW.—Programme relayed at Intervals by the following stations. **Bordeaux PTT** (275 metres), **Eiffel Tower** (2,650 metres), **Grenoble** (416 metres), **Lille** (264 metres), **Limoges** (285 metres), **Lyons PTT** (480 metres), **Marseilles** (303 metres), **Rennes** (280 metres), **Toulouse PTT** (200 metres).—**8.0 a.m.**, General News Bulletin and Time Signal. **9.25 a.m.**, International Time Signal and Weather Report and Forecast. **12.0 Noon**, Concert arranged by "Les Editions Salabert." **1.0**, Industrial Notes. **1.30**, Concert organised by the General Association of French Wireless Listeners. **4.0**, Pasdeloup Concert of Symphony Music conducted by M. Rhené Bâton; Le Radio Journal de France. **8.0**, The Day's Sport. **8.30**, Concert organised by the General Association of French Wireless Listeners, followed by Late News Bulletin, Time Signal and Weather Report. **10.30** (approx.), Dance Music relayed from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FI. (2,650 metres); 5 kW.—**7.56 a.m.**, Time Signal on 32.5 metres. **9.26 a.m.**, Time Signal on 2,650 metres. **5.0**, Relay of Pasdeloup Concert. **7.10 to 7.20**, Weather Report and Forecast. **7.30**, "Le Journal Parlé par T.S.F." with Talks by Dr. Pierre Vachet, Detective Ashelbé, and M. René Casalis. **7.56**, Time Signal on 32.5 metres. **8.0 to 9.0**, Vocal and Orchestral Concert, Nocturne in F Sharp Major (Chopin). **10.26**, Time Signal on 2,650 metres. **11.15** (approx.), Close Down.

PARIS (Petit Parisien) (340.9 metres), 0.5 kW.—**8.45**, Gramophone Records. **8.50**, Talk. **8.55**, News from the Press. **9.0**, Vocal and Instrumental Concert by Artistes from the Paris Opera and the Opéra-Comique; Overture to "The Italian Girl in Algiers," by Rossini. **9.25**, General News Bulletin; Symphony Concert conducted by Professor Estyle, of the Paris Conservatoire. **10.0**, Late News Bulletin. **10.15**, Concert of Orchestral Music. **11.0** (approx.), Close Down.

PARIS (Radio L.L.), (370 and 60 metres); 1 kW.—**12.30**, Programme arranged by Radio Liberté, Topical Review and News and Announcements, followed by Trio Concert. **1.0**, Carillon de Fontenay. **3.0**, Concert Programme of Dance Music, arranged by "Les Etablissements Radio L.L." **9.0**, Vocal and Instrumental Concert. **10.0**, Carillon de Fontenay. **10.15** (approx.), Close Down.

PARIS (Radio Paris), Call CFR (1,750 metres); 6 kW.—**8.0 a.m.**, General News Bulletin and News from the Press. **8.30 a.m.**, Physical Culture Lesson, under the direction of Dr. Diffre. **12.0 Noon**, Address by Father Dieux, followed by Programme of Sacred Music arranged by "La Vie Catholique." **12.30**, News from the Press. **12.45**, Concert of Light Music by the Albert Locatelli Orchestra with an item by Bilboquet in the interval. **4.30**, Popular Gramophone Selections organised by "L'Industrie Musicale." In the Interval, News from the Press. **7.0**, Agricultural Notes and News from the Press. **7.45**, The Radio-Paris Guignol. In the interval: "Les Jacasseries de Polichinelle," by Billboquet, Zecca, Brinchetaye and Madame Karl. **8.30**, Concert of Orchestral Music. In the Intervals: News from the Evening Press and Late News Bulletin. **10.30** (approx.), Close Down.

PITTSBURGH, Call KDKA (63 and 27 metres); 25 kW.—**4.0**, Sessions Chimes, followed by Church Service. **7.0**, "Roxy's Stroll." Evening Programme from WJZ, **New York**. **9.45**, Vesper Service relayed from the Shadyside Presbyterian Church, with Sermon by the Pastor, the Rev. Hugh Thomson Kerr. **11.30**, Orchestral Programme. **12.0 Midnight**, Session Chimes, Evening Service with Address from the Calvary Episcopal Church, Pittsburg, Pastor, Doctor E. J. Van Etten. **1.0 a.m.**, (Monday). National Broadcasting Company Programme from **New York**. **1.15 a.m.**, Collier's Radio Hour from **New York**. **2.15 a.m.**, The Utica Jubilee Singers' Programme from WJZ, **New York**. **2.45 a.m.**, El Tango Romantico from WJZ, **New York**. **3.15 a.m.**, Longine Time. **3.30 a.m.** (approx.), Close Down.

POSEN (344.8 metres); 1.5 kW.—**9.15 a.m. to 10.45 a.m.**, Relay of Cathedral Service. **11.05 a.m. and 11.30 a.m.**, Two Talks for Farmers. **11.55 a.m.**, Talk by Mr. Winiewicz. **2.15**, Concert of Symphony Music relayed from the Philharmonic Hall at **Warsaw**. **6.45**, Talk. **7.30**, Concert devoted to the works of Polish Composers, with the collaboration of the "Haslo" Choir, under the direction of Professor Stanislas Kwasnik. Choral Selection, Le Signal (Kwasnik). **9.0**, Time Signal. **9.5**, Variety Items. **9.20**, General News Bulletin and Sports Notes. **10.0**, Dance Music, relayed from the Carlton Restaurant. **11.0** (approx.), Close Down.

PRAGUE (348.9 metres); 5 kW.—**8.0 a.m.**, Morning Concert of Sacred Music. **11.0 a.m.** (approx.), Concert. **12.05**, Commercial Notes. **12.20**, Announcements. **3.30**, Popular Concert. **4.30**, Transmission for Workers. **5.0**, German Programme. **7.0**, Concert or Play. **9.0**, Time Signal and Late News Bulletin. **9.20** Dance Music. **10.15** (approx.), Close Down.

RABAT, Call PTT (416 metres); 2 kW.—**12.3 to 1.30**, Concert of Orchestral Music. **4.0 to 5.0**, Military Band Concert. **8.15**, "Le Journal Parlé." **8.20**, General News Bulletin. **8.30**, Concert by the Station Orchestra and Soloists. **10.30**, Dance Music. **11.0** (approx.), Close Down.

RIGA (526.3 metres); 4 kW.—**8.0 a.m.**, Sacred Service. **9.15 a.m.**, Morning Service relayed from the Mara Church. **12.0 Noon**, Music and Stories for Children. **3.0**, Orchestral Concert. **4.0**, Talks. **6.0**, Concert with Soloists. **8.0**, Weather Report and Forecast and Late News Bulletin. **8.30**, Relay of Dance Music from the Café de l'Opera. **10.0** (approx.), Close Down.

ROME Call 1RO (447.8 metres); 3 kW.—**8.30 a.m.**, Lesson in German. **9.0 a.m.**, Vocal and Instrumental Concert. **9.45 a.m. to 12.0 Noon**, No Transmission. **12.0 Noon**, Opening Signal. **12.5 to 1.0**, The Station Trio in a Concert of Light Music. **1.0 to 4.0**, No Transmission. **4.0**, Opening Signal. **4.5**, Variety Concert. **7.15**, Sports Notes and News from the Stefani Agency. **7.45**, Concert by the Symphony Orchestra, Le Carnaval des Animaux by Saint-Saëns. **9.50**, Late News Bulletin. **10.0** (approx.), Close Down.

SAN SEBASTIAN (Union Radio), Call EAJ8 (335 metres); 0.5 kW.—**10.0**, Concert by the Orchestra at the Municipal Casino. **12.0 Midnight** (approx.), Close Down.

SCHENECTADY, Call 2XAD and 2XAF (21.96 and 31.4 metres); 30 kW.—**6.30 to 7.0**, United Radio Corporation Programme. **8.30**, Recital of Organ Music by Elmer Tidmarsh from the Union College Memorial Chapel, Schenectady. **9.0**, Meeting for Men under the auspices of the Bedford Branch of the Y.M.C.A., with a lecture by Doctor S. Parkes Cadman, relayed from **Brooklyn, N.Y.** **10.30**, Acousticon Programme from **New York**. **11.0**, Stetson Parade and the Band of the American Legion, relayed from **Boston, Mass.** **11.30**, Musical Programme from **New York**. **12.30 a.m.** (Monday), Evening Programme from the Capitol Theatre, **New York**. **2.0 a.m.**, Address on "Our Government," by David Lawrence, Editor of the "United States Daily," relayed from **Washington, D.C.** **2.15 a.m.**, Atwater Kent Entertainment from **New York**. **3.15 a.m.**, Correct Time. **3.17, a.m.**, Experimental Television Broadcast. **3.30 a.m.** (approx.), Close Down.

SEVILLE (Union Radio), Call EAJ5 (434.8 metres); 1 kW.—**2.0 to 3.0**, Concert of Light Music by the Station Orchestra and Gramophone Records in the Intervals. **9.30**, Orchestral Concert of Spanish Music. **11.0**, Flamenco Songs and Dance Music by the Station Orchestra. **11.30**, (approx.) Close Down.

STAMBOUL (1,200 metres); 5 kW.—**3.30**, Concert. **4.30**, Stock Exchange and Grain Market Quotations. **5.15**, Concert of Turkish Music. **7.30**, Meteorological Report and Correct Time. **7.40**, Lecture on the History of Music. **7.55**, Concert by the Wireless Orchestra. **9.0**, Late News and Announcements. **9.30** (approx.), Close Down.

STUTTGART (379.7 metres); 4 kW.— Programme relayed by **Freiburg** (577 metres).—**10.15 a.m** (approx.), Morning Recital. **11.0 a.m.** (approx.), Orchestral Concert followed by Gramophone Records. **1.0**, Funkheinzelmann's Programme for Children. **5.0**, The German Requiem (Brahms) from **Heidenheim**. **5.30** (approx.), Literary or Musical Programme. **7.30** (approx.), Concert or Play followed by Light Music, Late News Bulletin and Sports News. **10.0** (approx.), Close Down.

TALLINN (408 metres); 2.2 kW. **8.0 a.m.** (approx.), Relay of Morning Service. **1.0**, Concert by the Station Orchestra. **6.0**, Concert of Orchestral Music. **9.0** (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (391 metres); 3 kW.—**12.30**, Meteorological Report, Municipal Market Reports and Local Fair Prices. **12.45**, Orchestral Concert. **1.0**, Correct Time. **1.45**, Press Reports furnished by Local Newspapers. **8.0**, Parisian Exchange and Grain Prices. **8.15**, Press Reports supplied by Parisian Newspapers. **8.30**, Orchestral Concert. **9.5**, Concert arranged by "L'Association des Commerçants Radio-Electriciens du Midi," Selections from "Thaïs," Lyrical Comedy in Three Acts, Book by Louis Gallet, based on the Novel by Anatole France, Music by Massenet. **10.15**, "Le Journal sans papier," giving North African News, followed by Late News and Announcements. **10.30** (approx.), Close Down.

WARSAW (1,111 metres); 10 kW.—**9.15 a.m. to 10.45 a.m.**, Relay of Cathedral Service. **10.56 a.m.**, Time Signal. **11.0 a.m.**, Aviation Route Conditions and Weather Forecast. **11.10 a.m.**, Concert. **1.0 to 2.0**, Agricultural Talks. **2.0**, Weather Report and Forecast. **2.15**, Concert of Symphony Music from the "Philharmonie de Varsovie," the Orchestra conducted by Mr. B. Szulc. Pianoforte Concerto in G. Major by Beethoven. **4.45**, Aviation Talk by J. Osinski. **5.0**, Popular Concert. **6.20**, Talk. **7.30**, Concert. **9.0**, Aviation Route Conditions and Weather Forecast. **9.5**, Late News Bulletin. **9.20**, Police and Sports News. **9.30**, Dance Music by the Orchestra of the "Oaza," conducted by W. Roszkowski. **10.30** (approx.) Close Down.

VIENNA (517.2 metres); 15 kW.—Programme relayed by **Graz** (357.1 metres), **Innsbruck** (294.1 metres), **Klagenfurt** (272.7 metres), and **Linz** (254.2 metres).—**9.20 a.m.**, Morning Recital. **10.0 a.m.**, Concert by the Vienna Symphony Orchestra, conducted by Professor Paul von Klenau; Songs with orchestral accompaniment by Emilie Birtner. **2.30**, Picture Transmission. **3.0**, Orchestral Concert. **6.35**, Vocal and Instrumental Programme, followed by Concert or Play and Picture Transmission. **10.15** (approx.), Close Down.

VILNA (435 metres); 1.5 kW.—**9.15 a.m.**, Relay of Morning Cathedral Service. **10.56 a.m.** Time Signal. **11.0 a.m.**, General News Bulletin, relayed from **Warsaw**. **1.0 to 6.0**, Programme relayed from **Warsaw**. **1.0 to 2.0**, Three Talks on Agriculture. **2.15**, Orchestral Concert, Symphonic Blues (Laks) conducted by the Composer. **4.28**, Talk, **5.0**, Concert. **6.0**, Talk in Lithuanian. **6.20 to 10.30**, Programme relayed from **Warsaw**. **6.20**, Talk. **6.45**, General News Bulletin and Time Signal. **7.30**, Concert of Light Music. **9.0** Aviation Route Report and Weather Forecast. **9.5**, News from the Polish Telegraphic Agency. **9.20**, Sports Notes and Police Report. **9.30**, Dance Music relayed from the "Oaza" Restaurant, **Warsaw**. **10.30** (approx.), Close Down.

ZAGREB (309.2 metres); 0.7 kW.—**10.0 a.m.**, Concert by the Croatian Philharmonic Society; "Tod und Verklärung," by Rich. Strauss. **4.0**, Popular Dance Music relayed from the Club Cabaret. **6.45**, Wireless Notes. **7.0**, Opera relayed from the Zagreb National Theatre; in the Intervals, Late News Bulletin and Sports Notes. **10.0** (approx.), Close Down.

ZÜRICH (588 metres); 1 kW.—**10.0 a.m.**, Concert from the Capitol Theatre. **11.0 a.m.**, Weather Report and Forecast. **11.30 a.m.**, The Wireless Orchestra. **3.0**, Concert by the Castellano Orchestra relayed from the Carlton Elite Hotel. **6.30**, Time Signal and Weather Report. **6.35**, Religious Address. **7.0**, Programme relayed from the Grossmünster, Zürich; The Station Orchestra conducted by Hermann Hofmann; Organist: Viktor Schlatter. **9.0**, Weather Report and News from the Neue Züricher Zeitung. **9.30** (approx.), Close Down.

USEFUL DATA CHARTS. (NOS. 17 & 17A.)

Self-inductance of Solenoids.

THE self-inductance of a solenoid of circular section is given by the formula:—

$L = L_0 N^2 D$.

where L is in microhenrys

N = total turns.

D = diameter of coil in inches.[1]

L_0 is a factor depending on the ratio of length to diameter of the coil.

The construction of the abac is shown as an operation in three stages in Fig. 1. In the first stage the equal lines indicate equal scales increasing upwards as shown by the arrows. On following the dotted lines from right to left we go through the process of finding L by multiplying together the quantities which lie on the right side of the formula.

Stage 2 brings in the simplifications of replacing $D^{1/2}$ (full scale) by D (half scale) and replacing 1/N by N with reversed scale.

In stage 3 the abac is folded up to one-third its size, using the scales of L_0N^2 and L_0 as hinges, and as these

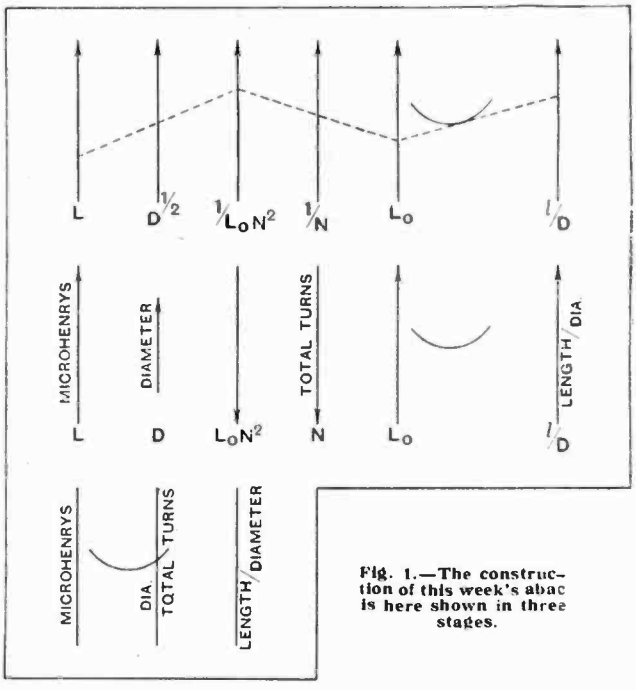


Fig. 1.—The construction of this week's abac is here shown in three stages.

two scales are superfluous in the final stage they are omitted.

The complete abac appears this week, and an inset is given which shows the order of procedure.

An Example.

A single-layer coil of circular section has an inductance of 204 microhenrys, its diameter is 4in., and 44 turns are used. The abac then shows that the corresponding ratio of length to diameter is 0.5; that is, the winding should be spread over a length of 2 inches.

Again, we might be faced with the problem of designing a coil of given inductance with a certain ratio of length to diameter. Then, as in Fig. 2, the points A and B are fixed while C is free to slide on its vertical scale, accordingly we can choose any diameter of coil

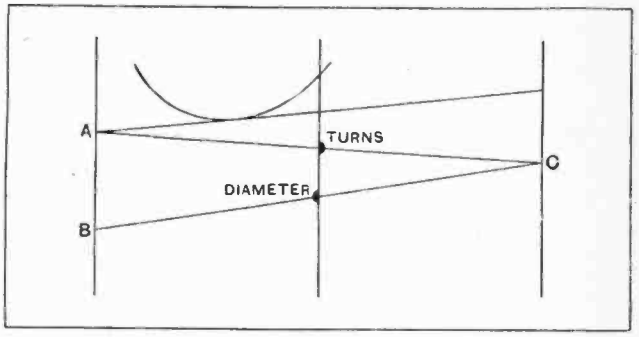


Fig. 2.—If the points A and B are fixed while C is free to slide on its vertical scale, a choice can be made of any diameter of coil and the corresponding number of turns found.

and find the corresponding turns. Thus in the example just given we might have a 4in. coil with 44 turns, 5in. with 39.4 turns, or 8in. with 31.2 turns.

Solenoids of Polygonal Section.

A solenoid wound on a former of polygonal section has the same inductance as a solenoid of the same length and turns wound on a round section former of suitably chosen diameter. This equivalent diameter is given by abac 17a, which is self-explanatory.

Thus a hexagonal ribbed former measuring 3in. when calipered across opposite vertices is equivalent to a round paxolin former of 2.74in. diameter. Strictly speaking, the correction factor should vary with the ratio of length to diameter, but between the limits 2 and 0.1 of this ratio the variation is less than the probable error in working abac 17.

The next useful data chart (Abacs Nos. 18 and 18a) will provide a method of measuring the self-inductance of multi-layer coils. The abac will be similar in construction to No. 17, and several examples will be worked out.

A sectional drawing of a typical coil will make the method of procedure of arriving at self-inductance quite clear to the amateur. R. T. B.

In abac No. 15, which appeared on November 7th, the value of the capacity given in the example on p. 648 should read 0.0189 instead of 0.0095 microfarads. The error was caused by dropping a 2 in the calculation: *if the abac had been used the error would not have arisen.*

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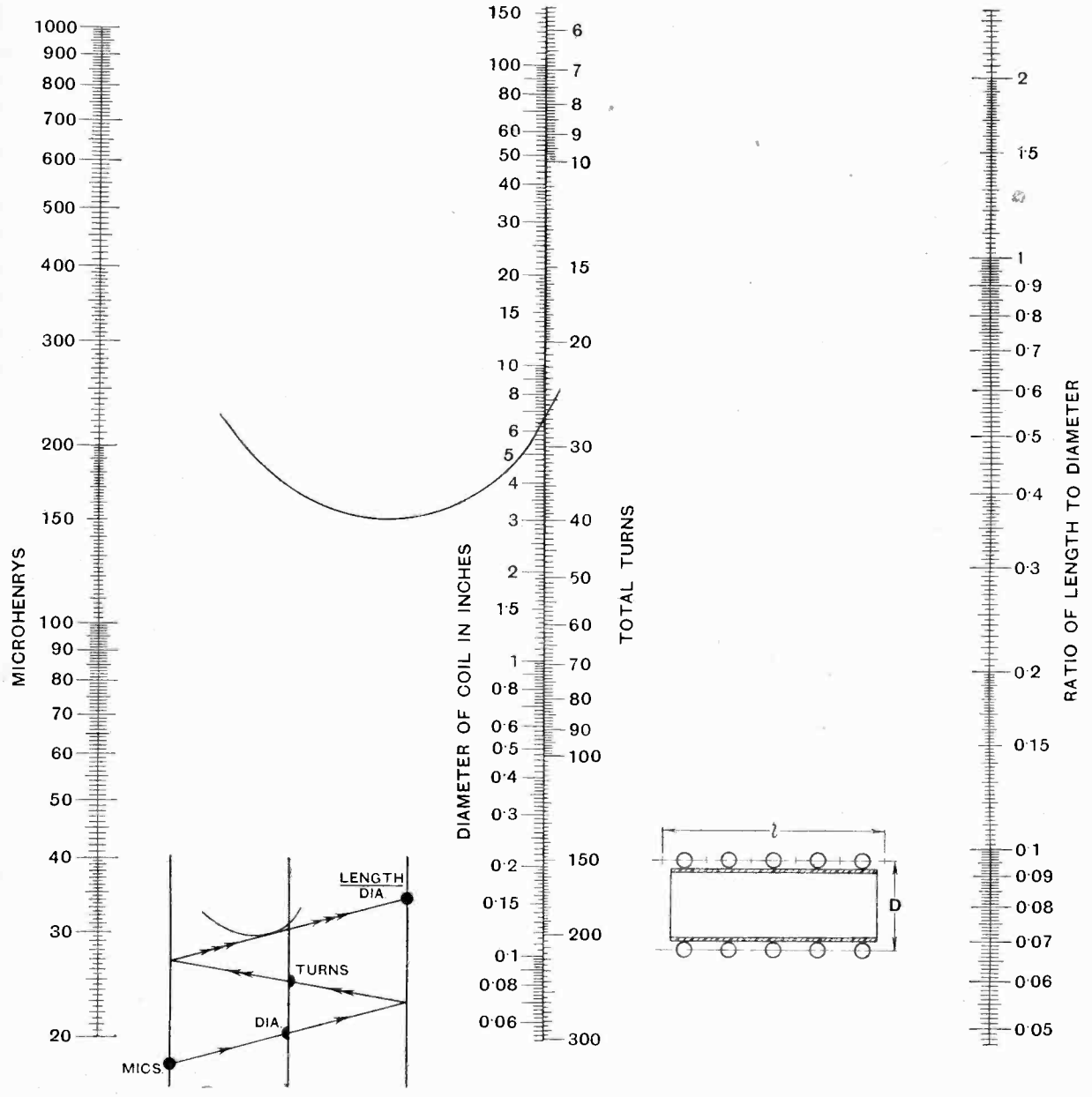
[1] Diameter = overall diameter of wound coil, less diameter of wire.
Length = number of turns multiplied by pitch

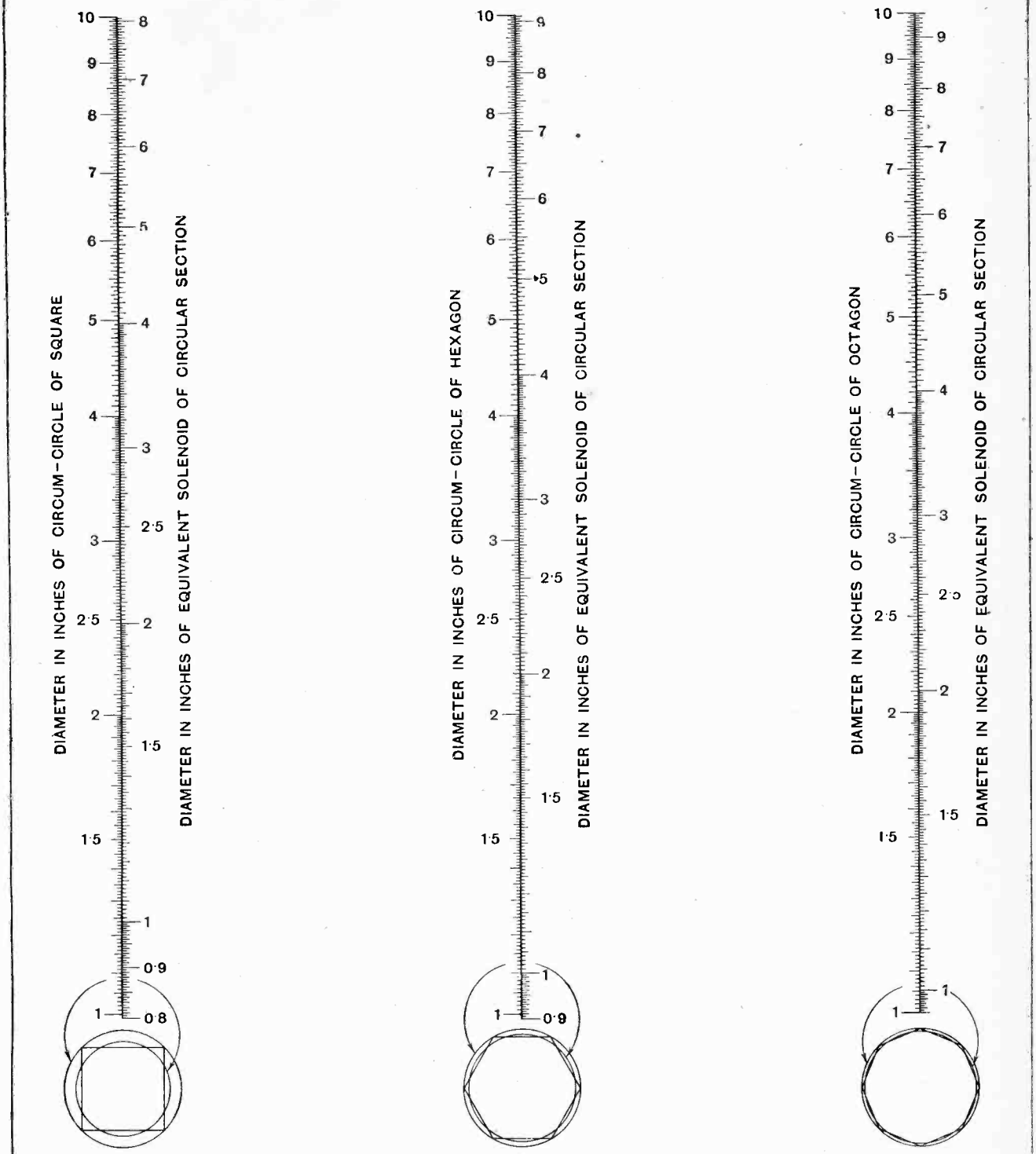


SELF INDUCTANCE OF SOLENOIDS OF CIRCULAR SECTION.

FOR CORRECTION FACTOR REQUIRED FOR SOLENOIDS
OF POLYGONAL SECTION SEE ABAC Nº 17a.

W. W. ABAC

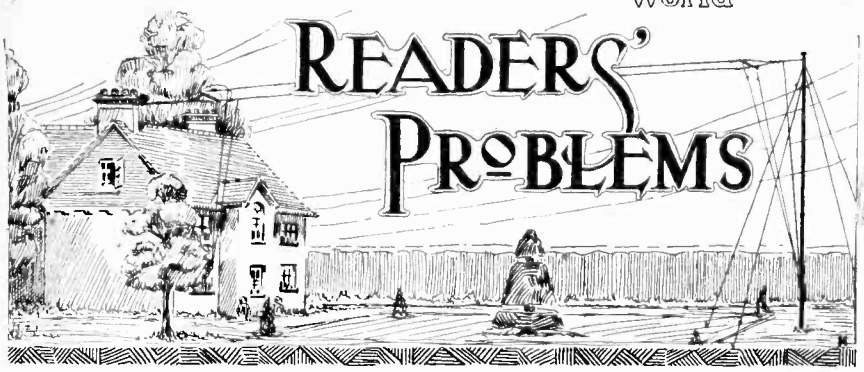
Nº 17



SELF INDUCTANCE OF SOLENOIDS OF POLYGONAL SECTION

W.W. ABAC

Nº 17a



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

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

The Kilo Mag Four.

Is it possible to substitute condensers of 0.0005 mfd. capacity in the "Kilo-Mag Four" receiver in place of the value specified? If possible, I should like to use those which I already have. H. T. F.

There is little practical objection to using condensers of 0.0005 mfd. in place of 0.0003 mfd. The only real disadvantage is that with coils as specified tuning will be comparatively sharper, but if slow-motion controls are fitted, this will not be serious.

○○○○

Remodelling the Original "All-Wave Four."

I am about to rebuild my "All-wave Four" receiver (the original model), adopting the circuit of the new set described in "The Wireless World" for June 13th. Do you recommend me to retain the separately tuned aerial circuit? Since I have mastered its operation, I believe that it is largely responsible for the exceptionally good results I have obtained, particularly on the long waves. N. L. C.

If you do not object to an extra control, we would certainly recommend you to retain the two-circuit tuner; although, as you probably realise, this will necessitate a slight increase in the size of the set.

○○○○

Differential Reaction.

Is it possible to use the Pye differential reaction control condenser in a receiver for the ultra-short wavelengths? If so, I should appreciate a hint as to how it may be connected. N. L. E.

This component may certainly be used in a short-wave receiver, and it should be connected in the manner shown in Fig. 1, from which you will see that the moving plates are joined to the anode of the valve, while one set of fixed plates is connected to negative filament and the other to the reaction coil (marked L_1 in the diagram). The inductance L is of course the grid coil.

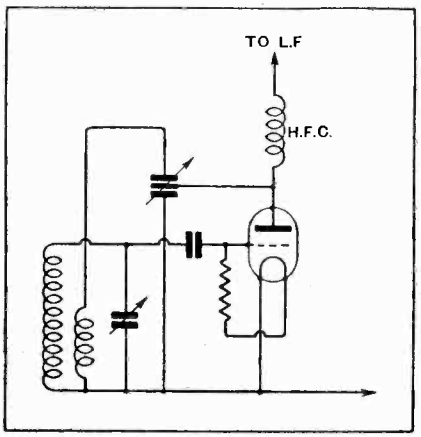


Fig. 1.—A short-wave detector circuit with a differential reaction condenser, which has two sets of fixed vanes.

The number of turns in the two windings will be more or less the same as in conventional circuits, but we may point out that it is always an advantage to adjust the reaction coil by the method of trial and error.

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.

meter.

I ... to use a ... value of ...de circuit ...ng-coil in- ...d in this ...ut how can ...dicated into P. H. M.

...illiamps. you must first ... ... resistance of your instrume... ...nis is marked, you will be able ... ...ain the necessary information from the manufacturers. This is generally given in the form of "ohms per volt," so the total resistance is got by multiplying this figure by the voltage indicated at full scale deflection. At this reading the current consumed is ascertained by dividing "voltage applied" by "resistance" (in ohms).

To take an example, we will consider a voltmeter reading from 0-6 and rated at 100 ohms per volt. The total resistance will be $100 \times 6 = 600$ ohms, so when the meter indicates 6 volts, the current consumed will be $6 \div 600 = 0.01$ amp. (or 10 milliamps.). The single volt divisions on the scale therefore represent $10 \div 6$, or about 1.6 milliamp.

You must not forget that the resistance of the voltmeter is much greater than that of a milliammeter, and that this factor may give rise to misleading results, particularly when the instrument is inserted in series with the anode of a low-impedance valve.

○○○○

Voltage Reducing Resistances.

In constructing a set and eliminator (as separate units), is it better to mount the voltage-reducing resistances in the receiver or in the H.T. unit? My set is to have a total of four valves, and the full voltage of the eliminator will be applied only in the output stage; there will be three series anode resistances. D. R. L.

This is not a matter of very great importance, but you will probably find it more convenient to include the resistances in the set; by doing so, the number of connections between receiver and H.T. unit will be reduced.

○○○○

Noisy H.T. Batteries.

Is there any easy way of testing my 120-volt H.T. battery so that I can prove conclusively if it is responsible for noises which have of late given a good deal of trouble? T. F. V.

We suggest that you might connect across the battery a pair of phones in series with a wire-wound resistance of about 100,000 ohms, which will limit the current flowing to about 1 milliampere; this is quite a safe value. You should then listen carefully, and assuming both phones and resistance to be perfect, you can rest assured that any noises heard will be due to the battery.

A still more conclusive test could be carried out by reducing the value of the resistance so that the current passed would approximately equal that taken by the set.

The Wireless World AND RADIO REVIEW

(16th Year of Publication)

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CONTENTS OF THIS ISSUE.

TRANSMISSION QUALITY.

CRITICISM of quality in the B.B.C. transmissions is a comparatively new phase in broadcasting, but the strength of evidence that all is not well is sufficient to impress upon us the need for enquiry into the matter. Now, the only people who are in a position to check the transmissions satisfactorily are the B.B.C. engineers themselves, and that, of course, at once places the listener at a disadvantage.

A New Phase.

When we speak of criticism of the transmissions as "a new phase in broadcasting," we do so intentionally and not merely using the expression as a convenient phrase. In the early days of broadcast telephony transmissions any sort of transmission which was intelligible was accepted by the public as wonderful, and almost as soon as broadcasting on an established basis in this country began, improvements in transmission quality shot ahead so rapidly that in the race reception quality was outstripped.

The B.B.C. was entitled to boast at that time that its transmissions were, if anything, too good for any receiver available to pick them up. The B.B.C., in fact, were somewhat severe in their criticisms of the standard of reception, and we believe that at one time the B.B.C. had recourse to a definite "cooking" of the transmitter output in order to put in, say, the bass register which they considered would be inadequately reproduced by the vast majority of receivers. But matters have changed since those days, and it would seem that we are fast approaching (if we have not already reached) a stage when a reversal of the old order of things has come about. The performance of the receiver as a unit has progressed to such an extent that it has, we believe, overtaken transmission, so that to-day, transmissions with certain exceptions, do not do justice to the standard of reception which has been attained.

Quality Variations.

We know that the B.B.C. suffers from very severe handicaps when transmissions are carried over landlines to the transmitter, yet strangely enough, some of the very best of their transmissions—those which stand out in the minds of listeners as exceptionally good, have been over landlines of considerable length; also, a very large proportion of the complaints of transmission quality relate to broadcasts from the studios associated with the transmitter.

We know that for some time past opinions have differed amongst experts on transmission as to the degree of studio draping which is desirable. Unfortunately, broadcast transmission experience is limited to those few who are actually engaged on the work, so that it might be very difficult to argue the case with B.B.C. engineers or their colleagues who are musical experts, but we do suggest that when transmissions, as for instance, those from the Grand Hotel, Eastbourne, have been generally considered so successful, that greater attention should be paid to endeavouring to repeat more nearly those conditions in studio broadcasting.

Views of our Correspondents.

In the correspondence pages of this issue several letters on this topic are published, out of a very large number which have been received, and we shall publish a further selection in future issues. The views expressed by most of our correspondents seem to us to be based on intelligent observation over a long period, and in the face of this evidence we think it would be very rash on the part of anyone who, as spokesman for the transmitting authorities, would contend that there is not at least some foundation for the accusations made.

will reflect them and, on account of its enormous extent, will return an appreciable amount of their energy to the earth's surface. To account for the 15-second interval, the radius of the ring must be $1\frac{1}{2}$ million miles! Theory shows that this radius should be larger the smaller the speed of the electrons, and that this particular radius would correspond to electrons travelling at 0.89 of the velocity of light, a speed which is attained by β-particles emitted by radium. The shorter intervals would call for electrons of still higher speed. There is no difficulty in imagining that in the enormous play of energy at work in the sun voltages may be produced sufficient to eject electrons at such velocities.

Since in the course of a single night's observations the echo intervals varied from 3 to 15 seconds, the radius of the electron ring must have been subject to enormous changes. It should be remembered that similar spasmodic changes occur in the Aurora and in the strength of the magnetic field of the earth, and that these fluctuations are attributed to external electric currents.

Whistling Echoes.

When a telephone is connected directly to a large aerial with no H.F. apparatus or rectifier in the circuit, noises are heard at times which start as a high whistle and quickly drop to a low note. These effects have been studied by T. L. Eckersley at Chelmsford during the last nine months, and he finds [4] that during a magnetic storm there is also a storm of whistles, and that frequently a violent click is first heard, followed at intervals of a few seconds by a series of whistles. He suggests that the click is due to some sudden disturbance in the upper atmosphere which spreads into space and is reflected from different parts of the electron ring, so that on the home journey the pulse is drawn out into a series of pulses which form a whistle.

The Heaviside Layer can be Penetrated.

If the above views are correct, the Heaviside layer of ionised air in the upper atmosphere is not the in-

[4] *Nature*, November 17th, 1928, p. 768.

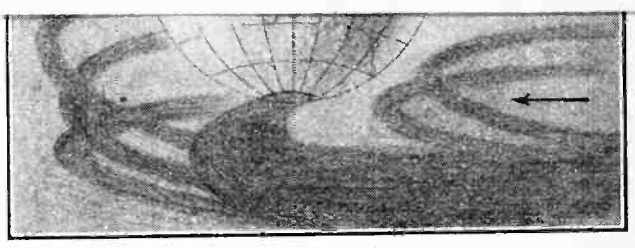


Fig. 3.—Electrons arriving in higher latitudes may become entangled in the earth's atmosphere. The Aurora is probably caused in this way.

reflector now under way for an American observatory we may yet send greetings to a possible decaying brotherhood of life on Mars and receive their message in return: *ave atque vale.*

A New Opening for Research.

When wireless communication attained to such a stature that one transmitting station could dominate a continent, splendid opportunities arose for tracking down the puzzling effects of fading, of atmospherics, and the remarkable behaviour of short waves, which may disappear over a range of a thousand miles and reappear farther on with almost undiminished intensity. From such observations we learnt a great deal about the Heaviside layer, its probable height and density, its seasonal changes and its fluctuations in sympathy with those vast disturbances in the sun which occur so frequently.

Practically nothing is known to-day about the electron sheath, of which Figs. 2 and 3 give a primitive picture. If we imagine these figures combined we should see an envelope like a Rugby football lying horizontally, with deep dimples on its upper and lower surfaces and vortex rings rotating in its equatorial surface. The picture would be further complicated by the presence of positively charged atoms which must also be shot out from the sun during the atmoic explosions which take place within it. Up to now these phenomena have only been inferred from the behaviour of magnetic storms and auroras, but the long-period echo may allow the problem to be attacked from a fresh angle.

Short-wave Signals which Travel Over a Million Miles and Return.

By R. T. BEATTY M.A., B.E., D.Sc.

IN the summer of last year Engineer Jørgen Hals, of Oslo, while listening to the Dutch short-wave station PCJJ at Eindhoven, heard a remarkable echo; unlike the usual echo to which he was accustomed it occurred at the huge interval of three seconds after the signal had been received. Hals perhaps felt some diffidence in making this strange story public, for it was not till February of this year that he wrote to Professor Størmer as follows [1]:

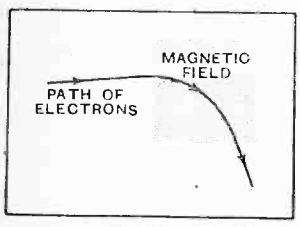


Fig. 1.— The bending of a beam of electrons into an arc when passing through a uniform magnetic field whose direction is at right angles to the plane of the paper.

"... I heard the usual echo which goes round the earth with an interval of about 1/7th second, as well as a weaker echo about three seconds after the principal signal had gone. When the principal signal was especially strong, I suppose that the amplitude for the last echo three seconds after lay between 1/10th and 1/20th of the principal signal in strength. From where this echo comes I cannot say for the present. I will only herewith confirm that I heard with four seconds between them. Similar effects were noticed by van der Pol.

Echoes from Beyond the Moon?

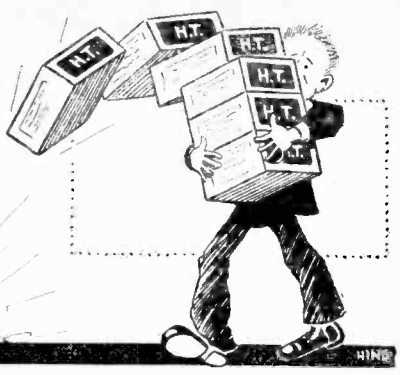
Where had these waves been during those 15 seconds? They flash round the earth in 1/7th second, and they have even been registered on their second lap, but we are faced here with an interval 100 times as great. We cannot imagine that they have scored a century round the globe; surely the intensity would have fallen to a negligible value in doing so; besides, no series of intermediate echoes was heard. Perhaps the moon, 240,000 miles away, reflected them. Not so, for the echo would have returned in 2.6 seconds.

Størmer gives an explanation [2] which may seem fantastic, but the 15-second interval is almost incredible, so that any explanation sounds comparatively rational.

Over twenty years ago Størmer [3] investigated the paths of electrons shot out from the sun and deviated by the magnetic field of the earth. We know that electrons when in motion are affected by magnetic forces,

[2] *Nature*, November 3rd, 1928, p. 681.
[3] *Archives des Sci. phys. et nat.*, Geneva, 1907.

Dropping Volts!



Some Notes on the H.T. Feed to Modern Sets with Special Reference to the *Megavox-Three.*

By W. I. G. PAGE, B.Sc.

THE anode feed resistance scheme, sometimes known as the H.T. de-coupling, battery filtering, or anti-coupling scheme, which has for its main object the prevention of back-coupling and distortion by isolation of the output oscillatory circuit of a valve, has been widely adopted in modern receivers. The method, which has been described from time to time in the pages of this journal, consists essentially in providing a separate low resistance path to the filament negative for the anode A.C. component, as shown in Fig. 1(a). Here we have a penultimate L.F. valve coupled to the output stage by a transformer where the H.T. current is fed through a resistance R_1 of, say, 20,000 ohms.

Taking for example a speech frequency of 200 cycles, the 2 mfd. condenser (Fig. 1(a)) offers the comparatively low resistance of about 400 ohms, so that the A.C. component will be almost entirely diverted to the filament and will not circulate through the H.T. battery. Not the least attractive feature of interposing anode feed resistances is that by a suitable choice of values one H.T. tapping can be used for a multi-valve set where various H.T. potentials are required for each stage.

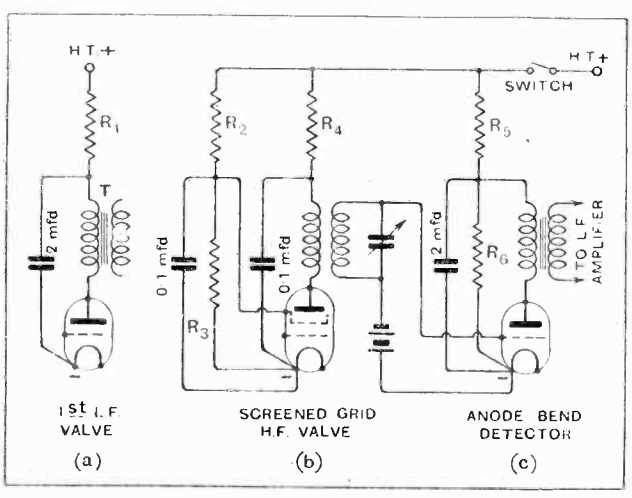


Fig. 1.—(a) The anode feed resistance scheme as applied to a first L.F. valve. At two hundred cycles the 2 mfd. offers about 400 ohms resistance, whilst R_1 is, say, 20,000 ohms. (b) Potential-divider feed to the screen of a screened grid valve. (c) Potential-divider feed to the plate of an anode bend detector where an appreciable voltage has to be dropped. Note the H.T. + switch.

In sets where high-frequency amplification is carried out by means of triodes followed by leaky grid detection and low-frequency amplification, and where only one H.T. positive lead is desired, the general principles of Fig. 1(a) can be carried out with every valve without any difficulty, provided that the value of the feed resistance is arrived at by dividing the volts to be dropped by the current in amperes. When we come, however, to consider the feed to the screen of a screened grid valve or to the plate of an anode bend detector in a set where it is desired to use one H.T. tapping and where the maximum H.T. voltage is considerably above that required, the problem is not so easy. Let us assume in a screened grid valve that 0.5 mA. is the screen current when the screen voltage is 80 and that our H.T. supply is 200 volts; clearly we shall require a feed resistance of $120 \div 0.0005 = 240{,}000$ ohms to drop the necessary volts.

If for experimental purposes the anode voltage or the grid bias (or the valve itself) were changed, involving a rise in screen current to, say, 0.7 mA., then the voltage on the screen would be changed to 200 less $240{,}000 \times 0.0007 = 200$ less $168 = 32$ volts, but screen voltage is critical, and in the case quoted should not vary more than perhaps 10 volts above or below 80. It is thus evident that a single series resistance is inadmissible for the purpose of dropping an appreciable voltage where the feed current is very small, such as that in the screen circuit of a screened grid valve. For the same reason it is inadvisable to use a single series resistance in the H.T. feed to an anode bend detector when more than 40 or 50 volts have to be dropped. There is, moreover, a further complication in this case, for when the signal input to the grid is increased in amplitude the mean value of the steady D.C. anode current rises, with consequent fall in potential on the anode due to the presence of the feed resistance. This would mean that a different operating point on the curvature of the characteristic would result for strong and weak signals. In practice, however, it would not be very serious, since the valve would be

Dropping Volts!—

biased to give probably best rectification on loud signals. From the foregoing considerations it would appear more satisfactory to remain content with a tapping to the necessary voltage on the H.T. battery, and rely on a small de-coupling resistance of about 600 ohms (with by-pass condenser) in the case of the screen of a screened grid valve to deflect the high-frequency A.C. component from the H.T. battery. Where mains voltages are used, or where it is *specially desired* for reasons of even discharge to employ one H.T. tapping with an H.T. battery, separate potential dividers are necessary in a set incorporating screened grid and anode bend detector valves.

Potential Divider Values.

In Fig. 1(b) we will consider that the screen voltage must be 80; we therefore connect a potential divider, consisting of two clip-in resistances, R_2 and R_3, across the H.T. supply, which we will assume is 200 volts. A lead from the junction of the two resistances is taken to the screen, which will have an applied potential of 80 volts if the values of the resistances are to one another as 80 is to 120, that is, the voltage across one resistance will have to be two-fifths, and across the other three-fifths, of 200 volts, *provided that no current is taken by the screen*. The total value of the resistances in the potential divider should be such that the constant current flowing is considerably greater than that of the feed current to the valve concerned, which in the case under discussion we will take as 0.5 mA. (with 150 volts on the anode).

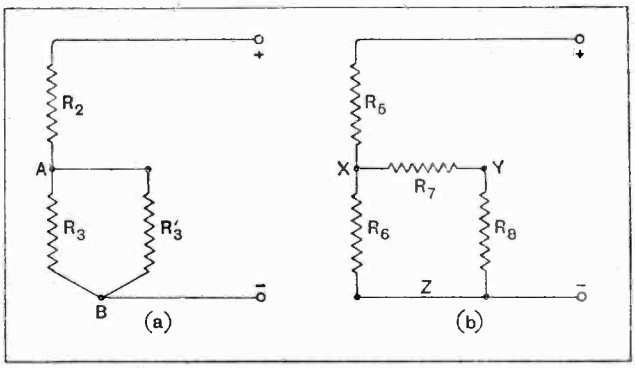


Fig. 2.—(a) The equivalent screen circuit of Fig. 1(b). (b) The equivalent diagram for the anode feed circuit of the *Megavox-Three*, where optional anode bend or leaky grid detection is used.

A convenient value is 100,000 ohms, which will pass at 200 volts a current of 2 mA. (this is four times greater than the valve current). In these circumstances it would appear to be necessary to make R_2 and R_3 respectively 60,000 and 40,000 ohms, but unfortunately we are faced with a slight complication since, as already stated, the screen *does take current*, a condition which in effect adds another resistance in parallel with R_3 and is tantamount to reducing it in value. In Fig 2(a) the potential divider of Fig. 1(b) has been redrawn to show the screen resistance as R'_3; its value is taken as 160,000 ohms (as it passes 0.5 mA. at 80 volts), and by reference to *The Wireless World* Abac No. 11 it will be seen that 40,000 (R_3) and 160,000 (R'_3) in parallel are equivalent to a single resistance of 32,000 ohms. The potential difference between A and B (*i.e.*, the screen voltage) now becomes $\frac{32,000}{92,000} \times 200 = 69.5$ volts, and not 80 volts. In working out values of potential-divider resistances it is thus necessary to take the D.C. resistance[1] of the valve circuit into account, as it makes it necessary to raise the tapping point on the potential divider nearer to H.T. +. By making R_2 and R_3 respectively 55,000 and 45,000 ohms, by similar calculation we get a screen potential of about 78 volts, which is more satisfactory. It can easily be shown that a rise in screen current to 0.7 mA. is now accompanied by a drop in potential to just over 70 volts, which is rather different from a drop to 32 volts when a single series resistance is used in similar circumstances; this incidentally proves the case for the potential divider. When a screened grid valve (Fig. 1(b)) is fed from H.T. batteries a sufficient by-pass in association with the de-coupling resistances is effected by 0.1 mfd. condensers; but it is usual to replace these by 2 mfd. condensers if the receiver is mains fed, since ripple current may have to be passed.

The battery filtering effect of the potential divider is the same as that of a single series resistance; in fact, R_2 and R_3 of Fig. 1 perform precisely the same function as R_1, but since a steady current is always flowing across the potential dividers, whether or not the filaments are alight, it is necessary to fit a switch in the common H.T. + lead. The feed to an anode bend detector is shown in Fig. 1(c).

Those who wish to feed a *Megavox - Three* receiver from a single tapping on an H.T. battery of 130 volts would be well advised to include a potential divider for the screen and retain the original resistance in the plate circuit of the detector, also that in the screen circuit of the pentode.

In an eliminator for the *Megavox-Three* shortly to be described separate potential dividers will be used for the H.T. feeds to the screen of the screened grid valve and to the plate of the anode bend detector, while the other H.T. feeds will have series resistances. The incorporation of separate potential dividers together with series resistances provides no common paths for speech currents, and from the point of view of avoiding back-coupling is equivalent to having series feeds throughout. Care must be exercised to differentiate between the system just described and the method of providing several H.T. potentials from a single potential divider shunted across the H.T. supply. How L.F. oscillation or distortion can occur when employing this latter system was dealt with recently in an article[2] by the author.

The Case of the *Megavox-Three*.

A switch is provided in the *Megavox-Three* to change over from leaky grid to anode bend detection and automatic correction of the anode voltage is effected by a 20,000 ohm feed resistance. What method shall we employ to create the necessary reduction when the source

[1] This is not the same as the impedance of the valve, which is the differential resistance, *i.e.*, change in anode volts ÷ change in anode current.

[2] Back Coupling in Eliminators. *The Wireless World*, September 26th, 1928.

Dropping Volts !—

of H.T. supply is 200 volts? Earlier in this article it has been shown that a potential divider is preferable for anode bend, and that the constant current flowing should be much more than that of the feed current to the valve. Presumably we shall use the same potential divider for leaky grid where the anode current is approximately 3 mA., thus necessitating a constant current of at least 6 mA. The total potential-divider resistance required is thus about 35,000 ohms, and before we can decide on the position of the tapping point it is necessary to study the equivalent circuit of Fig. 2(b), where R_5 R_6 is the 35,000 ohm potential divider across 200 volts H.T.: R_7 is the 20,000 ohm resistance already in the receiver, and R_8 the D.C. resistance of the valve.

Let us take R_5 as 10,000 ohms and R_6 25,000 ohms, and work out the difference in potential between X and Z. The lower limb (XZ) of the potential divider has an effective resistance when leaky grid detection is used of R_6 (25,000 ohms) in parallel with R_7 (20,000 ohms) + R_8 (23,000 ohms obtained by assuming 3 mA. anode current at 70 volts H.T.), which works out at 16,000 ohms; therefore the volts across XZ are $\frac{16}{26} \times 200 = 123$ volts, while the volts across YZ, that is the actual plate voltage, will be approximately half 123 volts, i.e. 60 volts, representing a satisfactory applied potential for leaky grid detection.

With anode bend R_8 becomes about 240,000 ohms (0.5 mA. at 120 volts), so that the lower limb XZ of the potential divider becomes R_6 (25,000 ohms) in parallel with R_7 (20,000 ohms) + R_8 (240,000 ohms), which equals 23,000 ohms; and the difference in potential between X and Z now equals about 140 volts and between Y and Z (the plate of the valve) about 130 volts—a satisfactory potential for anode bend detection.

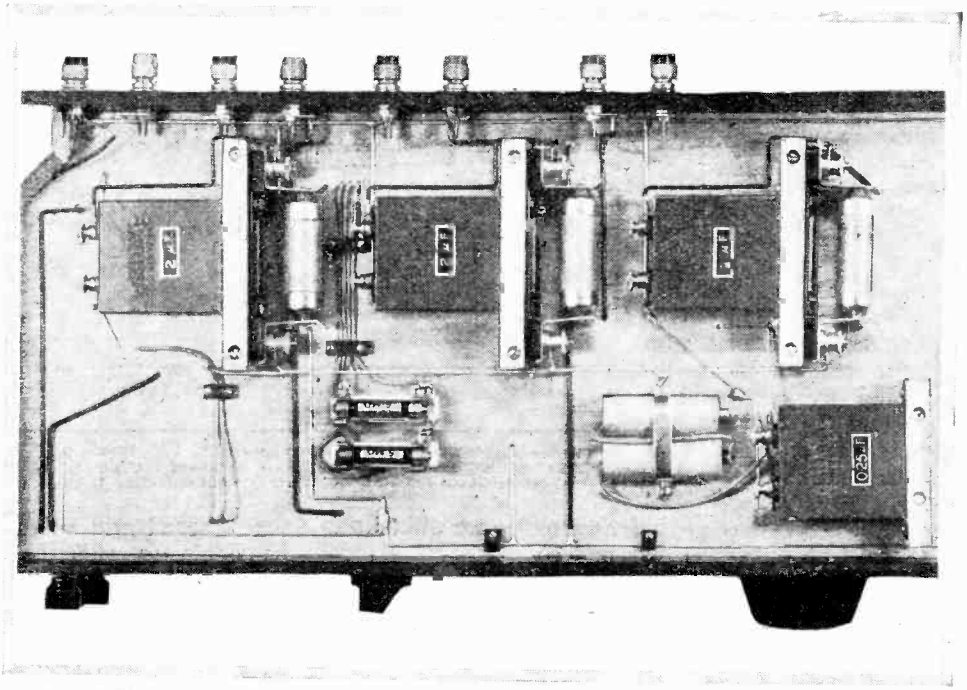
It is hoped that the examples given will assist readers to calculate the resistances required when employing separate potential dividers to break down either mains or battery voltages for the H.T. feeds in a multi-valve receiver embodying an anode bend detector and one or more screened grid valves.

The salient points in connection with the accommodation of the H.T. supply for various anode requirements can be summarised as follows:—

1. *H.T. Dry Batteries and H.T. Accumulators* probably give the simplest and most certain way of providing the correct plate voltages for each valve by reason of the large number of tapping points which can be used without the complication that change in feed current is associated with serious change in voltage. Any appreciable internal resistance of the battery, however, is accompanied by back coupling and probably distortion if this type of feed be employed without anode feed resistances.

2. *Anode Feed Resistances,* used in conjunction with suitable by-pass condensers, when embodied in a receiver combine the dual function of preventing back-coupling and distortion due to the internal resistance of a battery and provide a means of feeding from one H.T. tapping a set where various H.T. potentials are required for each stage. This method holds good where triodes are used in the H.F. stages and where leaky grid detection followed by triode or pentode L.F. valves is employed.

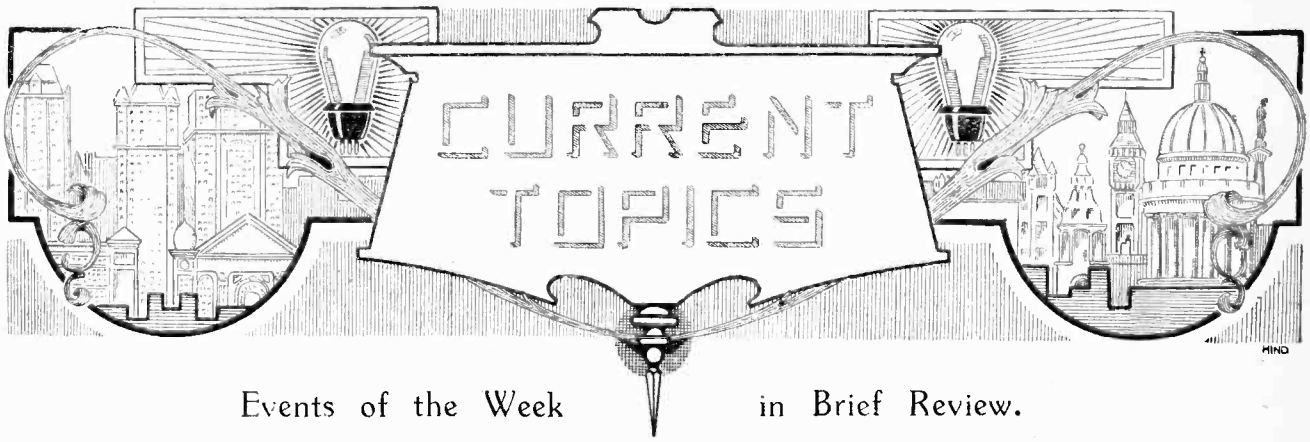
3. *The Screen of a Screened Grid Valve* should be fed from a potential divider if many volts have to be dropped either from a battery or from the mains.



A typical H.T. battery filtering scheme making use of only one H.T. tapping. The illustration shows the sub-baseboard layout of *The Wireless World* "*New All-wave Four*" receiver.

4. *An Anode Bend Detector,* if any appreciable voltage has to be dropped (from a battery or from mains equipment) should be fed from a potential divider because the anode current is relatively small and because the mean D.C. feed current alters with change of amplitude of signal impressed on the grid.

5. *Potential Dividers* (which can consist of clip-in resistances in series) of suitably high resistance not only provide a means of supplying H.T. from one tapping where screened grid and anode bend detector valves are used, but also perform the same function as single series anode resistances as regards preventing back-coupling. In working out the values of potential-divider resistances it is necessary to take into account the D.C. resistance of the valve circuit in parallel with one limb.



Events of the Week in Brief Review.

POPULAR PICTURE TRANSMISSION.

"Wireless Pictures" were placed first in a competition to discover the most popular exhibit at the Manchester Wireless Show.

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RUSSIA BUYS AMERICAN RADIO GEAR.

The Soviet Government is reported to have signed an agreement with the Radio Corporation of America for the purchase of £60,000 worth of wireless equipment.

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AN ENTERPRISING CORPORATION.

It is believed that the enterprise of the Middlesbrough Corporation in initiating a scheme for the hire purchase of battery eliminators by electricity consumers has aroused considerable interest among other municipalities. Similar schemes are likely to be tried in other parts of the country.

Middlesbrough listeners obtain their eliminators on the deposit of £1, the remainder of the purchase price being payable in half-yearly instalments of £1, extending over a period of five years.

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MARCONI ROYALTIES APPEAL.

In the Chancery Division on November 20th Mr. Justice Tomlin declined to fix a date for the pending appeals by Marconi's Wireless Telegraph Co. against the decision of the Patent Comptroller in respect of the "Brownie" and "Loewe Radio" royalty cases.

Mr. Justice Tomlin informed the Attorney-General (who has been added as a party) that if one of the prior cases now in his list were settled, further application could be made.

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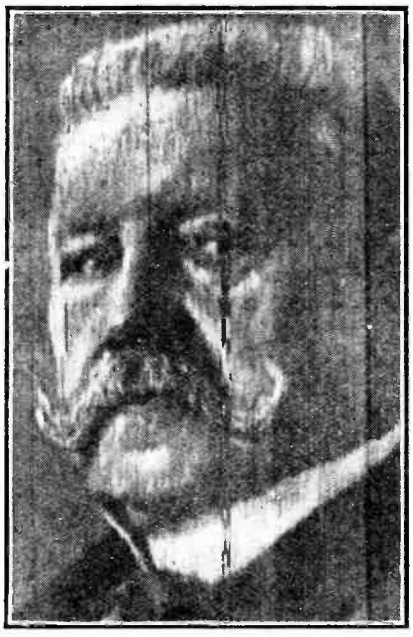
MEMORIAL SERVICE FOR WIRELESS OPERATOR.

More than 2,000 people attended a memorial service on November 18th at Old Trinity Church, Wall Street, New York, for Mr. Michael O'Loughlin, the senior wireless operator of the "Vestris." The congregation included members of the crew, representatives of the Veteran Wireless Operators' Association, Army and Coastguard officers, and Sir Harry Gloster Armstrong, the British Consul-General in New York. The service was broadcast.

LONG-DISTANCE PICTURE RECEPTION.

The distance possibilities of the "Fultograph" system were successfully demonstrated on Tuesday, November 20th, when a number of London listeners equipped with "Fultograph" receivers were able to pick up the inaugural picture transmission from Königswusterhausen,



PICTURES FROM BERLIN.—President Hindenburg's portrait as received in London on a "Fultograph" set during the inaugural picture transmission from Königswusterhausen on November 20th.

Berlin, on 1,649 metres. A portrait of President Hindenburg came through well, despite the nearness in wavelength of 5XX, which caused only a few blemishes.

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CHINA'S WIRELESS PLANS.

The Nationalist Government of China has signed an agreement with the Radio Corporation of America for the institution of a high-speed radio circuit between Shanghai and the United States. A similar agreement has been concluded between the Chinese Government and Trans Radio, Berlin.

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A WIRELESS BANQUET.

Sir William Bull, M.P., will preside at the annual banquet of the Radio Manufacturers' Association on Thursday, December 6th.

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STOCKBROKERS AT SEA.

Wireless facilities for the establishment of stockbrokers' offices on transatlantic liners are being considered by the General Post Office.

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IRISH AMATEURS TO UNITE.

A fusion of the Wireless Society of Ireland with Irish Radio Transmitters' Society is to be recommended at the annual general meeting of the former on Friday next, November 30th.

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FREE STATE WIRELESS.

The establishment of a large wireless factory in the Irish Free State has been suggested to Mr. Heffernan, Minister of Posts and Telegraphs, for consideration by the Dail. It is urged that such a factory would mean cheaper wireless apparatus for Irish listeners, besides giving employment.

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NE PLUS ULTRA-SHORT WAVES?

"Radio waves too small for science to measure—" says a Scottish newspaper "—so small that the actual amount of energy exerted was a million times less than the pressure of a fly's foot—were used by Maurice J. Francill, the radio engineer, to secure this wonderful result."

The result referred to was the distant control of four cars in Chicago. But more wonderful than the distant control is surely Mr. Francill's discovery of the *really* ultra-short waves. 5-metre work has lost its glamour.

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STOCK EXCHANGE WIRELESS.

Doupevitch, a Parisian gentleman who had erected a wireless transmitter in his house with a telephone line to the

Bourse, is now in prison. He has been sentenced to one year's imprisonment and a fine of 5,000 francs (£40) for communicating exchange prices by wireless to friends in other countries, thereby enabling them to use their first-hand information to the detriment of other speculators.

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FRENCH RIVAL TO WIRELESS-CABLE MERGER ?

A French wireless-cable merger is reported to be under consideration. Radio-France, which controls wireless communication from France to Britain, Austria, Spain, Norway, Yugo-Slavia, Rumania, and Czecho-Slovakia, is understood to be in negotiation with the French Cable Company, the owners of cables connecting Europe with North and South America, New Caledonia, and Australia. The merger, if formed, would be a reply to the British proposals and new American schemes for placing world communication under a single control.

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BRITISH WIRELESS EXPORTS.

During August last, says *The Wireless Trader*, radio exports from this country were valued at £69,974, valves accounting for £12,617. The principal market was Australia. Continental customers included Spain (£4,830), France (£3,781), Norway (£2,473), and Belgium (£2,009).

SETS ON HIRE.

A Warminster firm advertises the free installation of a receiving set, "including erection of aerial, earth, loud speaker and all accessories" at a charge of 4s. 9d. per week, with a minimum contract of six months. Query: Who pays for the receiving licence?

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SHORT WAVES FROM AFRICA.

An opportunity is available to short-wave listeners to hear 30-metre telephony transmissions from wildest Africa. We understand that, until further notice, Major Court Treatt is transmitting on this wavelength from Bahr-el-Arab, Southern Sudan, between 6 and 8.30 p.m. G.M.T., using the call-sign FXCT. He is engaged with Mrs. Court Treatt in the production of two pictures for British Instructional Films, Ltd.

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"WIRED WIRELESS" FOR AMERICA.

In view of the recent publication of articles on broadcasting by "wired wireless" (*The Wireless World*, November 14th and 21st), it is interesting to note that the Kolster Radio Corporation and the North American Company are pooling their resources to develop a "wired radio" system throughout the United States, involving the use of the North American Company's network of electric wires throughout the country. A "unique broadcasting service" is to be provided which, according to present plans, will ultimately include television. Receiving sets are shortly to be available at a nominal rental.

"Wired wireless" has peculiar advantages in America, where the existing broadcasting conditions are still far from the ideal. Atmospherics are troublesome, but the greatest bugbear is mutual interference between the 650 stations, despite the prolonged endeavours of the Federal Radio Commission to bring order out of chaos.

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WIRELESS-CABLES MERGER BILL.

In the House of Commons last week the Imperial Wireless and Cables Bill was read a second time, the Labour amendment for the rejection being defeated by 258 to 134. The Bill was committed to a Committee of the whole of the House.

In the course of the debate, Labour Members contended that the bargain was a bad one for the Government. In reply, Sir John Gilmour said that the scheme had been unanimously recommended by an authoritative and representative Imperial Conference when faced by the common Imperial problem of preserving the cables. Some kind of fusion was agreed to be essential.

Government influence in the new company would be preserved by two Government directors, one of whom must be chairman.

SCIENTIFIC FOUNDATIONS OF BROADCASTING.

New German Work on Electro-Acoustics.

THE flood of German scientific treatises shows no sign of abating: as the reader wades each autumn in the rising tide he is inclined to say: "Is it worth while?"

This book* seems to be well worth while for the first third of its course, in which an excellent account is given of the nature of speech and music and of the fascinating but difficult subject of electro-acoustics. But the treatment of electric waves, valve theory, amplifiers, transmitters and receivers, has little to distinguish it from the subject-matter of any of half-a-dozen English books on similar subjects.

Chapter 2 treats of the modern work on the analysis of speech sounds. The old controversy between Helmholtz's view that the upper partials of any vowel are fixed in pitch, whatever the pitch of the fundamental, and the rival theory that the partials rise as the fundamental rises, as when a gramophone record is rotated at higher and higher speeds, has now been definitely settled. It appears that Helmholtz was nearly right: the group of overtones which characterises any vowel rise in pitch, but only slightly, as we pass from bass to soprano voices. Thus when the vowel A is sung by two voices, the relative frequencies of the fundamental pitches being 5 to 1, the relative frequencies of the important overtones are only in the ratio 5 to 4. "U" sounds contain the lowest overtones, "A" sounds the highest: the variations are due to the different sizes of the cavities of the mouth and throat, which act as resonators when these vowels are spoken or sung.

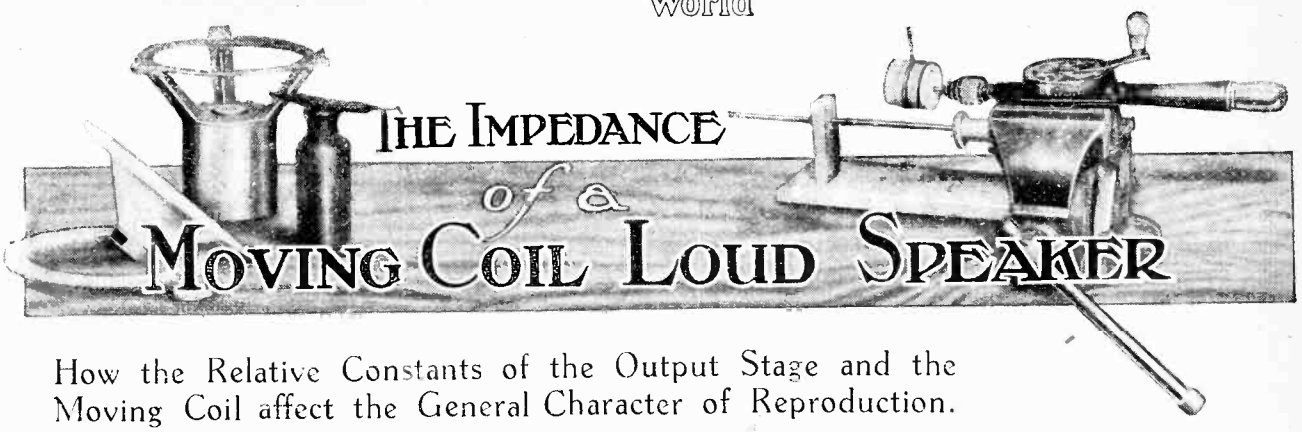
The microphone is unkind to soprano voices. The soprano's fundamental is already far out on the sideband; her overtones, which are still farther away from the carrier frequency, are frequently suppressed entirely.

A summary is given of recent work on the acoustics of concert halls: echoes from bare walls are distressing; on the other hand, walls clothed entirely with tapestries cause a dull and stifled effect. Formulæ have been worked out to give the correct amount of "absorption loading," partly due to the audience, partly to wall hangings, so as to produce an agreeable result. The theory of combination tones is touched upon: the ear possesses the power of supplying fundamental tones which the loud speaker may omit to supply; thus two defects unite to improve reception provided the sound is sufficiently loud. Sound-producing instruments are divided into three classes: those of zero order emit radiation equally in all directions; this class is typified by pulsating spheres: oscillating spheres and diaphragms open to the air on both sides belong to the first order with one nodal line or circle. Instruments with two or more nodal lines or circles, such as bells, belong to the second or higher orders. In each case the device is loaded by the air (or in submarine transmitters by the water) which is set in motion; and this resistance loading, which varies with the wavelength, can be found by simple approximate formulæ; expressions are also given for the change in resonance frequency due to the surrounding medium.

In the chapter on electro-acoustics the general theory of telephones and loud speakers is given, these devices being considered as coupled to the electrical driving system, and this section alone would justify the production of the book. A long discussion lays down clearly the relations which should exist between the impedances of the driving system, the loud speaker mechanism, and the air loading, the result being expressed as a factor of merit. Exponential horns, coil-driven diaphragms, and the "Blatthaller" are thoroughly dealt with.

The rest of the treatise treads well-worn paths in wireless engineering, but a flash of interest is excited by the section on strays, atmospheric and otherwise. The author surveys the geographical distribution of atmospherics and their relation to thunderstorms and seasonal weather changes, and has a good deal to say about the superiority of transmission on short wavelengths. R. T. BEATTY.

* Die Wissenschaftlieben Grundlagen des Rundfunkempfangs [The Scientific Foundations of Broadcast Reception]. Edited by K. W. Wagner. Pp. 418. 25 marks. Julius Springer, Berlin. 1927.



The Impedance of a Moving Coil Loud Speaker

How the Relative Constants of the Output Stage and the Moving Coil affect the General Character of Reproduction.

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

IN a previous article[1] on the moving coil loud speaker, I showed that (1) the impedance of the moving coil increased at low frequencies owing to the back e.m.f. caused by its motion in the magnetic field of the pot; (2) there was electro-mechanical resonance (apart from the influence of any mechanical support) at some frequency in the middle register, this point corresponding to *minimum* impedance; (3) above this frequency the impedance increased due to the inductance of the coil. Using the theory and data given in the above article, the impedance of the coil can be calculated over a certain band of frequencies. Now it is important to observe the conditions under which the impedance is calculated. These are as follows: (1) The coil was a *high resistance* type of 1,000 turns 46 enamelled s.w.g., 2in. in diameter. This avoided any complication due to a transformer. (2) The diaphragm was about 9½in. in diameter (*The Wireless World*, August 8th, 1928, p. 157, for actual size) and free from resonances. (3) The resonance of the diaphragm on its surround is assumed to be below the lower limit of audibility (see footnote *re* this on page 94, "Loud Speakers," 2nd Edition). (4) The inductance and resistance of the coil are assumed to be constant at all frequencies.

These conditions are conducive to simplicity, but hardly fit in with the practical case. There is a variation in inductance and resistance, with the frequency which we shall discuss later, but it merely alters the magnitude of the impedance in a certain degree. Condition (3) relative to the absence of surround resonance can be fulfilled by taking the necessary precautions, but there are coil drive loud speakers where this resonance exists in a marked degree. This was shown clearly in another article[2]. In Fig. 1 is reproduced a curve showing the current in a moving coil loud speaker as specified in the explanatory matter beneath the diagram. The current falls from a maximum value of 42 mA. to a minimum value of 27 mA. This is clearly due to an increase in the impedance of the moving coil *system* (not the moving coil, *per se*). Turning to Fig. 2 we have an equivalent diagram of the power valve stage with the loud speaker. The voltage of the fictitious alternator is constant, so that the current will depend upon the impedance of the complete circuit, i.e., two power valves in parallel plus the loud speaker. The internal resistance of the valves was not measured, but it can be assumed as 1,350 ohms. without introducing serious error.

We know that impedance $= \frac{\text{volts}}{\text{current}} = \frac{m \times Vg}{\text{current}}$. Now m for an L.S.5A is about 2.2, whilst the r.m.s. voltage applied to the grid[3] was 45. The value of mv_g is

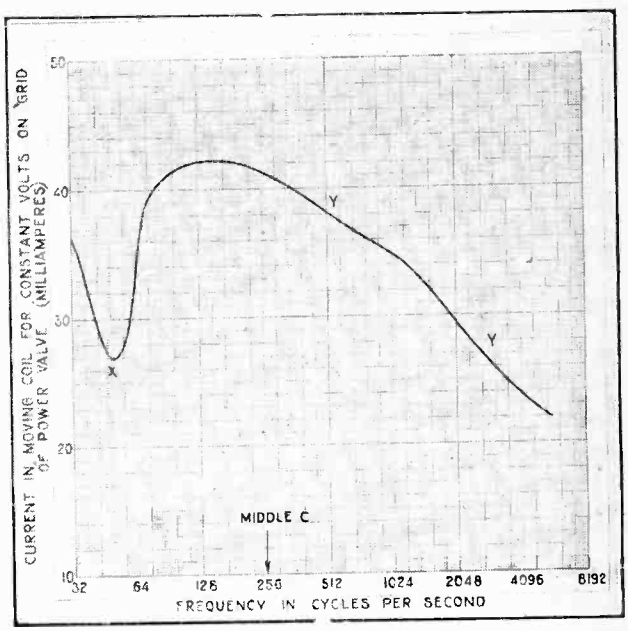


Fig 1.—Curve showing alternating current in moving coil loud speaker. The moving coil was wound with 1,000 turns, and the flux density in the air gap 8,300 lines per square cm. The power stage contained two LS5A valves in parallel. The fall in current at X is due to mechanical resonance of diaphragm, and the fall in current at YY is due to inductance of coil and also increase in A.C. resistance due to iron loss.

[1] *The Wireless World*, March 30th, 1927, p. 372.
[2] *The Wireless World*, August 8th 1928, p. 154.

[3] This applies to the present Fig. 1 and to Figs. 3 and 4, *The Wireless World*, August 8th, 1928. In Fig. 5 (August 8th, 1928) the input voltage was 34. Owing to the large amplitude of the cone, to sideways motion, and to the general mechanical properties of the rubberised silk, the minimum current at 50 cycles was difficult to secure accurately. I have another current value of 23 mA. (for Fig. 5) which gives an impedance in accordance with Fig. 1.

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therefore $2.2 \times 45 = 99$. The current in the denominator is read from Fig. 1. Thus by dividing the ordinates of Fig. 1 into 99, we still obtain the total impedance of the loud speaker plus power valve. This is plotted in Fig. 3, from which we see that the impedance has a (mathematical) maximum value at 50 cycles and a minimum value about 170 cycles. To secure the loud speaker impedance it is necessary to subtract the resistance of the power valves from the total circuital impedance. Since the loud speaker impedance is not a pure resistance (except at 50 cycles and 170 cycles) its value cannot be found by simple subtraction of valve resistance from the ordinates of Fig. 3. However, at 50 cycles and 170 cycles this subtraction is permissible. The circuit impedance (a resistance in these two cases) at 50 cycles is 3,660 ohms. The valves account for 1,350 ohms, leaving 2,310 ohms as the impedance of the loud speaker. At 170 cycles the total impedance is 2,350 ohms, leaving 1,000 ohms for the loud speaker. This has been confirmed by measurement of the effective A.C. resistance of the loud speaker. The D.C. resistance is 930 ohms, so that the iron loss does not cause a serious rise in resistance at the frequency under consideration. The influence of the surround resonance, in this particular case, is substantially to double the loud speaker impedance. As indicated in an earlier footnote the actual current at resonance was difficult to measure owing to the peculiar action of the rubberised-silk and to the large amplitude. Using data from *The Wireless World*, August 8th, 1928, Fig. 5, the loud speaker impedance is about 4,000 ohms, i.e., a fourfold increase over that at 170 cycles. Using a rubber surround the impedance was greater than 4,000 ohms, but as this occurred *below the limit of audibility*, it does not affect the problem at issue, namely, the impedance variations over the *audible* frequency range. Of course, by increasing the radial tension on the rubber (or other supporting material) it would have been possible to secure a greater impedance due to the surround resonance. The increased tension would be accompanied by resonance at a higher frequency where its effect would be noticeable. The object in designing a coil drive loud speaker, however, should be to place the surround resonance well below the working frequency range.

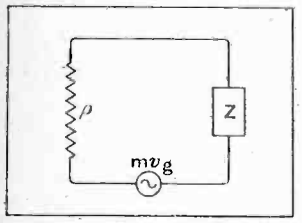

Fig. 2.—The equivalent circuit of power valves and loud speaker. ρ is the resistance of power valves in parallel; Z the impedance of loud speaker, and mvg the voltage of fictitious alternator.

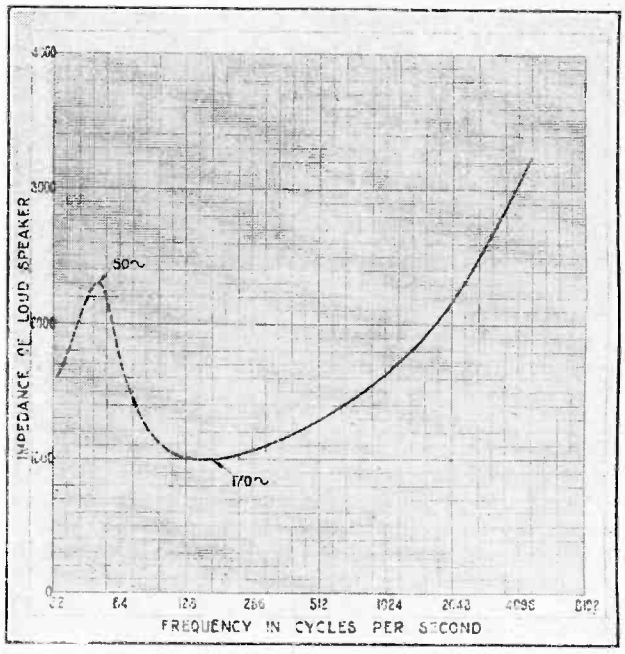

Fig. 4.—The impedance of coil drive loud speaker as specified under Fig. 1. At 50 cycles the rise in impedance is due to resonance of the surround, whilst at the higher frequencies it is due to the inductive reactance. The ordinates of Figs. 3 and 4 are ohms. In all curves the irregularities due to diaphragm resonances have been omitted deliberately.

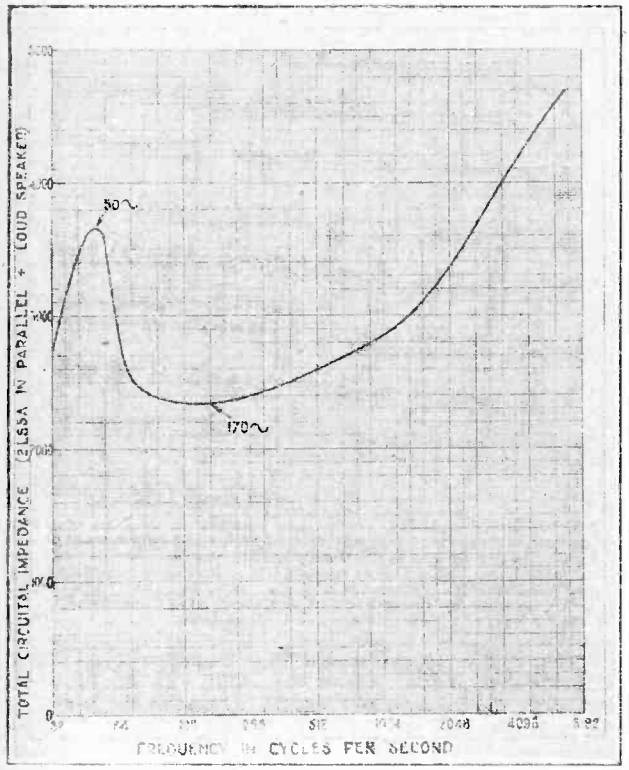

Fig. 3.—Curve showing total impedance of two LS5A valves in parallel together with coil drive loud speaker as specified under Fig. 1.

So far our attention has been confined to a certain type of loud speaker operated by a high resistance coil. This is a simple mode of precedure since it eliminates any complications which may arise when using an output transformer and a low resistance coil. As a number of readers use output transformers, I think it will be of interest to add an impedance curve—better still, a current curve—relating to this case. In Fig. 5 is

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depicted a current-frequency curve for a certain loud speaker with transformer and low resistance coil[3]. Neither the speaker nor the transformer was designed by me. The diaphragm is a good deal smaller than that used with the high-resistance coil. The surround resonance occurs consequently at a higher frequency, viz., 75 cycles. This resonance is pronounced and objectionable in the reproduction of speech and music. With *one* LS5A power valve the coil current at 4,000 cycles was reduced to half its value at 250 cycles, due mainly to coil inductance and transformer leakage. Nevertheless, there was a definite tendency in reproduction to accentuate the upper register. This is due to con-

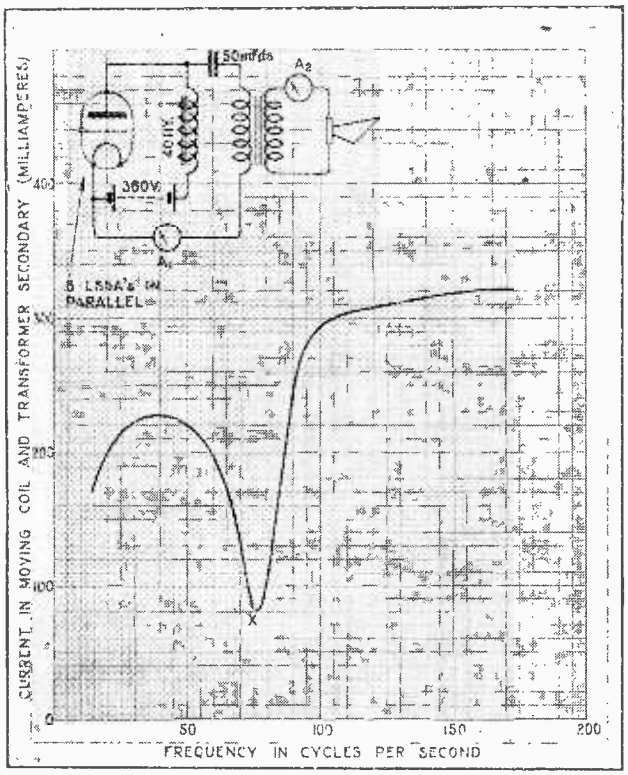

Fig. 5.—Curve showing current in moving coil loud speaker with transformer output from power valves. X is the resonance frequency of the surround. At 4,000 cycles the secondary current was 82 mA. with five LS5A's in parallel.

certina action as stated in a previous article[4]. Although the surround resonance with a diaphragm of this type is unpleasant, it counteracts the effect of the upper register to an extent. When the low frequency resonance is eliminated the upper register is distressing.

The transformer is rather a unique piece of apparatus. Owing to its low primary inductance, the ratio of the secondary to the primary current falls from nearly 16 at 100 cycles to 3.2 at the resonance point of the surround This is portrayed by the curve of Fig. 6. Using another transformer of higher primary inductance the ratio was substantially constant. Even at the resonance frequency there was no marked change in

[3] This is the case cited in my letter to *Experimental Wireless*, October, 1928.

[4] *The Wireless World*, October 17th, 1928, p. 542.

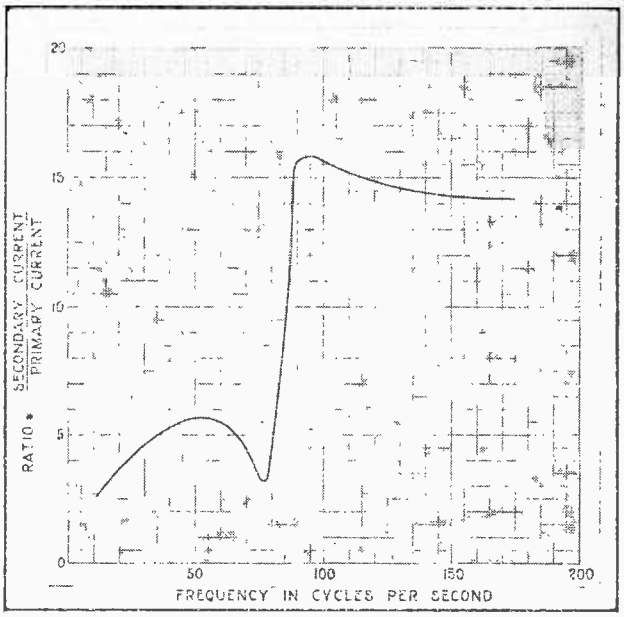

Fig. 6.—The curve given here shows current ratio of transformer used with low resistance coil drive loud speaker.

ratio. To deduce the primary current of the transformer it is merely necessary to divide the secondary current by the ratio of transformation. The reader can easily do this for himself.

We have now to compare the variations in loud speaker impedance with the internal resistance of the power valve. Taking the 1,000 turn high resistance coil and one LS5A valve we see from Fig. 7 that the impedance of the coil at 50 cycles and at frequencies

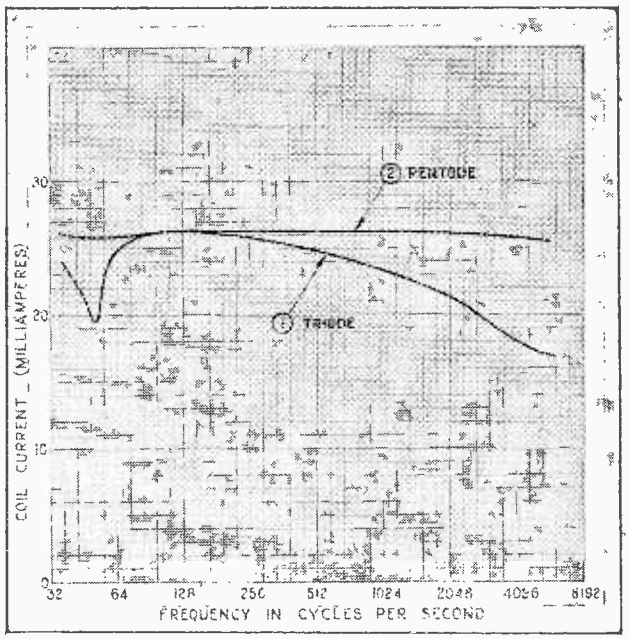

Fig. 7.—Curves showing variation in coil current when loud speaker specified under Fig. 1 is used with one LS5A (2,700 ohms, curve 1), or one pentode (60,000 ohms, curve 2). It is clear that there is no appreciable current variation with the pentode, which proves that the coil impedance is relatively negligible.

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above 2,000 cycles causes an appreciable reduction in current. Thus the variation in impedance of the loud speaker is not negligible. When, however, the *same coil* is used with a pentode of 60,000 ohms resistance, the variation in current and therefore in loud speaker impedance is negligible. This will be clear from Fig. 7. Since the current at 50 cycles and at the higher frequencies is greater with a pentode than with a triode, the acoustic output will also be greater. Thus the surround resonance at 50 cycles and the upper frequencies will be more pronounced than they are with a triode. In practice, however, there is a certain degree of balance, but the proper course to pursue is to reduce the surround resonance below the audible range. This enables a better upper register to be secured without the L.F. resonance effect. If the higher frequencies are too strong there are several well-known methods of reducing them. (1) The H.F. by-pass condenser on the detector can be increased; (2) the selectivity of the H.F. circuits can be enhanced; (3) the number of turns on the moving coil can be increased. By utilising the scheme of item (3) the acoustic output can be augmented very materially. This increased output is a definite asset, a point which I have corroborated in practice.[5].

The general character of the output from the loud speaker depends upon the receiver, the relative impedance of power valve and speaker, the size and shape of the diaphragm, together with the material used in its construction. A small cone of very stiff paper usually results in a powerful upper register, which makes the letter "S" whistle. Thus the receiver, coil, valve, and cone must be blended. If we secure uniform input to the grid of the power valve at all frequencies, it is necessary to deal with the coil, valve, and cone only. It must be left to the experimenter himself to choose his own quantities. There is such a variation in individual tastes that one man's meat is another man's poison.

[5] See *The Wireless World*, July 25th, 1928.

CLUB REPORTS AND TOPICS

Secretaries of Local Clubs are invited to send in for publication Club News of general interest.

Factors in Cone Construction

Cones for loud speakers provided a subject for keen discussion at the last meeting of the South Croydon and District Radio Society. The outcome of the debate was the discovery by many members that the construction of suitable cones presents more difficulties than is often realised. Much may depend upon the size of the cone having regard to the particular purpose to which it may be put. The evening was a profitable one in that it served to reveal many factors which must not be neglected if a cone speaker is to give anything approaching perfect reproduction.

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

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Wembley's Winter Programme.

The latest type of screened grid valve was described by a Marconi engineer at the meeting of the Wembley Wireless Society on Friday last, Nov. 23rd. The Society has prepared an interesting list of fixtures for the coming months. Particulars of membership may be obtained on application to the Hon. Secretary, Mr. H. Comben, 24, Park Lane, Wembley.

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"Inveterate Oscillator" Captured.

Mr. O. U. Howler, described as an inveterate oscillator, whose ham-bandedness has been responsible for howls of annoyance in the neighbourhood, has been run to earth by the Wimbledon Radio Society. His misdemeanours will be exposed at a "Mock Trial by Jury," which the Society will hold early in the New Year.

In a fault-finding competition recently organised by the Society, Mr. E. A. Fielder was successful in tracing 14 out of 16 mistakes present in six circuits.

The Society has prepared a very interesting programme, and new members will be welcomed.

Hon. Secretary, Mr. P. G. West, 11, Montana Road, West Wimbledon, S.W.20.

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Fault-finding Step by Step.

The wireless set that won't work is a familiar phenomenon to most owners of receivers, and many find themselves at a loss to know how to go about tracing the fault. For all in trouble of this sort, the demonstration given by Mr. E. H. Laister at the last meeting of the North Middlesex Radio Society was extremely useful.

The lecturer had brought his own receiver, which was shown to be in working order, and he then asked for faults to be introduced into it in his absence. This was done, and he then proceeded to locate the faults systematically. Beginning with the output stage it was first found that the valves did not light. By a process of elimination and with the aid of a voltmeter this was found to be due to a faulty connection in the accumulator. Having rectified this, the lecturer discovered that no anode current was flowing. This was tracked down to a broken flex lead between the two H.T. batteries. The lecturer worked back in this way to the detector stage and then the H.F., exposing the various defects as discovered until finally the receiver was again in working order. It became obvious that in fault-finding a meter of some kind was almost indispensable.

Hon. Secretary, Mr. E. H. Laister, Endcliffe, 7a, Station Rd., Winchmore Hill, N.21.

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Mains Drive Problems.

At a meeting of the Kensington Radio Society on Nov. 8th, Mr. A. W. Knight read a paper on "Various Problems around Mains Drive Instruments," in which he gave some reasons for the "hum" so frequently experienced, and described a method of "stepping up."

Mr. Maurice Child will demonstrate a straightforward broadcast receiver at the Society's meeting on December 13th.

Hon. Secretary, Mr. G. T. Hoyes, 71a, Elsham Rd., W.14.

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A Vote for Professor Ohm.

Who is the best-known scientist, past or present, connected with radio? The vote of the Alma Radio Society (Battersea) goes to Professor Ohm. Members of this Society have come to the conclusion that they can solve most radio and electrical problems by the correct application of Ohm's Law. Anyone in the district having doubts upon this point, besides those who have not, is invited to join the Society and discuss the question at one of the meetings. These are held on Tuesdays and Thursdays from 7.30 to 9.30 p.m. at the Alma Institute, Southwark Park Road. Enquiries should be addressed to the Hon. Secretary, Mr. S. F. Harris (G5SH), 13a, Winstead Street, S.W.11.

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Valves, Yesterday and To-day.

Mr. Burgess, of The Mullard Wireless Service Co., Ltd., lectured on "Valve Progress" at the last meeting of the Ilford and District Radio Society. The lecturer covered a great deal of ground from the early days to the present time, when valves are to be had in a bewildering variety.

Hon. Secretary, Mr. C. E. Largen, 16, Clements Road, Ilford.

FORTHCOMING EVENTS.

WEDNESDAY, NOVEMBER 28th.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Lecture: "This Season's New Valve Developments," by Mr. F. E. Henderson, A.M.I.E.E.

Wigan and District Technical College Radio Society.—Lecture: "Valve Manufacture," by Mr. J. E. Clarke, of Messrs. Edison Swan Electric Co., Ltd.

Tottenham Wireless Society.—At 8 p.m. At 10, Bruce Grove, N.15. "The Latest Valves," a lecture-demonstration by the Mullard Valve Co.

THURSDAY, NOVEMBER 29th.

Leyton and Leytonstone Radio Society.—At 8 p.m. At Grove House, High Road, Leyton. Demonstration of Short-Wave Receiver and Wavemeter.

FRIDAY, NOVEMBER 30th.

South Manchester Radio Society.—At the Co-operative Hall, Wilmslow Road, Didsbury. Ten-Minute Papers and a demonstration.

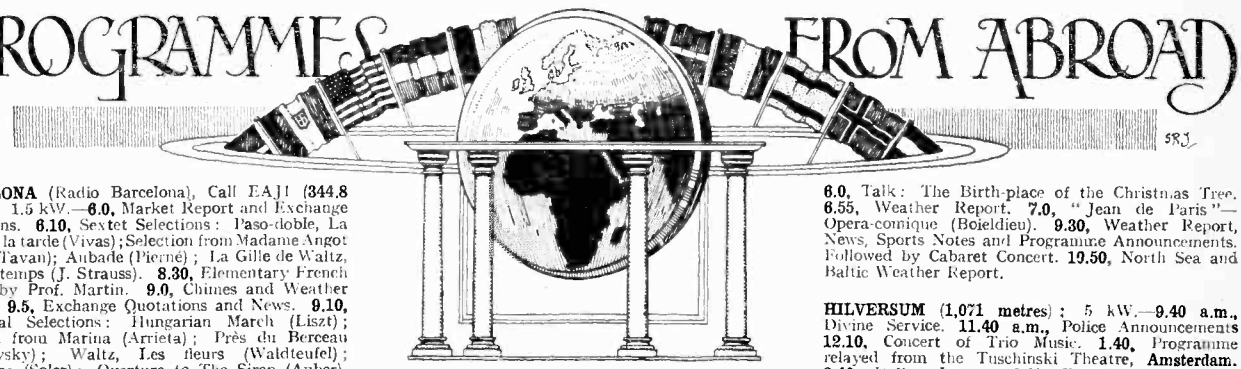
MONDAY, DECEMBER 3rd.

Newcastle-upon-Tyne Radio Society.—At 7.30 p.m. At 11, Saville Row. Open Night.

Croydon Wireless and Physical Society.—At 7.15 p.m. At 5, Altyre Road, East Croydon. Annual General Meeting, to be followed by a demonstration of Moving Coil Loud Speakers by Mr. A. Baker.

Hackney Radio and Physical Society.—At 8 p.m. At Electricity Show Rooms, Lower Clapton Road, E.5. Public Meeting.

PROGRAMMES FROM ABROAD



SATURDAY, DECEMBER 1st.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

BARCELONA (Radio Barcelona), Call EAJ1 (**344.8 metres**); 1.5 kW.—**6.0,** Market Report and Exchange Quotations. **6.10,** Sextet Selections: Paso-doble, La estocá de la tarde (Vivas); Selection from Madame Angot (Lecocq-Tavan); Aubade (Pierné); La Gille de Waltz, Joli printemps (J. Strauss). **8.30,** Elementary French Lesson, by Prof. Martin. **9.0,** Chimes and Weather Report. **9.5,** Exchange Quotations and News. **9.10,** Orchestral Selections: Hungarian March (Liszt); Selection from Marina (Arrieta); Près du Berceau (Moszkovsky); Waltz, Les fleurs (Waldteufel); Delicadeza (Soler); Overture to The Siren (Auber). **10.0,** Programme relayed from **Madrid,** EAJ7.

BERGEN (**370.4 metres**); 1.5 kW.—**5.30,** Programme for Children. **6.0,** Programme for Girls. **7.0,** Orchestral Concert. **7.50,** Topical Talk. **8.0,** Concertina Recital by Einar Bolstad and A. Wergeland. **8.30,** Mr. Schroder-Nielsen, Talk: A Hunting Expedition in Nigeria. **9.0,** Weather Report, News and Time Signal. **9.15,** Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) (**1,250 metres**); 40kW. —**3.0,** Prof. Lampe, Talk: From Modern Educational Periodicals. **3.30,** Programme relayed from **Hamburg.** **4.30,** Herr Winters, Talk: Ten Years of The League of German Officials. **5.0,** Talk between Industrial Workers, by Prof. Woldt. **5.30,** Elementary Spanish Lesson. **5.55,** Prof. Wagner, Talk: The Technical Application of Acoustics. **7.0,** Programme from **Voxhaus.**

BERLIN (Voxhaus) (**484 metres**); 4 kW.—**9.10 a.m.,** Market Prices. **9.15 a.m.,** Weather Report, News and Time Signal. **10.0 a.m.,** Programme of Gramophone Records. **10.30 a.m.,** Exchange Quotations. **11.55 a.m.,** Time Signal. **12.30,** Weather Report and News. **1.0,** Programme of Gramophone Records. **2.0,** Exchange Quotations. **2.10,** Agricultural Report and Time Signal. **3.0,** Illustrated Music Talk by Dr. James Simon. **3.30,** Orchestral Concert: Overture, Sonne (Craven); Cortège oriental (Heymann); Liebeserklärung (Bauer); Largo from Katzensteg (Becce); Serenata d'Amalfi (Becce); Mongolian Love Dance (Marsden); Intermezzo (d'Albert); Lyric and Dramatic Suite (d'Albert); Romance Op. 5 (Tchaikovsky); Andante from the Fifth Symphony (Tchaikovsky); Liebesfeier (Weingartner); Lied (Arnold); Tango, Mirage (Larento); A Wedding in Lilliput (Translateur); Serenata appassionata (Steiner); Eine kleine Nachtmusik (Mozart); followed by Advertising Notes. **5.25,** Wolfgang Schwarz, Talk: Problems of the Preservation of Peace. **5.55,** Prof. Wagner, Talk: Acoustics. **7.0,** Octet in F Major, Op. 166, for Two Violins, Viola, 'Cello, Double Bass, Clarionet, Horn and Bassoon (Schubert). **8.0,** Modern Musical Selections: Introductory Talk; Four Songs (Hebbel), (a) Abendgefühl, (b) Schlafe, schlafe, (c) Heimkehr, (d) So sollt' es immer sein (Jirák); Hähnchen und Hühnchen (Nemcova). **8.30,** Dr. Ludwig Berger, Talk: German Film Work in Hollywood; followed by Weather Report, News, Time Signal, Sports Notes and Dance Music. **11.0,** "Jenseits," Play (Hasenclever).

BERN (**411 metres**); 1.5 kW.—**4.0,** Orchestral Concert. **6.29,** Time Signal and Weather Report. **6.30,** Dr. Gustav Hans Graber, Talk: The Meaning of Dreams. **7.0,** "Requiem" (Berlioz), relayed from the **Basle** Cathedral. **9.15,** News and Weather Report. **9.30,** Wireless Variety Programme. **11.0** (approx.), Close Down.

BRESLAU (**322.6 metres**); 4 kW.—**6.20,** Shorthand Lesson. **6.50,** Georg Lichey, Talk: Peter the Great. **7.15,** Concert: Overture to Preciosa (Weber); Concerto in E Minor Op. 64 for Violin and Orchestra (Mendelssohn); Concerto grosso in D Minor for Strings (Vivaldi, arr. Franko); German Dances (Beethoven); Three Ballet Pieces (Rameau, arr. Mottl); Reitermarsch (Schubert-Liszt). **9.0,** News and Announcements. **9.30,** Dance Music from **Voxhaus.** **11.0** (approx.), Close Down.

BRÜNN (**441.2 metres**); 2.5 kW.—**3.30,** Programme for Children. **4.30,** Dr. Vetterl, Talk: The Essential Facts about Music for Listeners-in. **4.45,** German Transmission. **5.15,** Journalistic Review by Dr. Cestmír Jerábek. **6.0,** Yugo-Slavian Programme. **7.0,** Programme from **Prague.** **9.25,** Dance Music by Tzigane Orchestra, relayed from **Bratislava** (300 metres).

BRUSSELS (**508.5 metres**); 1.5 kW.—**5.0,** Programme of Dance Music. **6.0,** Elementary English Lesson. **6.25,** Intermediate English Lesson. **6.45,** Violin Recital. **7.0,** Gramophone Selections of Dance Music. **7.30,** "Radio-Chronique." **8.15,** Orchestral Concert. **9.0,** Topical Talk. **9.10,** Concert (continued). **10.10,** News and Esperanto Announcements. **10.20,** Orchestral Concert from the Palace Hotel. **11.0** (approx.), Close Down.

BUDAPEST (**556.6 metres**); 20 kW.—**3.0,** Legal Talk. **4.10,** Reading. **4.45,** Concert of Orchestral Selections. **5.50,** Talk: The Coronation Ceremonies of the Emperor of Japan. **6.30,** Vörösmarthy Commemoration Programme. **7.30,** "Die Fledermaus"—Operetta (Johann Strauss), relayed from **Munich** (535.7 metres). **9.20,** Zigeuner Concert from the Hotel Hungaria.

CRACOW (**566 metres**); 1.5 kW.—**6.55,** Time Signal and Agricultural Report. **7.5,** Review of Foreign Politics during the last Week, by Mr. J. Regula. **7.30,** Programme from **Warsaw.** **9.0,** Programme from **Warsaw.** **9.30,** Restaurant Concert. **10.30** (approx.), Close Down.

DUBLIN, Call 2RN (**319.1 metres**); 1.5 kW.—**1.30,** Weather Report and Programme of Gramophone Records. **7.20,** News. **7.30,** Poetry Recital by Chrissie Daly. **7.45,** Irish Lesson by Seamus O'Duirinne. **8.0,** "The Lilac Ribbon"—Play by Gertrude Quinn and Company. **8.30,** "Rigoletto"—Opera (Verdi), by Soloists and the Station Opera Chorus. **10.30,** News, Weather Report and Close Down.

FRANKFURT (**428.6 metres**); 4 kW.—**2.5,** Programme for Children. **2.55,** Talk for the Housewife, by Fini Piannes. **3.35,** Vocal and Orchestral Concert of Italian Opera Music: Overture to The Daughter of the Regiment (Donizetti); Song; Selection from Lucia di Lammermoor (Donizetti); Introduction and Chorus from The Oath (Mercadante); Overture to Sicilian Vespers (Verdi); Song; Dance of the Hours from La Gioconda (Ponchielli); Selection from Il Trovatore (Verdi); in the Intervals, Wireless Notes and other Announcements. **5.10,** Reading from The Two Planets (Lasswitz), by O. W. Studtmann. **5.30,** The Letter Box. **5.45,** Esperanto Lesson by Herr W. Wischhoff. **6.15,** Franz Diettrich reads from his own Works. **6.45,** Astronomy Talk by Prof. E. D. Sittig. **7.15,** "Gas"—Drama, Part I (Georg Kaiser), followed by Relay of the Frankfurt Six-Day Races and Dance Music from **Voxhaus.**

HAMBURG, Call HA (in Morse), (**394.7 metres**); 4 kW.—**9.15 a.m.,** News. **10.0 a.m.,** Programme of Gramophone Records. **11.10 a.m.,** Weather Report. **11.15 a.m.,** Exchange Quotations. **11.30 a.m.,** Concert relayed from **Hanover** (297 metres). In the Interval at 11.55 a.m., Time Signal. **12.10,** News. **1.40,** Exchange Quotations. **2.30,** Review of Books. **3.0,** Illustrated Music Talk by Dr. Wilh. Heinitz. **3.30,** Violin and Pianoforte Recital: Sonata in A Major for Violin and Pianoforte (Händel); Waltz in A Major (Brahms); Concerto in G Minor for Violin (Bruch); Ständchen (Schubert-Marteau); Andantino (Martini-Kreisler). **4.30,** Request Programme. **5.30,** Dr. S. Landshut, Talk: Work as Economic Factor. **6.0,** Talk: The Birth-place of the Christmas Tree. **6.55,** Weather Report. **7.0,** "Jean de Paris"—Opera-comique (Boieldieu). **9.30,** Weather Report, News, Sports Notes and Programme Announcements. Followed by Cabaret Concert. **10.50,** North Sea and Baltic Weather Report.

HILVERSUM (**1,071 metres**); 5 kW.—**9.40 a.m.,** Divine Service. **11.40 a.m.,** Police Announcements **12.10,** Concert of Trio Music. **1.40,** Programme relayed from the Tuschinski Theatre, **Amsterdam.** **3.40,** Italian Lesson. **4.40,** French Lesson. **5.30,** Concert: Overture to Marinarella (Fucik); Selection from the Works of Waldteufel (Kling); Dutch Fisher Girls—Interlude (Joan Fresco); Selection from The Desert Song (Romberg); Waltz, Wiener Praterleben (Translateur); March, Klingende Grüsse (Blankenburg). **6.30,** German Lesson. **7.40,** Programme arranged by the Workers' Radio Society. **11.15** (approx.), Close Down.

HUIZEN (**340.9 metres**); 4 kW.—Transmits on 1,852 metres from 3.40 p.m. **12.10,** Concert of Trio Music. **2.40,** Programme for Children. **5.10,** Gramophone Selections. **6.30,** Catholic Bulletin. **6.40,** English Lesson. **7.10,** Lesson in Dressmaking. **7.40,** Talk by Dr. Raag. **8.0,** Concert of Choral Music and Soprano Solos.

JUAN-LES-PINS (Radio L.L.) (**244 Metres**); 1.5 kW. —**1.0,** Orchestral Concert. **9.0,** News, Talk for Women by Mme. la Comtesse de Tremeuge, and Concert. **10.0,** Dance Music. **10.30** (approx.), Close Down.

KALUNDBORG (**1,153 metres**); 7 kW.—Programme also for **Copenhagen** (337 metres).—**6.30 a.m.,** Morning Gymnastics. **10.0 a.m.,** Weather Report. **11.15 a.m.,** Educational Talk. **2.0,** Concert of Instrumental Selections; in the Interval, Reading by Carl Schionning. **5.20,** Arnold Richard Nielsen, Talk: Jes Pedersen, the Danish Champion Wrestler. **5.50,** Weather Report. **6.0,** News and Exchange Quotations. **6.15,** Time Signal. **6.30,** Hartvig Frisch, Talk: Bernard Shaw. **7.0,** Chimes from the Town Hall. **7.2,** Reading from Selected Works of George Bernard Shaw. **7.30,** Concert of Old Dance Music: March, Hand in Hand (v. Blon); Mazurka (Suppé); Amalie Polka (Jensen); Den gamle Sekstur; Waltz, The Swimmer (Lanner); Dagmar Mazurka (Norup); Polka, Euphrosyne (Lumbye); Tyrolese Waltz and Hopsa; Kontrasejre; Waltz, North Sea Pictures (Joh. Strauss); Gallop, Northern Foster Brothers (Lumbye). **8.30,** News and Announcements. **8.45,** Concert of Light Music: The Dwarfs' Patrol (Noack); Intermezzo, Niniche (Ohlsen); Recitation (Vilh. Krag); Serenade (Gade); March, En avant (Gung'l); Recitation (Vilh. Krag); Waltz and Sabot Dance from Molboerne (Jespersen); Wireless Listeners' March (Hechmann). **9.45,** Dance Music by the Industri Restaurant Orchestra. **11.0,** Chimes from the Town Hall. **11.15** (approx.), Close Down.

KATTOWITZ (**422 metres**); 10 kW.—**2.45** Financial Report. **3.0,** Programme for Children. **3.55,** Announcements. **4.10,** Talk by Dr. V. Francic. **4.35,** Children's Letter Box. **5.0,** Programme from **Vilna.** **6.0,** Announcements and News. **6.30,** Talk. **6.56** Time Signal and Agricultural Report. **7.5,** Mr. K. Rutkowski, Talk: Impressions of a Journey to Greece. **7.30,** Concert, relayed from **Warsaw.** **9.0,** Weather Report and News. **9.30** Dance Music.

KAUNAS (**2,000 metres**); 7 kW.—**3.0,** Talk by Mr. Z. Kuznickis. **3.30,** Concert. **4.0,** Talk. **4.15,** Agricultural Talk, by Herr Strazdas. **4.45,** Announcements. **5.30,** News. **6.0,** Weather Report. **6.15** Aviation Notes. **6.45,** Popular Concert by Soloists from the National Opera. **7.45,** Herr J. Slapsinskas, Talk: A Strong Will. **8.15,** Concert of Light Music.

LAHTI (**1,522.8 metres**); 35 kW.—**6.10,** Accordion Selections by Ekman and Konno; in the Interval, "Neropatti," Play. **7.10,** Talk; followed by Orchestral Selections. **7.45,** News in Finnish and Swedish, and Close Down.

LANGENBERG (**468.8 metres**); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres) and **Münster** (250 metres).—**10.10 a.m.,** Talks: The Choice of Careers for Girls. **11.10 a.m.,** Gramophone Selections. **12.5,** Orchestral Concert. **1.30,**

Programmes from Abroad.—

Hints for the Housewife. **2.40,** Herr P. Brüls, Talk on Wireless Technique: Magnetic and Electric Induction. **3.5,** Talk: Healthy Youth—Girls in the Field of Sport. **3.30,** Talk for Women. **4.0,** Dr. E. Huber, Talk: Pictures of Ancient Babylon. **4.20,** English Lesson by Prof. F. Hase. **4.45,** Concert of Quartet Music: Cornet Quartet, March from The Magic Flute (Mozart); Double Quartet, (a) Nachtzauber (Storch), (b) Das Grafenkind (Hosse); Cornet Quartet, Two Minuets (Schubert); Double Quartet, (a) Slavonic Serenade (Jungst), (b) Indian Cradle Song (Bungart); Cornet and Vocal Quartet, Selection from Preciosa (Weber). **5.30,** Dr. Hans Zbinden, Talk: Intellectual Problems of America. **6.15,** Prof. Honigsheim, Talk: Educational Problems in Large Cities. **6.40,** Prof. Leyen, Talk: Fairy Tales in the Literature of the World. **7.0,** "Papa hat's erlaubt," Wireless Play, after von Moser and l'Arronge (Müller). **9.30** (approx.), News, Sports Notes, Business Announcements, Orchestral Selections and Dance Music. **12.0 Midnight** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—**1.30,** Concert of Gramophone Selections. **2.0,** Weather Report. **3.30,** Orchestral Concert. **4.45,** Wireless News and Talk. **5.20,** Weather Forecast, News and Labour Market Report. **5.30,** Programme from **Königswusterhausen. 6.0,** Prof. Lichtenberger, Talk: Nietzsche in France. **6.30,** Josef Greff, Talk: Psycho-analysis. **7.0,** Variety Programme by Marianne Rauhöglauer (Vocalist), Anna Eisele (Piano), Karl Münch (Violin), and Hans Reimann (Elocutionist). **9.0,** News, Sunday Programme Announcements and Sports Notes. **9.30,** Dance Music from **Voxhaus. 11.30** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 **(375 metres);** 3 kW.—**7.0,** Chimes, followed by Concert of Sextet Selections: Selections from El asombro de Damasco (Luna); Faust (Gounod); La balada de la luz (Vives); Interlude by Luis Medina. **8.0,** Dance Music from the Alkázar. **8.25,** News. **9.45,** Market Prices Report. **10.0,** Chimes, followed by Comic Opera Selection from "La del Soto del Parral" (Soutullo and Vert); in the Interval, News. **12.30 a.m.** (approx.) (Sunday), Close Down.

MILAN, Call 1MI **(549 metres);** 7 kW.—**7.15,** Talk, News and Time Signal. **7.31,** Variety Concert: Overture to Maritana (Wallace); Talk on Verdi with Pianoforte Illustrations; Baritone Solo, Nearing the utmost limit, from Mephistopheles (Boito); Pianoforte Solos, (a) Two Sonatas (Scarlatti), (b) Sœur Monique (Couperin); Selected Item; Violin Solos, (a) Turkish March from The Ruins of Athens (Beethoven), (b) Elegy (Rachmaninoff), (c) The Bee (Schubert); Reading; Tenor Solos, (a) Dream from Manon (Massenet), (b) Air from L'Amico Fritz (Mascagni); Pianoforte Solos, Three Fragments from the Manuscripts of Anna Maria Bach. Selected Item; Violin Solos, (a) Nocturne in E Minor (Chopin), (b) La Chasse (Cartier), (c) Old Dance (Dussek); Quintet Selections, (a) Selection from Madame Butterfly (Puccini), (b) Prelude and Minuet (Andreoli). **9.55,** News, followed by Tzigane Music from the Piaschetteria Toscana. **10.45** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Böden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres).—**4.0,** Concert of Light Music from **Göteborg. 5.0,** Programme for Children. **5.30,** Selection of Old-time Dance Music. **6.15,** Reading from the Works of Edgar Allan Poe. **6.45,** Pianoforte Recital, from the Works of Chopin, Nocturne in C Sharp Minor: Etude in A Flat Major; Berceuse in D Flat Major; Waltz in E Minor. **7.0,** Time Signal. **7.2,** Popular Concert: 'Cello Solos, (a) Stor och ringa (Norrman), (b) Jag ville vara tärar (Norrman); Harp Solo, A Fairy Tale (Godefroid); 'Cello Solos, (a) Cantabile (Cui), (b) La Cinquantaine (Gabriel-Marie), (c) Canzonetta (Pergament); Harp Solos, (a) Arabesque in E Major (Debussy), (b) Patrullen (Hasselmans); Jeg ser for mit öie (Sjögren); Locklät (Peterson-Berger); Fjällvandring (Peterson-Berger); 'Cello Solos (a) Visa (Norrman), (b) Minuet (Debussy), (c) Habanera (Ravel). **8.0,** Topical Talk. **8.15,** News and Weather Report. **8.45,** Dance Music. **11.0** (approx.), Close Down.

NAPLES, Call 1NA **(333.3 metres);** 1.5 kW.—**4.0,** Concert of Vocal and Instrumental Selections. **4.30,** Time Signal. **4.35,** Foreign Report by M. R. Lotto. **7.30,** Wireless Talk. **7.40,** Announcements. **7.50,** News. **7.55,** Harbour Notes. **8.0,** Time Signal. **8.2,** Variety Programme: Orchestral Selections, (a) Triumphal March (Hartmann), (b) Serenade (Lange-Muller), (c) In the Blue Grotto (Gade), (d) Champagne Gallop (Lumbye); "The Secret": Comedy in One Act (Sabatino Lopez); Orchestral Selections, (a) Overture to The Love Potion (Auber), (b) Berceuse (Van Westerhout), (c) Barcarolle (Siede), (d) Gavotte célèbre (Gossec), (e) Selection from Oberon (Weber); "I Due Paperi": Comedy in One Act (Giuseppe Baffico). **9.0,** Review of the Week. **9.50,** News. **9.55,** Calendar and Programme Announcements. **10.0** Dance Music from the Trocadero. **10.30,** (approx.) Close Down.

OSLO (461.5 metres); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres) and **Rjukan** (448 metres).—**5.0,** Programme for Children. **6.0,** Children's Birthday Greetings. **6.15,** Weather Report and News. **6.30,** M. Sverre Iversen, Talk: The Question of the Organisation of Spas in Norway. **7.0,** Time Signal. **7.2,** Dance Music by the Station Orchestra. **8.30,** Weather Report and News. **8.45,** Topical Talk. **9.0,** Dance Music from the Grand Hotel. **11.0** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL **(2,650 metres);** 5 kW.—**5.0,** Pasdeloup Concert. **7.10,** Weather Report. **.30,** Le Journal Parlé.

PARIS (Petit Parisien) **(340.9 metres);** 0.5 kW.—**8.45,** Gramophone Selections, Talk, News and Announcements. **9.0,** Musical Selections: Overture to The Caliph of Bagdad (Boieldieu); Selection from A Voyage in China (Bazin). **9.25,** News and Symphony Concert: Forest Murmurs from Siegfried (Wagner); Finale from the First Symphony in D Major (Schubert). **10.0,** News and Concert: Scènes pittoresques (Massenet); Irish Melodies (Myddleton); Monôme d'étudiants (Casadesus).

PARIS (Radio-Paris), Call CFR **(1,750 metres);** 6 kW.—**6.45 a.m.,** Physical Culture Lesson, by Dr. Diffre. **7.30 a.m.,** Physical Culture Lesson (continued). **8.0 a.m.,** News. **10.45 a.m.,** News and Exchange Quotations. **12.30,** Concert of Columbia Gramophone Records; News in the Intervals. **2.0,** Exchange Quotations. **3.45,** Dance Music by the Joss Ghistery Symphonians; News in the Intervals. **7.0,** Agricultural Report. **7.45,** Talk arranged by the Union des Grandes Associations françaises, followed by Market Prices, Announcements and News. **8.0,** Concert arranged by "Le Matin," "Madame L'Archiduc" (Offenbach), News in the Intervals.

PITTSBURGH, Call KDKA **(63 and 27 metres);** 25 kW.—**11.30 p.m.,** Concert from the William Penn Hotel. **12.0 Midnight,** Sessions Clock Chimes and Address from the University of Pittsburgh. **12.15 a.m.** (Sunday), Home Radio Club. **12.30 a.m.,** Readings by Elbert R. Moses. **12.45 a.m.,** Dr. Julius Klein, Talk: A Week of the World's Business. **1.0 a.m.,** Selections by Godfrey Ludlow. **1.30 a.m.,** Songs. **1.45 a.m.,** Instrumental Selections. **2.0 a.m.,** "The Philco Hour." **3.0 a.m.,** Longine Time Signal and Eddie Kern and his Egyptian Serenaders. **3.30 a.m.,** Weather Reports. **3.35 a.m.,** Selections by Don Bestor's Orchestra from the William Penn Hotel. **4.0 a.m.,** Special Arctic and Antarctic Broadcast.

POSEN (344.8 metres); 1.5 kW.—**6.50,** Literary Talk and Reading. **7.20,** Jugoslavian Evening: Talk and Vocal Selections. **9.0,** Time Signal and Miscellaneous Items. **9.20,** News and Weather Report. **9.40,** Dance Music from the Carlton Restaurant. **11.0,** Concert arranged by La Maison Philipps. **1.0 a.m.** (approx.) (Sunday), Close Down.

PRAGUE (348.9 metres); 5 kW.—**6.0,** Programme from **Brünn. 7.0,** "Boccaccio": Operetta (Suppé). **9.0,** Time Signal and News. **9.25,** Tzigane Music relayed from **Bratislava** (300 metres).

ROME, Call 1RO **(447.8 metres);** 3 kW.—**7.10,** Sports Notes, News, Exchange Quotations and Weather Report. **7.29.**—Time Signal and Topical Talk. **7.30,** Report of the International Labour Office, Geneva. **7.45,** "Cendrillon"—Opera (Massenet). In the Interval—Review of Art and Literature and Talk for Women. **9.50,** News and Close Down.

SCHENECTADY, Call 2XAD and 2XAF **(21.96 and 31.4 metres);** 30 kW.—**12.0 Midnight,** Statler's Pennsylvanians, from **New York. 12.30 a.m.,** (Sunday).

Saturday, December 1st.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

Concert from the Hotel Sagamore, **Rochester. 1.0 a.m.,** Concert from the Hotel Onondaga, **Syracuse. 1.30 to 3.0 a.m.,** New York Relay. **1.30 a.m.,** "The Park Bench." **2.0 a.m.,** Programme by the Adler Quartet with Contralto Solos by Sonia Essin. **2.30, a.m.** Selections by Male Quartet. **3.0 a.m.,** Lucky Strike Programme. **4.0 a.m.,** Time Signal. **4.2 a.m.,** Dance Music from the Hotel Ten Eyck, **Albany.**

STAMBOUL (1,200 metres); 5 kW.—**3.30,** Concert. **4.30,** Market Prices Report. **5.15,** Concert of Turkish Music. **7.30** Weather Report and Time Signal. **7.40,** Vocal and Orchestral Concert: Orchestral Selections, (a) Overture to Don Juan (Mozart), (b) Hungarian Dance No. 4 (Brahms); Songs; Orchestral Selections, (a) Nocturne (Borodine), (b) Wedding March (Mendelssohn). **9.0,** News and Announcements. **9.10** (approx.), Close Down.

STUTTGART (379.7 metres); 4 kW.—**2.15,** Concert of Songs, Duets and Orchestral Selections. **3.45,** Programme from **Frankfurt. 5.0,** Time Signal and Weather Report. **5.15,** Dr. Carol Ring, Talk in English—English Sport and Sports. **5.45,** Talk by Prof. Kutscher. **6.15,** Hans Brandenburg, Talk: Our Christmas Manger. **6.45,** Time Signal and Sports Notes. **7.15,** Chamber Music from the Works of Johannes Brahms: Sonata in E Minor for 'Cello and Pianoforte; Sonata in E Flat Major No. 2 Op. 120, for Clarionet and Pianoforte. Followed by Variety Concert: Orchestral Selections, (a) Prelude (Rachmaninoff), (b) Dance of the Witches (Leuschner); "The Haunted Castle"—Sketch (Carl Struve); Orchestral Selection, Overture to Die Fledermaus (Strauss); Delilah (Bernard); The Sparrow in Winter (Benatzky); Die ungleichen Eheleut'; Man schenkt sich Rosen (Egen); Oh, weisst du, schöne Frau (Grün); Orchestral Selection, Chatterbox Rag (Botsford); Der schönste Duft (Volker); Kurios (Seidl); All for Love (Benatzky); The Love Oracle (Arnold); Katinka from Prague (Ligi); Kling-Klang (Raymond); Orchestral Selection, Waltz, Roses of the South (Strauss); In the Night from 12 to 1 (Benatzky); Love Idyll (Sammestorf); My Sweet Monkey (Cleave); Orchestral Selection, March to Bed, Sweetheart! (Kollo); followed by News and Dance Music from **Voxhaus.**

TOULOUSE (Radiophonie du Midi), **(389.6 metres);** 8 kW.—**12.45,** Concert. **8.0,** Exchange Quotations and News. **8.30,** Concert: Military March from the Algerian Suite (Saint-Saëns); Overture to The Thieving Magpie (Rossini); Second Waltz (Godard). **8.50,** Selection from Carmen (Bizet). **9.0,** Time Signal. **10.5,** Dance Music. **10.15,** North African News. **10.30** (approx.), Close Down.

VIENNA (517.2 metres); 15 kW.—**3.0,** Programme for Children. **4.30,** Recital of Fairy Tales. **5.0,** Rosa Meyreder in Selections from her own Works. **5.30,** Reading of Modern Lyrics and Prose by Ilse Kammitzer. **6.0,** "The Canary Bird," by Hans Kretzer. **6.30,** Chamber Music: Trio in D Minor, Op. 63 (Schumann), followed by Song Recital from the Works of H. Wolf, by Dr. Hans Schwarz-Glossy. **7.15,** Julius Karsten, Talk: The Life and Works of Ottaker Kernstock (died November 5th, 1928), with Illustrations. **7.50,** "The Pannicke Case"—Play (Auditor), followed by Orchestral Concert: March, Wien bleibt Wien (Schrammel); Overture to Die Fledermaus (Joh. Strauss); Waltz from La belle polesane (Lehár); Songs and Serenade (Bert Silving); Song, Das war in einer Walzernacht (Ganglberger); Light Drinking Song (Max Rhode); Song, Drob'n am Hamean (Strecker); Song, Blondes Mädel vom Rhein (Strecker); Wiener Halloh-Marsch (Reckteniwald), followed by Photo-telegraphy Transmission.

VILNA (435 metres); 1.5 kW.—**3.30,** Announcements. **3.45,** Talk for Men, by Mr. S. Czaplicki. **4.10,** Poetry Recital (Mr. Z. Kleszczynski). **4.35,** Talk from **Warsaw 5.0,** Divine Service from the Ostra Brama Chapel. **5.45,** Art Talk by Prof. Jules Klos. **6.10** News. **6.30,** Programme from **Warsaw.**

WARSAW (1,111 metres); 10 kW.—**4.10,** Talk. **4.35,** Talk by Prof. H. Moscicki. **5.0,** Programme relayed from **Vilna. 6.0,** Miscellaneous Items. **6.30,** "Radio-Chronique," by Prof. Stepowski. **6.56,** Time Signal. **7.0,** Agricultural Report. **7.5,** Mr. B. Winawer, Talk: The Latest Scientific and Technical Discoveries. **7.30,** Concert of Operetta Music. **9.0,** Aviation Notes, Weather Report, News, Police Announcements and Sports Notes. **9.30,** Dance Music from the Oaza Restaurant. **10.30** (approx.), Close Down.

ZÜRICH (588 metres); 1 kW.—**7.0,** "Requiem" for Tenor Solo, Choir and Orchestra (Berlioz), from Basle Münster. **9.0,** Weather Report and News. **9.10** (approx.), Close Down.

Programmes from Abroad.—

BARCELONA (Radio-Barcelona), Call EAJ1 (344.8 metres); 1.5 kW.—**11.0 a.m.**, Relay of Cathedral Chimes. **11.5 a.m.**, Weather Report from the Provincial Meteorological Service. **1.30**, Concert by the Iberia Trio with Gramophone Records at Intervals. **2.45 to 5.30**, No Transmission. **5.30**, Relay of an Opera from the Gran Teatro del Liceo. In the Interval, Local Market Prices. **8.0 to 8.20**, Talk, arranged by the Catalonian Institute of Agriculture at San Isidro. **8.30**, Orchestral Selections. **8.40**, Sports News. **9.0** (approx.), Close Down.

BASLE (1,010 metres); 1.5 kW.—Programme relayed from **Bern**. **7.0**, Advent Festival relayed from the Kreuzkirche, **Zürich**, First Performance of the Christmas Oratorio by Felix Pürstenger, Words by Emil A. Grob. **8.45**, Sports Notes, Late News Bulletin, and Weather Report. **9.15** (approx.), Close Down.

BERGEN (370.4 metres); 1.5 kW.—**9.30 a.m.**, Relay of Divine Service. **11.30 a.m.**, Weather Report and Forecast and General News Bulletin. **7.0**, Orchestral Concert. **7.20**, Concert. **7.50**, Talk on a Current Topic. **8.30**, Recitation by Doris Johannesen and Mrs. Jenny Jebsen; "Syndens Sold," by H. Meidell. **9.0**, Weather Report and Forecast, Late News Bulletin and Time Signal. **9.15**, Dance Music. **11.0** (approx.), Close Down.

BERLIN (Königswusterhausen) (1,250 metres); 40 kW.—**7.55 a.m.**, Garrison Church Chimes, relayed from Potsdam. **8.0 a.m.**, Concert and Address, relayed from **Voxhaus**, followed by Berlin Cathedral Chimes. **10.30 a.m.** (approx.), Concert, relayed from **Voxhaus**. **3.30**, Musical Programme, relayed from **Voxhaus**. **5.0 to 7.0**, Talks, arranged by the "Deutsche Welle," followed by relay of another German Programme. **9.15**, Late News Bulletin and Sports Notes. **9.30**, Light Musical Selections. **11.30** (approx.), Close Down.

BERLIN (Voxhaus) (484 metres); 4 kW.—**7.55 a.m.**, Chimes, relayed from the Potsdam Garrison Church. **8.0 a.m.**, Concert with Choral and Instrumental Items and Address in the Interval, followed by Berlin Cathedral Chimes. **10.30 a.m.** (approx.), Concert. **3.0**, Talk. **3.30**, Concert. **4.0**, Musical or Literary Programme. **6.0**, Talk. **7.0**, Concert. **9.15**, Weather Report and Forecast, Time Signal, Sports News and Late News Bulletin. **9.30**, Dance Music. **11.30** (approx.), Close Down.

BERN (411 metres); 1.5 kW.—**9.30 a.m. to 10.30 a.m.**, Religious Address. **12.0 Noon**, Time Signal and Weather Report and Forecast. **12.5**, Orchestral Concert. **6.15**, Violin Recital by Vasco Gaudini. **6.29**, Time Signal and Weather Report. **6.30**, Reading or Talk. **7.0**, Concert. **8.45**, Sports News, Late News Bulletin and Weather Report. **9.0**, Concert. **9.35** (approx.), Close Down.

BRESLAU (322.6 metres); 4 kW.—Programme relayed by **Gleiwitz** (329.7 metres).—**8.15 a.m.**, Chimes relayed from Christ Church. **10.0 a.m.** (approx.), Recital of Music and Address. **1.0**, Guessing Competition. **1.10**, Talk or Literary Programme. **1.35**, Talk for Chess Players. **2.0**, Stories for Children by Friedrich Reinicke. **2.30**, Agricultural Talk. **7.15**, "Im weissen Rössl." **9.0**, Late News Bulletin. **9.30**, Dance Music. **11.0** (approx.), Close Down.

BRUSSELS (508.5 metres); 1.5 kW.—**5.0**, Selections by the Orchestra at the Palace Hotel. **6.0**, Programme for Children. **6.30**, Concert by the Station Trio. **7.30**, "Le Journal Parlé de Radio-Belgique." **8.15**, Orchestral Concert with Soloists. **10.10**, News from the Evening Papers. **11.0** (approx.), Close Down.

BUDAPEST (556.6 metres); 20 kW.—**8.0 a.m.**, General News Bulletin and Beauty Hints. **9.0 a.m.**, Relay of Morning Service and Sermon. **11.30 a.m.** (approx.), Concert. **2.30**, Agricultural Talk. **3.15**, Concert. **6.30**, (approx.), Concert or Relay of an Opera. **9.45**, Concert of Light Music. **10.30** (approx.), close Down.

COLOGNE (283 metres); 4 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Langenberg** (468.8 metres), and **Münster** (250 metres).—**6.45 a.m.**, Boxing Lesson. **7.5 a.m.**, Esperanto Talk on the Weekly Programmes. **7.15 a.m.**, Lesson in Music by Olly Wirtz-Koort. **7.35 a.m.**, Lesson in Esperanto by Alfred Dormanns. **8.0 a.m.**, Church Chimes. **8.5 a.m.**, Evangelical Recital and Address. **12.0 Noon**, Musical Selections. **3.30**, Orchestral Music. **6.45**, Sports News. **7.0**, "The Cousin from Nowhere," an Operetta in Three Acts by Eduard Künneke, Text and Lyrics by Hermann Haller and Rideamus, Musical Director, Buschkötter, followed by Late News Bulletin, Sports News and Light Music. **11.0** (approx.), Close Down.

CORK, Call 6CK (400 metres); 1.5 kW.—**8.30**, Concert with Vocalists, Baritone Songs by Douglas Pemberton. **11.0**, National Anthem and Weather Report and Forecast. **11.15** (approx.), Close Down.

SUNDAY, DECEMBER 2nd.

All Times are reduced to Greenwich Mean Time and are p.m. except where otherwise stated.

CRACOW (566 metres); 1.5 kW.—**9.15 a.m. to 10.45 a.m.**, Relay of Cathedral Service. **10.56 a.m.**, Relay of the Fanfare from the Church of Notre Dame, followed by Time Signal and Weather Report. **11.10 a.m.**, Programme relayed from **Warsaw**. **1.0 and 1.20**, Two Talks for Farmers. **1.40**, "La Chronique Agricole," by Dr. St. Wasniewski. **2.15**, Concert relayed from **Warsaw**. **4.20**, Talk. **5.0**, Relay from **Warsaw**. **7.30**, Literary Programme: "Zagloba at the Wedding," Selections from the Novel, "By Fire and Sword," by H. Sienkiewicz, dramatised for wireless performance, and rendered by the Circle of Polish Wireless Amateurs. **9.0**, Programme relayed from **Warsaw**. **9.30**, Relay of Concert from a Restaurant. **10.30** (approx.), Close Down.

DUBLIN, Call 2RN (319.1 metres); 1.5 kW.—**8.30 to 11.15** (approx.), Programme relayed from **Cork**. **8.30**, Vocal and Instrumental Concert. Selections by the No. 2 Army Band. **11.0**, National Anthem and Weather Report. **11.15** (approx.), Close Down.

FRANKFURT (428.6 metres); 4 kW.—Programme relayed by **Cassel** (252.1 metres).—**7.30 a.m. to 8.30 a.m.** (approx.), Morning Recital and Address. **12.0 Noon**, Programme under the auspices of the Wiesbaden Agricultural Institute. **7.30**, Musical or Literary Programme. **9.30** (approx.), Dance Music. **11.0** (approx.), Close Down.

HAMBURG, Call HA (in Morse) (394.7 metres); 4 kW.—Programme relayed by **Bremen** (272.7 metres), **Hanover** (297 metres), and **Kiel** (254.2 metres).—**7.25 a.m.**, Time Signal. **7.30 a.m.**, Meteorological Report, General News and Announcements. **7.50 a.m.**, Talk on Topical Economic Problems. **8.15 a.m.**, Morning Recital of Instrumental and Vocal Music. **9.55 a.m.** (for **Kiel** only), Divine Service with Address relayed from the University Church, **Kiel**. **10.0 a.m.** (for **Hamburg** and **Hanover**), Talk: Rambles through the Hamburg Museums. **10.0 a.m.** (for **Bremen**), Talk: Famous Landmarks in the Bremen District. **1.0**, Funkheinzelmann's Programme for Children. **6.30**, Sports Talk arranged by the Hamburg School of Physical Culture. **6.40**, Sports News. **6.55**, Meteorological Report. **7.0**, "Das Jungste Gericht"—First Performance, by Dietrich Buxtehude, relayed from the Marienkirche, **Lübeck**. **9.30**, Weather Report and Late News and Announcements followed by Popular Concert. **10.50** (for **Hamburg**, **Bremen**, and **Kiel**), North Sea and Baltic Weather Report. **11.0** (approx.), Close Down.

HILVERSUM (1,071 metres); 5 kW.—**12.40**, Concert of Trio Music. **2.10**, Orchestral Concert relayed from the Amsterdam Concert Hall. **3.40**, Musical Programme. **7.40**, Weather Forecast, News and Announcements. **7.55**, Concert from the Works of Mozart by the Augmented Wireless Orchestra conducted by Nico Treep, including "The Impresario," arranged by Louis Schmidt. **10.40** (approx.), Close Down.

HUIZEN (340.9 metres); 4 kW.—Transmits from 3.40 on 1,852 metres.—**8.5 a.m. to 9.0 a.m.**, Relay of Morning Service and Address. **10.0 a.m.**, Sacred Service. **12.10**, Concert. **1.10**, Talk. **1.40**, Talk. **2.10**, Concert. **4.10**, Programme for Hospitals. **5.40**, Relay of Evening Service from **Amsterdam**. Sermon by the Minister, the Rev. P. Stegenge Azn. on the text from St. Luke VII.-19. Choral Renderings by the Christian Song Union. **7.40**, Orchestral Concert. **10.25**, Choral Epilogue conducted by Mr. Jos. H. Pickkers. **10.40** (approx.), Close Down.

KALUNDBORG (1,153 metres); 7 kW.—Programme also for **Copenhagen** (337 metres).—**9.0 a.m.**, Morning Service relayed from **Copenhagen**. **10.30 a.m. to 10.40 a.m.** (**Kalundborg** only), Weather Report and Forecast from the Meteorological Institute. **12.0 Noon to 12.25**, German Language Lesson arranged by "Radiolytteren." **5.50** (**Kalundborg** only), Bulletin and Weather Forecast from the Meteorological Institute. **6.0**, Press News and Announcements. **6.15**, Correct Time. **6.16** (approx.), Talk. **7.0**, Town Hall Chimes from **Copenhagen**. **7.5**, "Das Jungste Gericht" (Dietrich Buxtehude), the first Performance relayed from the Marienkirche at **Lübeck** through the **Hamburg** Station, followed by Dance Music relayed from the Palace Hotel, **Copenhagen**. In the Interval at **11.0**, Town Hall Chimes relayed from **Copenhagen**. **11.30** (approx.), Close Down.

KATTOWITZ (422 metres); 10 kW.—**9.15 a.m.**, Relay of Sacred Service. **10.56 a.m.**, Time Signal. **11.0 a.m.**, Weather Report and Forecast. **11.10 a.m.**, Musical Selections by the Station Quartet. **1.0**, Religious Talk. **1.20 and 1.40**, Talks for Farmers. **2.0**, Weather Report and Forecast. **2.15**, Concert relayed from the **Warsaw** Philharmonic. **5.0**, Instrumental Concert. **6.0**, Announcements. **6.20**, Humorous Selections by Professor St. Ligon. **6.56**, Time Signal. **7.0**, Talk. **7.30**, Orchestral Concert. **9.0**, Weather Report and Forecast, News from Press and Sports Notes. **9.30**, Concert of Light Music. **10.30** (approx.), Close Down.

KÖNIGSBERG (303 metres); 4 kW.—Programme relayed by **Danzig** (272.7 metres).—**8.0 a.m.**, Morning Service with Choral and Instrumental Items and Sermon. **10.0 a.m.** (**Königsberg** only), Meteorological Report. **11.55 a.m.**, Relay of the Time Signal from **Nauen**, followed by Meteorological Report. **5.0**, Scientific Talk by Doctor Willy Schultz, "Physiological Researches into the Mental Capacity of Bees—Bees and a Sense of Colour." **9.15**, Late News and Announcements and Sports Notes, followed by Silent Night for reception of Foreign Stations.

LAHTI (1,522.8 metres); 35 kW.—Programme also for **Helsingfors** (375 metres). **8.0 a.m.**, Relay of Morning Service. **9.50 a.m.**, Press News. **10.5 a.m.**, Concert. **10.50 a.m.**, Weather Report and Time Signal. **11.0 a.m.**, Relay of Morning Service in Swedish. **3.0**, Orchestral Concert, under the direction of Erkki Linko. **4.0**, Relay of the Festival of Advent Services from St. John's Church. **5.40**, Musical Programme. **6.0**, Talk. **6.40**, Concert by the Wireless Orchestra. **7.45**, Late News Bulletin given in Finnish and Swedish. **9.0** (approx.), Close Down.

LANGENBERG (468.8 metres); 20 kW.—Programme also for **Aix-la-Chapelle** (400 metres), **Cologne** (283 metres) and **Münster** (250 metres).—**6.45 a.m.**, Physical Instruction by Dr. Ludwig Bach. **7.5 a.m.**, Alfred Dormanns: Programme Review in Esperanto. **7.15 a.m.**, Lute and Guitar Lesson. **7.35 a.m. to 7.55 a.m.**, Esperanto Lesson. **8.0 a.m.**, Church Chimes. **8.5 a.m.**, Evangelical Festival of Music and Address. **10.55 a.m. to 11.35 a.m.**, Music Talk: Schubert and his Songs. **12.0 Noon**, Concert. **3.30**, Orchestral Concert. **6.45**, Sports News. **7.0**, Concert or Play, followed by Late News Bulletin, Sports News and Musical Selections. **11.0** (approx.), Close Down.

LEIPZIG (365.8 metres); 4 kW.—Programme relayed by **Dresden** (275.2 metres). **7.30 a.m.**, Organ Recital, relayed from the Church of St. Nicholas. **8.0 a.m.**, Vocal and Instrumental Recital. **2.0**, Musical Programme. **5.30**, Talk. **8.30**, Lawrence Sterne (Born in Southern Ireland, 1713; died in London, 1768): Readings from "Tristram Shandy," with Introductory Address by Dr. Felix Zimmermann, of Dresden. **9.0**, Sports Notes. **9.30**, Dance Music, relayed from **Berlin**. **11.30** (approx.), Close Down.

LYONS (Radio Lyon) (291 metres); 1.5 kW.—**7.45**, "Le Journal Parlé" and General News Bulletin. **8.0**, Instrumental Concert: Violin Solos by M. Camand, of the Lyons Conservatoire; and 'Cello Solos by M. Testanière; Incidental Music to Shakespeare's Hamlet (Ambroise Thomas). **9.0** (approx.), Close Down.

MADRID (Union Radio), Call EAJ7 (375 metres); 3 kW.—Programme, relayed by **Salamanca**, EAJ22 (405 metres).—**11.30 a.m.**, Programme by the Municipal Band, under the Direction of Señor Villa, relayed from El Retiro. **2.0**, Chimes and Time Signal. **2.5**, Light Music by the Wireless Orchestra and Selection by Luis Medina in the Interval. **3.30 to 7.0**, No Transmission. **7.0**, Chimes. **7.5**, Concert by the Station Sextet. **8.0**, Dance Music by the Palermo Orchestra at the Alkazar. **8.30 to 10.0**, No Transmission. **10.0**, Chimes and Time Signal. **10.5**, Concert by the Band of the Saboya Regiment, under the Direction of Don Tomas Romo. **12 Midnight**, Chimes, followed by Dance Music by the Palermo Orchestra, relayed from the Alkazar. **12.30** (approx.) (Monday), Close Down.

MILAN, 1MI (549 metres); 7 kW.—**9.0 a.m.**, Opening Signal and English Lesson. **9.30 a.m. to 10.0 a.m.**, Vocal and Instrumental Concert of Sacred Music. **11.30 a.m.**, Time Signal and Concert by the Milan Wireless Quartet. **12.30 to 3.0**, No Transmission. **3.0**, Opening Signal. **3.5**, Concert by the Station Quintet. **4.15**, Programme, relayed from the Fiaschetteria Toscana; Selections by the Tzigane Orchestra. **5.0 to 6.55**, No Transmission. **6.55**, Opening Signal and Topical News. **7.30**, Time Signal. **7.35**, "La Grazia," Opera by V. Michetti, preceded by Introductory Talk on the Opera. **10.30** (approx.), Close Down.

MOTALA (1,380 metres); 30 kW.—Programme also for **Stockholm** (454.5 metres), **Boden** (1,190 metres), **Göteborg** (416.5 metres), **Malmö** (260.9 metres), **Ostersund** (720 metres) and **Sundsvall** (545.6 metres).—**10.0 a.m.**, Relay of Divine Service from a **Stockholm** Church. **4.55**, Carillon from **Stockholm** Town Hall. **5.0**, "The Blue Bird," Play by Maeterlinck. **8.15**, Late News Bulletin and Meteorological Report. **10.30** (approx.), Close Down.

MUNICH (535.7 metres); 4 kW.—Programme relayed by **Augsburg** (566 metres), **Kaiserslautern** (277.8 metres) and **Nuremburg** (241.9 metres).—**10.15 a.m.** "Der Stehengebliebene Wachtposten," Musical Play by Franz Schubert, a new arrangement by Dr. Erns,

Programmes from Abroad.—

Leopold Stahl and Dr. Franz Hallasch, relayed from the Residenz Theatre, Munich. **12.5**, Time Signal, Weather Forecast and Programme Announcements. **2.0**, Musical or Literary Programme. **9.0** (approx.), Late News Bulletin. **10.30** (approx.), Close Down.

NAPLES, Call 1NA (**333.3 metres**); 1.5 kW.—**9.0 a.m.**, Sacred Recital of Music. **3.45**, Children's Corner. **4.0**, Variety Programme with Vocal Items. **4.30**, Time Signal. **7.30**, Current Topics. **7.50**, Transmission by the Harbour Authorities of Naples. **8.0**, Time Signal. **8.2**, Concert by the Station Orchestra, with Soloists: Signor Raft, Aulicino, Baritone Solo with Orchestral Accompaniment, Son Pereda, son ricco d'onore, from La forza del destino (Verdi). **9.0**, Sports Results. **9.50**, Calendar and Notes on to-morrow's Programmes. **10.0** (approx.), Close Down.

OSLO (**461.5 metres**); 1.5 kW.—Programme relayed by **Fredriksstad** (434.8 metres), **Hamar** (555.6 metres), **Notodden** (411 metres), **Porsgrund** (500 metres), **Rjukan** (448 metres).—**9.20 a.m.**, Carillon. **9.30 a.m.**, Service relayed from St. Saviour's Church. **6.15**, Weather Report and Forecast and Press News, followed by Literary or Musical Programme. **8.30**, Weather Report and News from the Press. **8.45**, Talk by a well-known journalist on a Topical Subject. **9.0** (approx.), Relay of Dance Music from the Hotel Bristol. **11.30** (approx.), Close Down.

PARIS (Ecole Superieure). Call FPTT (**458 metres**); 0.5 kW.—Programme relayed at Intervals by the following stations: **Bordeaux PTT** (275 metres), **Eiffel Tower** (2,650 metres), **Grenoble** (416 metres), **Lille** (264 metres), **Limoges** (285 metres), **Lyons PTT** (480 metres), **Marseilles** (303 metres), **Rennes** (280 metres), **Toulouse PTT** (260 metres).—**8.0 a.m.**, General News Bulletin and Time Signal. **9.25 a.m.**, International Time Signal and Weather Report and Forecast. **12.0 Noon**, Concert. **1.0**, Industrial Notes. **1.30**, Orchestral Concert. **4.0**, Pasdeloup Concert of Symphony Music. **6.30**, "Le Radio Journal de France." **8.0**, Talk: Compulsory Insurance against Tuberculosis by Dr. Cavaillon. **8.30**, Concert, followed by Late News Bulletin, Time Signal and Weather Report. **10.30** (approx.), Dance Music relayed from the Coliseum de Paris. **12.0 Midnight** (approx.), Close Down.

PARIS (Eiffel Tower), Call FL (**2,650 metres**); 5 kW.—**7.56 a.m.**, Time Signal on 32.5 metres. **9.26 a.m.**, Time Signal on 2,650 metres.—**5.0**, Relay of Pasdeloup Concert. **7.10 to 7.20**, Weather Report and Forecast. **7.30**, "Le Journal Parlé par T.S.F.," with Talks by Dr. Pierre Vachet and Detective Ashelbé. M. René Casalis: Talk on the Day's Sport, with News from the paper "Paris Sport." **7.56**, Time Signal on 32.5 metres. **8.0 to 9.0**, Vocal and Instrumental Concert. Orchestral Selection: Clairière enchantée (Ed. Mignan) **10.26**, Time Signal on 2,650 metres. **11.15** (approx.), Close Down.

PARIS (Petit Parisien) (**420.9 metres**); 0.5 kW.—**8.45**, Gramophone Concert. **8.50**, Talk. **8.55**, News from the Press. **9.0**, Vocal and Instrumental Programme by Artistes from the Paris Opera and the Opéra-Comique. Selections from Cavalleria Rusticana by Mascagni. **9.25**, General News Bulletin. **9.30**, The Half Hour of Symphony Music conducted by Professor Estyle of the Paris Conservatoire. **10.0**, Late News Bulletin. **10.15**, Concert of Orchestral Music. **11.0**, (approx.), Close Down.

PARIS (Radio LL) (**370 and 60 metres**); 1 kW.—**12.30**, Radio Liberté Programme, General News Bulletin, followed by Instrumental Concert by the Charles Seringes Trio. **1.0**, Carillon de Fontenay. **3.0**, Popular Dance Music. **9.0**, Vocal and Instrumental Concert organised by "Le Journal des Debats." Quartet for Violin, 'Cello, Viola and Pianoforte (G. Fauré). **10.0**, Carillon de Fontenay. **10.15** (approx.), Close Down.

PARIS (Radio Paris), Call CFR (**1,750 metres**); 6 kW.—**8.0 a.m.**, General News Bulletin and Press Review. **8.30 a.m.**, Daily Physical Instruction, conducted by Dr. Difire. **12.0 Noon**, Religious address and Recital of Sacred Music arranged by "La Vie Catholique." Father de Tonquidec: "Ce qu'aurait été le monde sans Jésus-Christ: la pitié de Dieu sur le monde." **12.30**, News from the Press. **12.45**, Concert of Light Music by the Albert Locatelli Orchestra, with selection by Bilboquet in the Interval. **4.30**, Gramophone Concert arranged by "L'Industrie Musicale." In the Interval: News from the Press. **7.0**, Agricultural Talk and News from the Press. **7.45**, The Radio-Paris Circus. **8.15**, Music Hall Concert; in the Intervals: News from the Evening Press and Late News Bulletin. **10.30** (approx.), Close Down.

PITTSBURGH, Call KDKA (**63 and 27 metres**): 25 kW.—**4.0**, Sessions Clock Chimes, followed by Divine Service. **6.30**, Programme arranged by the Whitehouse Coffee Company, relayed from **New York**. **7.0**, "Roxy's Stroll," Programme from WJZ, **New York**. **9.0**, Organ Recital by Dr. Charles Heinroth,

Sunday, December 2nd.

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Director of Music at the Carnegie Institute. **9.45**, Evening Service relayed from the Shadyside Presbyterian Church and Sermon by the Pastor, the Rev. Hugh Thomson Kerr. **11.0**, Music by Don Bestor's Orchestra at the William Penn Hotel, **Pittsburgh**. **11.30**, Programme of Music by the Whittall Anglo-Persians. **12.0 Midnight**, arranged Session Clock Chimes, followed by Service from the Calvary Episcopal Church, **Pittsburgh**. Sermon by the Pastor, Dr. E. J. Van Etten. **10.0 a.m.** (Monday), National Broadcasting Company's Programme of Music from **New York**. **1.15 a.m.**, Collier's Radio Hour from **New York**. **2.15 a.m.**, The Utica Jubilee Singers from WJZ, **New York**. **2.45 a.m.**, El Tango Romantico relayed from **New York**. **3.15 a.m.**, Longine Time. **3.30 a.m.** (approx.), Close Down.

POSEN (**344.8 metres**); 1.5 kW.—**9.15 a.m. to 10.45 a.m.**, Relay of Cathedral Service. **11.0 a.m.**, Time Signal. **11.5 a.m. and 11.30 a.m.**, Two Agricultural Talks. **2.15**, Symphony Concert relayed from **Warsaw**. **4.50**, Talk. **6.20**, Talk relayed from **Warsaw**. **6.45**, Talk. **7.30**, Recital of Music. **8.0**, Concert by the Band of the Fifty-Eighth Regiment, under the direction of Captain Chmielewicz. **9.0**, Time Signal. **9.5**, Fifteen Minutes Variety. **9.20**, Weather Report and Sports News. **10.0**, Light Music. **11.0** (approx.), Close Down.

PRAGUE (**348.9 metres**); 5 kW.—**8.0 a.m.**, Recital of Sacred Music. **10.0 a.m.** (approx.), Concert. **12.5**, Talk on Industrial Topics. **12.20**, Social Notes. **3.30**, Orchestral Concert. **4.30**, Transmission for Workers. **5.0**, Programme for German Listeners. **5.30**, Sports News. **6.0**, Concert or Play. **9.0**, Time Signal and Late News Bulletin. **9.20**, Dance Music. **10.15** (approx.), Close Down.

RABAT, Call PTT (**416 metres**): 2 kW.—**12.30 to 1.30**, Concert by the Orchestra Radio-Maroc, PTT. **4.0 to 5.0**, Programme of Military Music. **8.15**, "Le Journal Parlé" in Arabic. **8.20**, News and Announcements. **8.30**, Concert of Instrumental and Vocal Music by Soloists and the Wireless Orchestra. **10.30**, Programme of Dance Music from the "Chaumière de Rabat." **11.0** (approx.), Close Down.

RIGA (**526.3 metres**); 4 kW.—**8.0 a.m.**, Divine Service in German. **9.15 a.m.**, Divine Service in Latvian relayed from the Mara Church. **12.0 Noon**, Programme of Story, Music and Song for Children. **3.0**, Afternoon Concert of Orchestral Music conducted by Arved Parups. **4.0**, Talks. **6.0**, Evening Concert with Soloists. **8.0**, Meteorological Report and Late News Bulletin. **8.30**, Programme of Light Music from the Café de l'Opéra. **10.0** (approx.), Close Down.

ROME, Call 1RO (**447.8 metres**); 3 kW.—**8.30 a.m.**, Opening Signal followed by German Lesson. **9.0 a.m.**, Sacred Recital of Vocal and Instrumental Music. **9.45, a.m. to 12.0 Noon**, No Transmission. **12.0 Noon**, Opening Signal. **12.5 to 1.0**, Concert by the Wireless Trio. **1.0 to 4.0**, No Transmission. **4.0**, Opening Signal. **4.5 to 5.30**, Variety Programme. **5.30 to 6.40**, No Transmission. **6.40**, Opening Signal, followed by News Bulletin. **7.10**, Agricultural Talk. **7.15**, Sports Results and News from the Stefani Agency. **7.29**, Time Signal. **7.31**, Talk. **7.45**, Concert by the Grand Symphony Orchestra; Symphony by Vincent d'Indy on a French Mountain theme for Pianoforte and Orchestra, Pianist: Rina Rossi. **9.50**, Late News Bulletin. **10.0** (approx.), Close Down.

SCHENECTADY, Call 2XAD and 2XAF (**21.96 and 31.4 metres**); 30 kW.—**6.30 to 7.0**, Programme arranged by the United Radio Corporation at **New York**. **8.30**, Organ Recital relayed from the Union College Memorial Chapel at **Schenectady**. Organist: Elmer Tidmarsh. **9.0**, Address to Men by Doctor S. Parkes Cadman, relayed from **New York**. **10.30**, Violin Solos by Arcadie Birkenholtz, relayed from **New York**. **11.0**, Stetson Parade Programme relayed from **Boston, Mass.** **11.30**, Programme from **New York**. **12.0 Midnight**, The Old Company's Programme, with Baritone Songs by Reinald Werrenrath, relayed from **New York**. **12.30 a.m.** (Monday), Programme relayed from the Capitol Theatre, **New York**. **2.0 a.m.**, Talk on "Our Government," by David Lawrence, relayed from **Washington, D.C.** **2.15 a.m.**, Atwater Kent Hour from **New York**. **3.15 a.m.**, Correct Time. **3.17 a.m.**, Experimental Television Signals. **3.30 a.m.** (approx.), Close Down.

SEVILLE (Union Radio), Call EAJ5 (**434.8 metres**); 1 kW.—**2.0 to 3.0**, Concert of Dance Music by the Station Orchestra and Gramophone Selections in the Intervals. **9.30**, Orchestral Concert of the Works of Spanish Composers. **11.0**, Programme of Flamenco Music by the Station Orchestra. **11.30** (approx.), Close Down.

STAMBOUL (**1,200 metres**); 5 kW.—**3.30**, Musical Programme. **4.30**, Exchange Quotations and Cereal Market Prices. **5.15**, Programme of Turkish Music. **7.30**, Weather Report and Forecast followed by Time Signal. **7.40**, Talk on the History of Music. **7.55**, Concert of Orchestral Music. **9.0**, Late News and Announcements. **9.30** (approx.), Close Down.

STUTTGART (**379.7 metres**); 4 kW.—Programme relayed by **Freiburg** (577 metres).—**10.15 a.m.** (approx.), Morning Recital of Sacred Music. **11.0 a.m.** (approx.), Concert of Orchestral Music, followed by Gramophone Selections. **1.0**, Programme for Children by Funkheinzelmann. **6.45**, Time Signal and Sports Notes. **7.15**, (approx.), Musical or Dramatic Programme, followed by Late News Bulletin and Sports News. **10.0** (approx.), Close Down.

TALLINN (**408 metres**); 2.2 kW.—**8.0 a.m.** (approx.), Relay of Divine Service. **1.30** (approx.), Musical Selections by the Station Orchestra. **6.0**, Programme of Orchestral Music. **9.0** (approx.), Close Down.

TOULOUSE (Radiophonie du Midi) (**389.6 metres**); 8 kW.—**12.30**, Meteorological Report and Local Market Prices. **12.45**, Orchestral Concert. **1.0**, Time Signal. **1.45**, News from "Le Télégramme," "L'Express" and "Le Midi Socialiste." **8.0**, Stock Exchange Quotations from Paris. **8.15**, News from the Press. **8.30**, Orchestral Concert. **9.0**, Time Signal. **9.5**, Concert, arranged by "L'Association des Commerçants Radio-Electriciens du Midi"; Selections from Faust, by Gounod. **10.15**, "Le journal sans papier," with North African News and Late News Bulletin. **10.30** (approx.), Close Down.

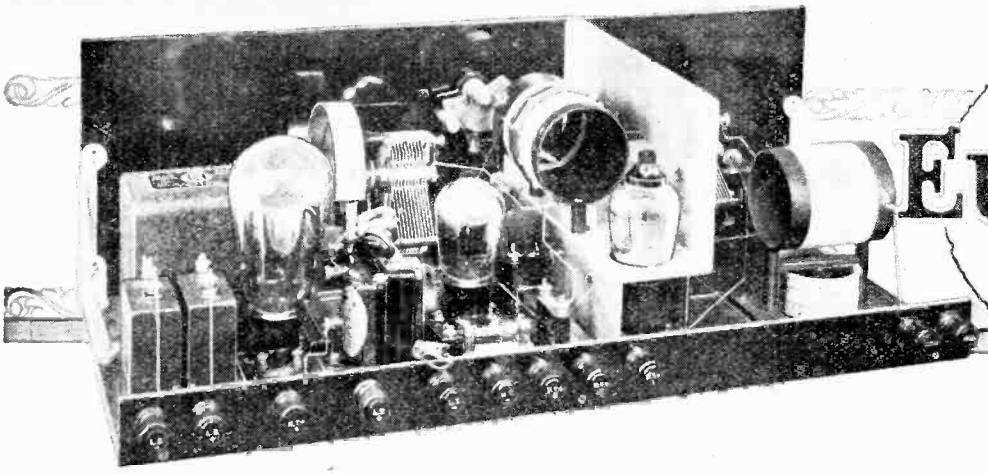
VIENNA (**517.2 metres**); 15 kW.—Programme relayed by **Graz** (357.1 metres), **Innsbruck** (294.1 metres), **Klagenfurt** (272.7 metres) and **Linz** (254.2 metres).—**9.20 a.m.**, Morning Recital. **10.0 a.m.**, Concert by the Vienna Symphony Orchestra. **2.30**, Experimental Picture Transmission. **3.0**, Concert of Orchestral Music. **7.10**, "Graf Toni," Operetta in Three Acts, by Rudolf Oesterreicher, Music by Edmund Eysler, under the Direction of Victor Flemming and Robert Kurmann; followed by Light Music and Experimental Transmission of Pictures. **10.15** (approx.), Close Down.

VILNA (**435 metres**); 1.5 kW.—**9.10 a.m. to 10.45 a.m.**, Relay of Morning Cathedral Service. **10.56 a.m.**, Time Signal. **11.0 a.m.**, General News Bulletin, relayed from **Warsaw**. **1.0 to 6.0**, Programme relayed from **Warsaw**. **1.0 to 2.0**, Three Talks for Farmers. **2.0**, Weather Report and Forecast. **2.15**, Orchestral Concert. **4.20**, Talk. **5.0**, Concert. **6.0**, Talk in Lithuanian. **6.20 to 10.30**, Programme relayed from **Warsaw**. **6.20**, Talk. **6.45**, General News Bulletin and Time Signal. **7.0**, Talk. **7.30**, Evening Concert from the Works of Rossini, rendered by the Wireless Orchestra, under the Direction of J. Oziminski, with the Collaboration of Madame I. Zapolska (Vocalist) and Prof. Urstein (Pianist). **9.0**, Aviation Route Report and Weather Forecast. **9.5**, News Bulletin from the Polish Telegraphic Agency. **9.20**, Sports News and Police Bulletin. **9.30**, Dance Music, relayed from the "Oaza" Restaurant, **Warsaw**. **10.30** (approx.), Close Down.

WARSAW (**1,111 metres**); 10 kW.—**9.15 a.m. to 10.45 a.m.**, Relay of Divine Service. **10.56 a.m.**, Time Signal. **11.0 a.m.**, Aviation Bulletin and Meteorological Report. **11.10 a.m.**, Symphony Concert, arranged by the Educational Section of the Magistracy of Warsaw and the Symphony Concerts Directorate: Introduction and the Death of Iseult, from Tristan and Iseult (Wagner), rendered by the Orchestra of the Warsaw Philharmonic, conducted by J. Oziminski. **1.0 to 2.0**, Agricultural Talks. **2.0**, Meteorological Report and Forecast. **2.15**, Concert of Symphony Music from the "Philharmonie de Varsovie." **4.45**, Talk on Aviation, by J. Osinski. **5.0**, Popular Concert. **6.20**, Talk. **7.30**, Concert. **9.0**, Aviation Notes and Meteorological Report and Forecast. **9.5**, Late News and Announcements. **9.20**, Police and Sports Notes. **9.30**, Programme of Dance Music from the "Oaza" Restaurant: Conductor, W. Roszkowski. **10.30** (approx.), Close Down.

ZAGREB (**309.2 metres**); 0.7 kW.—**10.0 a.m.**, Concert of Orchestral Music. **4.0**, Programme of Dance Music. **6.45**, Radio Talk. **7.0**, Opera, relayed from the Zagreb National Theatre; in the Intervals: Late News Bulletin and Sports News. **10.0** (approx.), Close Down.

ZÜRICH (**588 metres**); 1 kW.—**10.0 a.m.**, Concert by the Orchestra at the Capitol Theatre. **11.0 a.m.**, Weather Report and Forecast. **11.30 a.m.**, Concert by the Station Orchestra. **3.0**, Concert relayed from the Carlton Elite Hotel. **6.30**, Time Signal and Weather Report. **6.32**, Religious Address. **7.0**, Programme relayed from the Kreuzkirche, Zürich: Advent Festival; First Performance of the Christmas Oratorio, by Felix Phrstinger, conducted by the Composer; Text arranged by Emil A. Grob. **9.0**, Weather Report and News from the "Neue Züricher Zeitung." **9.30** (approx.). Close Down.



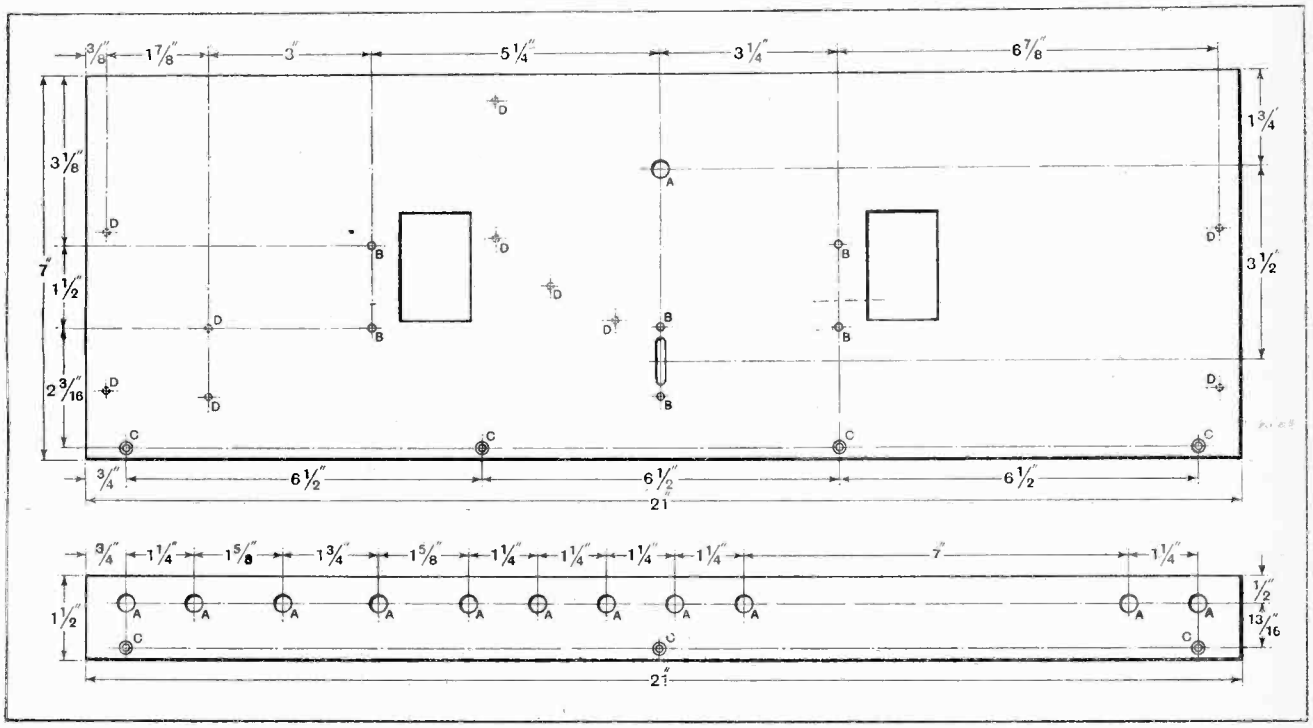
The EUROPA III

By
F. H. HAYNES.

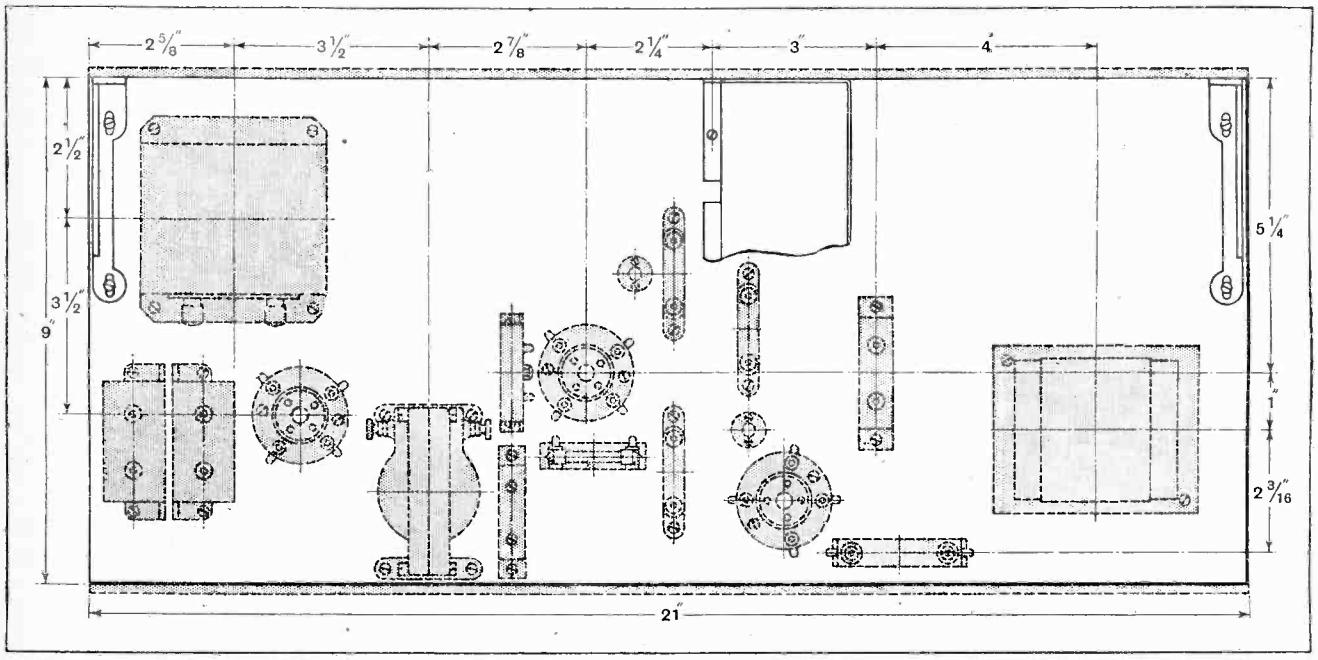
(*Concluded from page 697 of last week's issue.*)

Constructional and Operation Notes.

THE practical working drawings give all constructional details, though a few additional hints, arising out of the actual building of this set, may be helpful. The front panel of $\frac{3}{16}$in. highly polished bakelised board is supplied cut exactly to size. The apertures for the condensers are made by drilling and joining up rows of small holes. On the back of the panel filing may be necessary around the top and bottom edges to give clearance for the condenser scales. Take great care not to mark the panel, as a scratch once made cannot be removed. The irregularities around the condenser mountings will be hidden by the cover plates. Very slightly "dish" the cover plates before tightening up the fixing screws so that they may bed hard up against the face of the panel. It should be noted that the condenser brackets are fitted with insulating bushes in order that the front plates shall not be "live." The baseboard is of $\frac{3}{8}$in. five-ply wood, and its ends may be finished by filing. After fine glass-papering all over, the baseboard should be shellac varnished on both sides. Four screws, together with the end brackets, secure panel and baseboard. Actually, in the set shown, the brackets, screen and one of the switches were secured by screws passing from the back

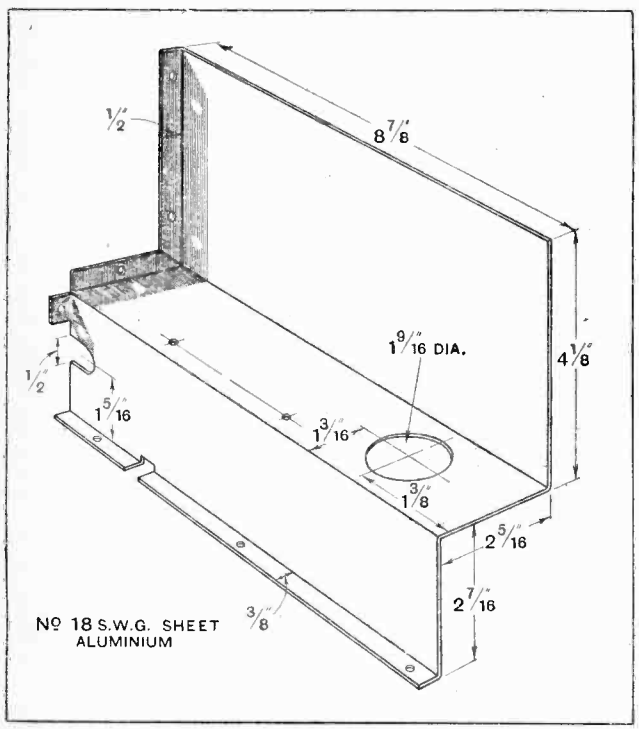


Details for drilling the front panel and terminal strip. Having located the front plates of the condensers, these are used as templates for the fixing holes and apertures. A, 5/16in.; B, 5/32in.; C, 1/8in., and countersunk for No. 4 wood screws. D, to accommodate 6 B.A. screws.

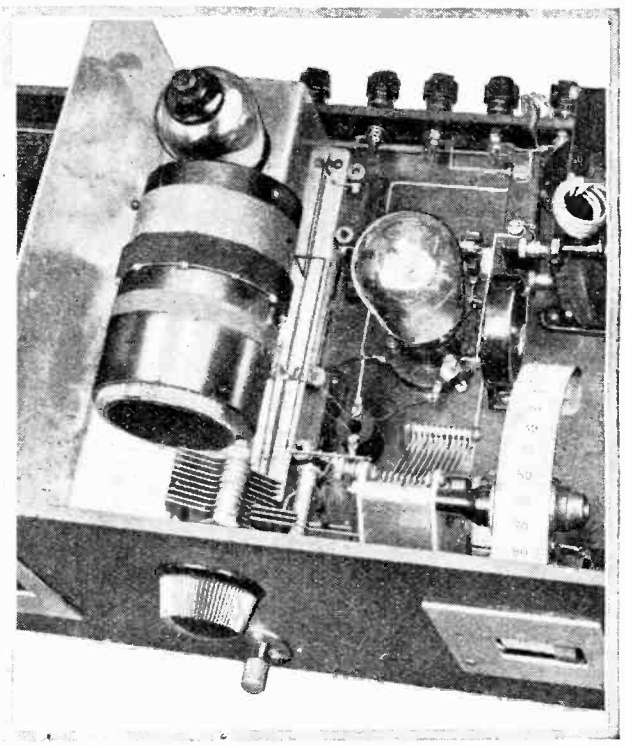


Dimensions for locating the components on the baseboard.

of the panel into blind holes. The beginner may prefer to drill the holes right through and use screws and nuts. Condensers and switches are, of course, fitted to the panel before it is mounted, taking great care that the switches move freely and make good contact. Beneath the screen is the valve-holder, anti-H.F. feed-back resistance and condenser, and the filament resistance. These must be wired up early in the construction. Grid bias is provided for the H.F. valve by its filament resistance, which is space wound with 55ins. of No. 36 S.W.G. Eureka wire or other winding to a resistance of 24 ohms. The positive filament lead passes in a slot



Dimensional drawing of screen arranged to accommodate a screened-grid H.F. valve. The valve must, of course, be held in a rigid valve holder.

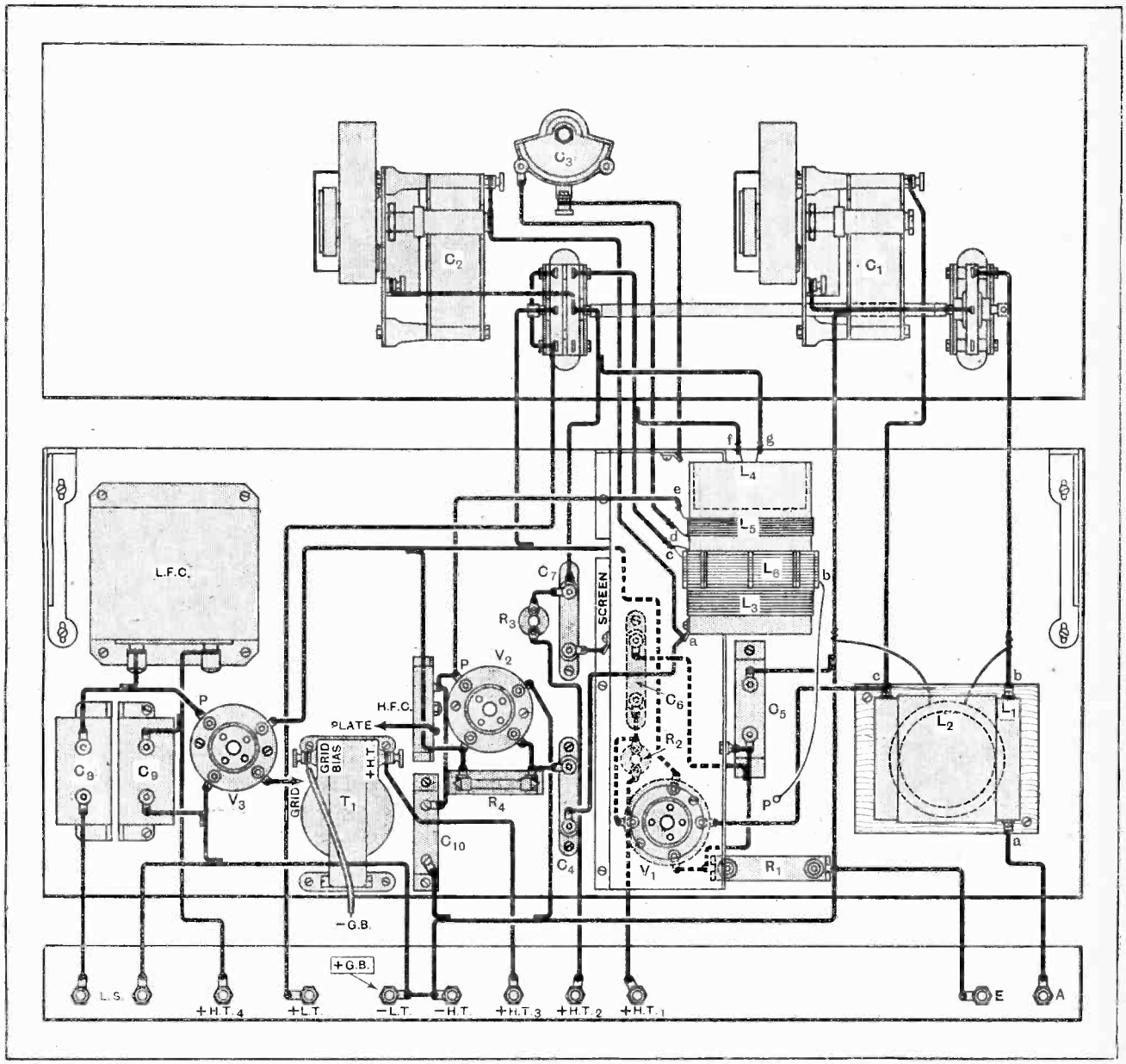


This view shows the method of assembling the H.F. intervalve transformer

The Europa III.—

under the screen, and should be covered with a small piece of empire cloth. Similarly the negative wire should be covered with sleeving where it takes a path between the back edge of the screen and the terminal strip. All filament wires lie on the baseboard and are held down by small clamps of wood or ebonite. The actual route taken by the wires may be copied without fear of dangerous couplings arising. No attempt has been made to substitute screw connections for soldered joints, for soldering is more reliable, and is not too difficult with an electrically or gas heated, well tinned iron. Plated tags should be filed bright and tinned before use, while a small piece of blotting paper placed under joints before soldering will prevent spreading of the Fluxite.

Comment may be made as to the number of H.T. terminals, but these are necessary, as it is common practice in good battery eliminators to take precautions against undesirable couplings, and a reduction of the number of terminals on the set would demand the fitting of de-coupling resistances and condensers which would be duplicated in the eliminator. Incidentally, this set is particularly suited for battery or eliminator operation without the dangers of "motor-boating," firstly, by the avoidance of a tuned anode H.F. coupling



The actual routes taken by the connecting wires are shown. The components beneath the bend in the screen are located and wired up before proceeding with the remainder of the construction. Care must be taken in carefully identifying, with the aid of the drawing of the H.F. intervalve transformer, the various leads associated with the H.F. amplifier.

The Europa III —

and, secondly, by the inclusion of a choke filter output feed. For battery working 150 volts should be applied to the plate of the P.M.14, 150 to 250 to the P.625 with up to 20 volts grid bias, 75 to the screen grid and the detector valve. It is worth experimenting with the exact setting of the screen and detector valve potentials.

In operation it will be found that the reaction knob will scarcely need to be touched while tuning, and the normal setting is roughly the same on both long and broadcast wavelengths. As the behaviour of the reaction control is in a large measure the merit of a set it may be used for bringing up signal strength as well as further improving selectivity. Its setting should not be critical, and actually a wide movement can be obtained between the position of no regeneration and the creation of the whistling sound, signal strength increasing all the time. This set is, of course, less selective on the long wave adjustment, but on the long waveband one is involved in tuning-in four stations as compared with twenty or more on the broadcast band. It is doubtful if the London listener, not in need of 5XX, which gives the London programme, has use for long-wave tuning range, and he might decide to save the trouble and expense of fitting it, substituting the lever wave-change and filament switch by an "on" and "off" press button. No change of apparatus is required should the user desire to make use of a pentode valve in the output stage, as it will not be unduly overloaded following the limited input voltage handling capacity of a leaky grid detector.

This set is available for inspection by readers at the offices of "The Wireless World," 116-117, Fleet Street, London, E.C.4.

WIRELESS IN THE WILDERNESS.

Across Africa with a "Transportable."

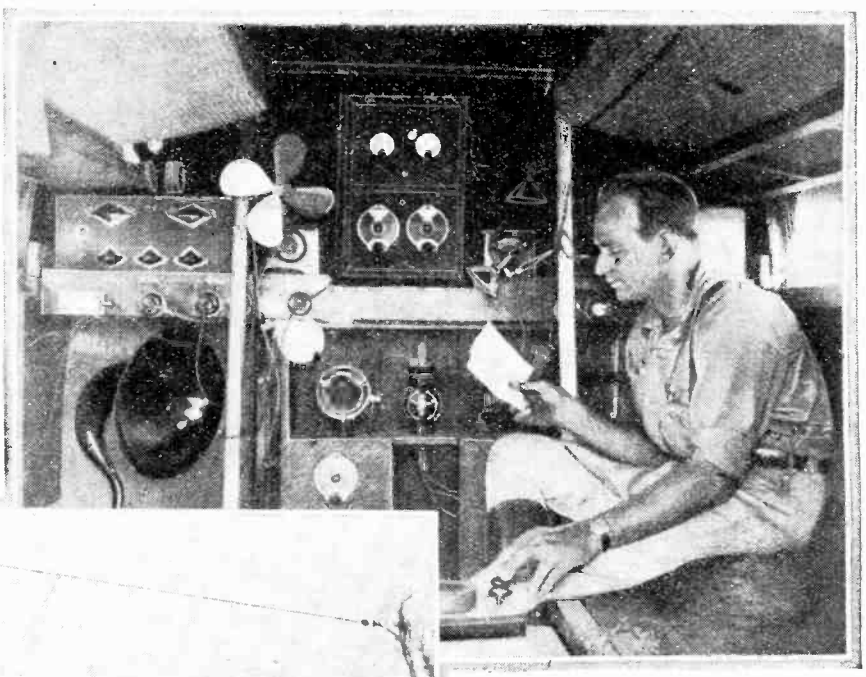
WIRELESS transmitting and receiving gear capable of withstanding the shocks of a seven months' car journey over some of the worst roads in the world was the requirement of General Motors of South Africa, Ltd., when they decided to send a Chevrolet car and 1-ton truck from Cape Town to London.

A well-known Port Elizabeth amateur, Mr. W. Wilson, was requested to help in the choice and collection of the apparatus. In two days it was complete, fitted with Mullard V.O.150 transmitting valves. Both transmitter and receiver were installed in the truck, the 2,000-volt generator being run off the engine.

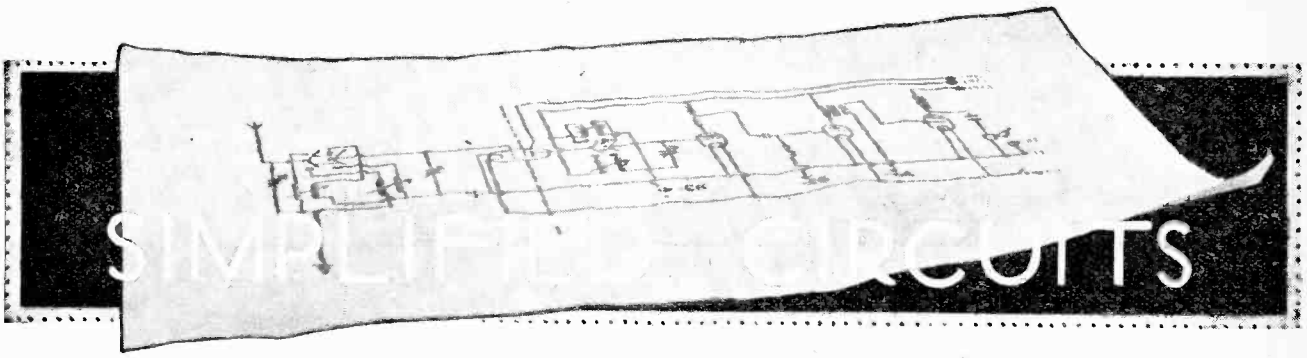
The receiver, as will be seen in the photograph, was the well-known Grebe short-wave two.

After the party entered Rhodesia press messages and reports were transmitted every night. The irregular nature of the country made the work extremely difficult. Sometimes the cars were in swamps, sometimes in forests, and, worst of all, in deserts, yet in spite of all handicaps the apparatus functioned perfectly, the travellers being able to listen to London dance music and Big Ben nearly every evening.

The trip took over seven months and it was never once necessary to replace a single valve.



(Above) Mr. Wally Wilson, the amateur who accompanied the party, transmitting a message. (Left) A very temporary wireless station at Sereate Camp, Northern Rhodesia.



How to Dissect a Theoretical Diagram.

By "RADIOPHARE."

TO the majority of readers of this journal, wireless is nothing more than a hobby; it therefore follows that there is not the slightest reason why they should be at pains to acquire any more knowledge of the subject than they feel inclined; indeed, study carried beyond the point where it yields interest becomes a laborious task, instead of a recreation.

It would be an impertinence on the part of the writer to take to task those who have neglected the art of reading theoretical diagrams, but it is permissible to point out that a knowledge of the subject is vital to a proper understanding of a receiving set; further, it affords a short cut to some knowledge of basic principles.

Much has been done to smooth the path of the home constructor; practical wiring plans are prepared with references and cross-references and colour schemes for the various classes of connections, and receivers are designed with the object of eliminating all puzzling complications; although these expedients render almost impossible any chance of error, they are ultimately found to be lacking. This is partly because the builder, by the very simplicity of his task, is lulled into a false sense of security; unless he knows enough to trace out the different circuits which go to make up a complete set, he will seldom be able to locate a fault—which is bound to develop sooner or later—or even to make those slight additions and modifications which are almost inevitable in an art which as yet shows no signs of having reached a state of finality.

All this refers primarily to the set builder, but it applies, although with less force, to the set buyer; there is no more certain way of reducing upkeep costs than by knowing something about one's receiver, and perhaps no easier way of getting this knowledge than by learning to read theoretical circuits. Put another way, it may be urged that knowledge can seldom be usefully applied to the solution of practical problems unless this art has been mastered.

Disentangling Individual Circuits.

Theoretical diagrams appear to be complicated only when they are considered as a whole, and many of the difficulties will disappear if one isolates the grid and plate circuits of each valve in turn, on the lines shown in Fig. 1, which represents the essentials of a three-valve set having an H.F. amplifier, anode bend detector, and a single transformer-coupled L.F. stage. It should be emphasised that the most complex multivalve receiver will yield to similar treatment.

A good deal of the diffidence with which the subject is generally approached may be attributed to the fact that it is customary to show a common high-tension voltage source for all valves; true, this is always used in practice, but it must be borne in mind that our anode circuits are not finished with when we come to the H.T. terminal; they must be carried through to the negative filament terminal of their associated valve. Starting from this common point, grid circuits should be traced out in the same way.

Still referring to Fig. 1, it will be as well to take each grid and plate circuit in turn, beginning with the H.F.

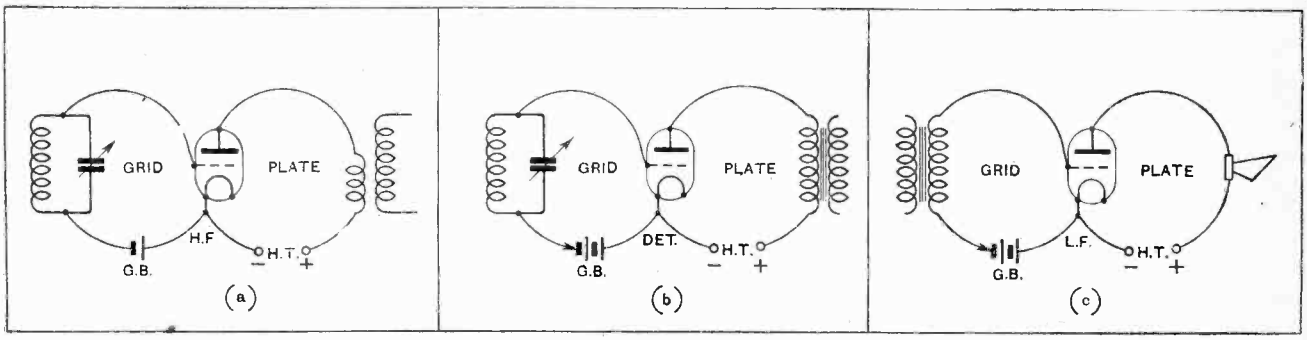


Fig. 1.—The basic grid and plate circuits of H.F., detector, and L.F. valves in a three-valve receiver.

Simplified Circuits—

amplifier (a). In series with grid and the common filament connection is a coil and condenser (which may conveniently be regarded as a self-contained unit), and also a grid bias cell. The plate circuit is completed through the primary winding of a coupling transformer and the H.T. battery.

The H.F. transformer secondary, in conjunction with its tuning condenser (omitted from diagram (a)), may properly be regarded as a part of the detector valve grid circuit, as shown in diagram (b). Similarly, the primary of the L.F. transformer is joined in series with the detector plate, but its secondary belongs to the L.F. amplifier grid circuit, so this winding must be transferred to the third diagram (c). The plate circuit of the output valve is completed through loud speaker and H.T. battery.

Unfortunately, we find in a practical receiver, even if it is of a comparatively simple kind, that a few complications must be introduced which tend to destroy the utter simplicity of the simple series circuits. Typical additions are shown in dotted lines in Fig. 2, which represents the separate single-valve circuits of Fig. 1 linked together. The connections of an aerial-earth system, whether in the manner indicated or otherwise, will not lead to confusion, but a neutralising system must, in the nature of things, introduce some complication, as it is bound to be common to both grid and plate circuits; however, if it is remembered that this will be so, and if the balancing winding and its condenser and connections are looked upon as an addition to the simple basic circuits, no difficulty will arise.

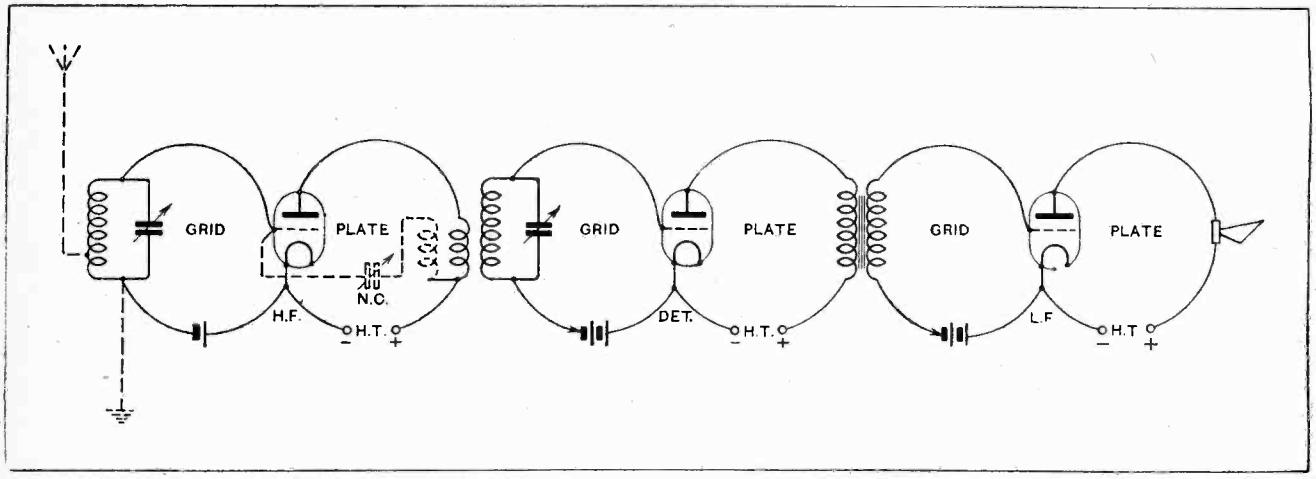


Fig. 2.—Diagram of a complete receiver, composed of the individual valve circuits given in the preceding figure.

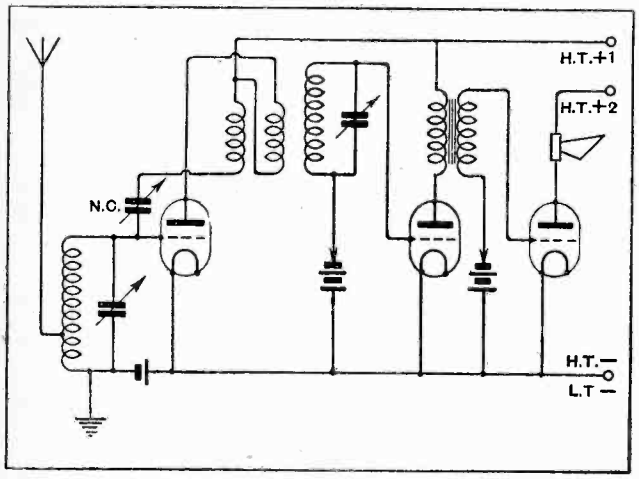


Fig. 3.—The circuit of Fig. 2, drawn in the conventional manner.

Fig. 3 is a repetition of Fig. 2, but is drawn in the conventional manner. Those who are sufficiently interested will find it worth while to compare the two, and to trace out the various circuits of the more complex diagram with the help of the dissected version.

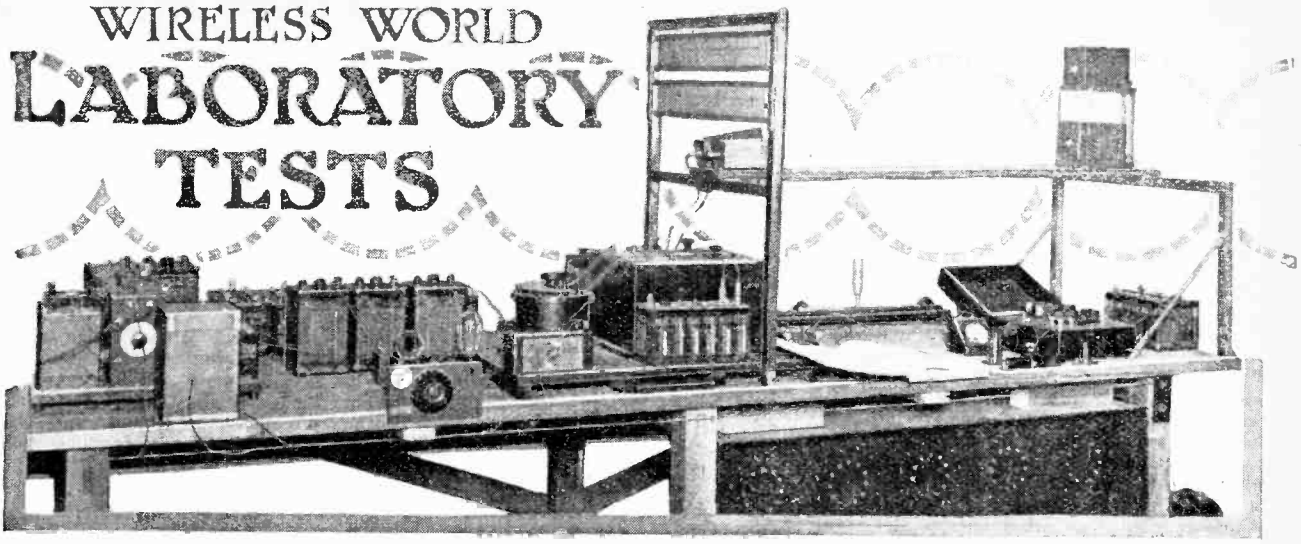
In the foregoing it has been assumed that the reader is familiar with the conventional symbols by means of which components are represented; this assumption is perhaps not altogether justified in the case of beginners, but it is considered unnecessary to repeat these symbols, as they are included in the majority of reference books dealing with wireless subjects.

Eliminating Another Complexity.

A type of circuit which may be responsible for some confusion is that in which valves are coupled by a condenser instead of a transformer; in this category are tuned anode H.F. stages and resistance- or choke-coupled L.F. amplifiers. The simplest way out of the difficulty is to regard the plate circuit as including whatever device may be in series with it, and to look on the grid circuit as being completed through its leak and bias battery, with the coupling condenser as a link between the two.

Unfortunately it is not possible to treat all the minor points of doubt which may arise when tracing out unusual arrangements; however, it will be a great help to remember that main plate circuits are always easy to follow, as they must include a through metallic path for D.C. current; any condensers, other than tuning capacities, can safely be regarded as shunts or as a part of parallel subsidiary circuits.

WIRELESS WORLD LABORATORY TESTS

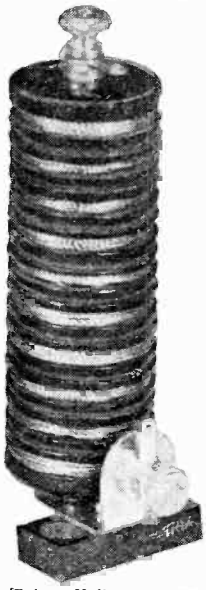


A Review of Manufacturers' Recent Products.

TRIX H.F. CHOKE.

The base of the Trix choke is so arranged that it can be mounted either vertically or horizontally; all that is necessary is to interchange the positions of the terminal and the H.F. choke on the metal angle bracket fixed to the ebonite base.

The choke former is cylindrical and the wire is wound in 10 sections with a spacing equal to about twice the width of the slot. The maximum impedance occurs at 1,600 metres in a circuit which imposes an external capacity of 8 micro-mfd.; the choke is therefore suitable for wavelengths below this value. Self oscillation will not occur until 1,600 metres is passed and the choke can be used in a circuit designed for the reception of 5XX, though the factor of safety is small. Naturally, the impedance at 1,600 metres is above the average, and the choking effect on the medium broadcast band is also good as this band is nearer to the resonance of the choke than usual. The actual values of impedance are as follow:—



Trix H.F. choke; D.C. resistance, 390 ohms.

Wavelength (metres).	Impedance (ohms).
200	13,100
500	47,000
1,600	287,000

Each choke is supplied with a copy of the Faraday House report on inductance and self-capacity, and the price is 5s. 6d. The makers are Messrs. Eric J. Lever (Trix), Ltd., 8-9, Clerkenwell Green, London, E.C.1.

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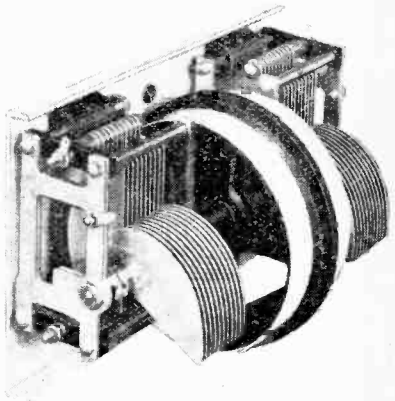
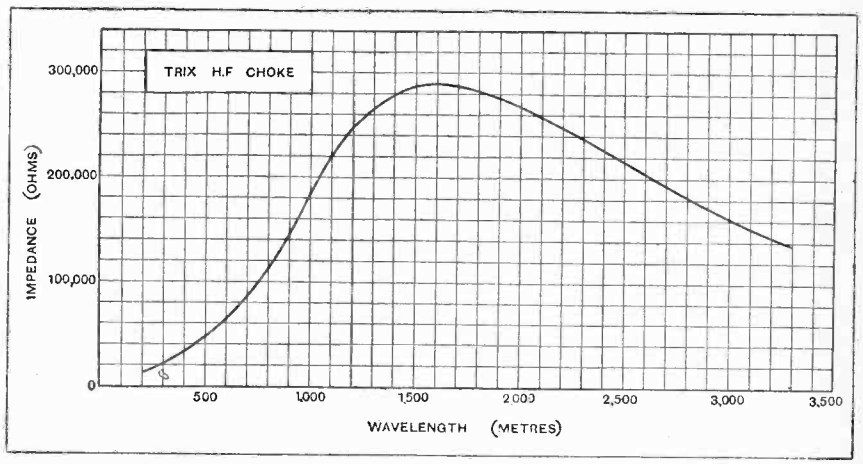
CYLDON SYNCHRATUNE TWIN CONDENSERS.

Many ingenious devices have been adopted for simplifying the operation of sets incorporating two, or more, tuned circuits, but the twin condenser assembly with control drums side by side is slowly but surely gaining popularity. The gang method of control, in which all condensers were connected to a common driving shaft, held sway for a period, but in very few cases was this entirely satisfactory. The wide use of drum control, as evidenced at the recent wireless exhibition, shows that designers have, for the forthcoming season, decided that this shall be the prevailing vogue, and many condenser manufacturers are now marketing their products with this attachment.

Messrs. Sidney S. Bird and Sons, Ltd., of Cyldon Works, Enfield, were among the first to put into production condensers



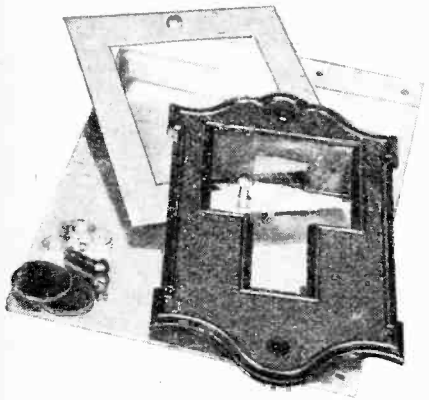
The new Cyldon "Synchratune" twin condensers.



Impedance curve of Trix H.F. choke; external capacity 8 micro-mfd.

designed specially for this method of operation, and long before the set manufacturers made drum control standard in many of their products. As is only to be expected, many improvements have been made since the first models were designed, and their latest "Synchratune" twin condensers embody a number of refinements which present-day practice demands as necessary with this method of tuning.

In the model illustrated, two log midline condensers, each with a maximum capacity of 0.0005 mfd., are mounted on an aluminium plate, the moving and fixed vanes both being well insulated, and the plate, therefore, forms an effective screen against hand capacity effects. Each condenser is fitted with a large diameter drum—4½in. over the ivorine scale—and these are mounted side by side with just sufficient clearance for a vertical screen to be fitted between them. The supporting plate is turned over at the top and bottom, and a narrow slot



The escutcheon plate, template and screen for the "Synchratune" condensers.

cut in each edge to facilitate accurate positioning of the screen. The object of this is to provide an electrostatic screen between the two condensers, as in many modern circuits the screening of each tuning condenser is as important as magnetic screening of the coils.

Two screws fix the unit to the front panel of the set, and these also hold in position an escutcheon plate moulded from bakelite. The unit is robustly made and exhibits the fine workmanship which characterises all this firm's products. The price complete is £2 7s.

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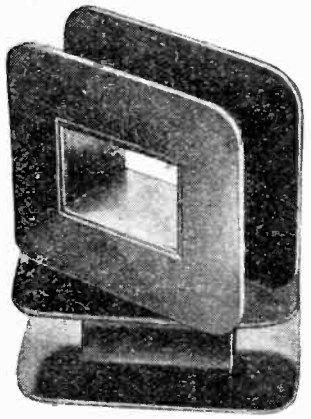
TRANSFORMER MATERIALS.

Readers intending to make up the mains transformer described by Mr. H. B. Dent in the issue of October 24th will be interested to know that suitable core stampings having the same size and magnetic properties as those originally specified are obtainable from Messrs. W. B. Savage, 146, Bishopsgate, London, E.C.2., the price being 8s. 3d. per gross pairs.

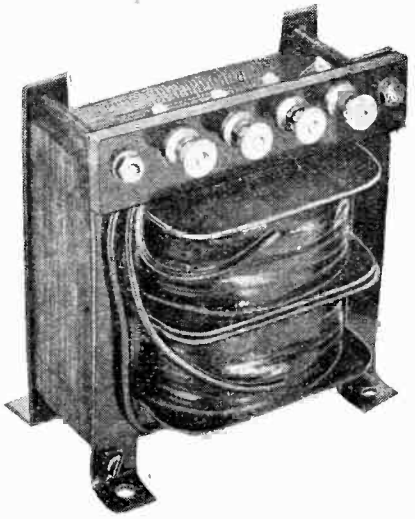
The construction of the transformer will also be simplified by the use of the bakelite bobbins supplied by this firm, which retail at the extremely reasonable price of 1s. 6d. per pair. These bobbins are made to fit the "No. 4" stampings and provide for a core of 1½ square inches cross sectional area as specified in



Bakelite bobbins for building the transformer described on page 569 of the October 24th issue.

the article; between 86 and 90 pairs of stampings will be needed to complete the core. The use of bobbins for supporting the coils will somewhat reduce the winding space, but this will be compensated for to some extent by the fact that binding tape will not be required.

The type C30/2 smoothing choke made by this firm incorporates the bobbins and stampings mentioned above, and is a thoroughly sound and reliable job. The maximum current carrying capacity (D.C.) is rated at 125 mA. and the maximum inductance at 30 H. There are two sections in the choke, wound on separate bobbins, the terminals being arranged so that the two halves may be connected either in series or in parallel. With no D.C. flowing through the winding the series connection gave a measured inductance of 33.9 henrys and the parallel connection 9.5 henrys, the D.C. resistances being 172 ohms and 43 ohms respectively. The inductance would, of course, be reduced by the steady current flowing through the windings, but the generous dimensions of the core indicate that the reduction would not be as serious as in the average design. The price is 17s. 6d.



Savage type C30.2 smoothing choke.

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HARLIE WAVE SELECTOR.

This device consists of a tuned circuit with three alternative tappings for inclusion in the lead-in wire from the aerial The function of the selector is to absorb the energy pick-up by the aerial from a local unwanted transmitter. The reception of distant stations which would otherwise be swamped by the local station is thus made possible.

The Model 9 illustrated is for the normal broadcast waveband, and costs 12s. 6d.; a similar model for long waves is in course of production.

Harlie Model 9 wave selector.

The workmanship is excellent, and special attention has been paid to the tuning condenser. This is of the moving vane type, with solid dielectric, and not the compression type often used in wave traps. A graduated dial on the top of the unit enables a record to be kept of the setting required to cut out the local station The moulded case is of the usual high quality associated with Harlie products, and is finished in the popular crystalline black.

The makers' address is Messrs. Harlie Bros., Balham Road, Lower Edmonton, London, N.9.

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BROWN "L.F." TRANSFORMER.

In the review of this transformer on page 640 of the November 7th issue the amplification at 30 cycles with a D.E.L. 610 valve was given in error as 35. The true value at this frequency is 42.5 with the D.E.L.610, and the amplification of 35 refers to the curve for a P.M.3 valve.

By Our Special Correspondent.

Engineers v. Musicians.—Royalty and the Microphone.—Yugo-Slavia's New Idea.—Audition Horrors.—Discontent in Scotland.—Illustrating Broadcast Programmes.

Another Trip to Eastbourne.

That "Eastbourne effect," referred to in these columns a fortnight ago, is more sought after at Savoy Hill than the public may have been led to believe. In a conversation last week, Capt. A. G. West, who heads the B.B.C. research department, confirmed the view that the lounge of the Grand Hotel at Eastbourne is the best "studio" that the B.B.C. have had at their disposal since broadcasting started

This fact was recognised three years ago, when Capt. West made a personal visit to Eastbourne and took rough measurements.

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New Acoustic Measuring Device.

Another excursion will probably be made shortly when the engineers will take with them a new acoustic measurement instrument now under construction at the Clapham laboratory. The device will also be taken to other buildings used for outside broadcasts.

The instrument will give the sound characteristics of any building, showing the natural resonances of the place and the extent to which echoes are prolonged at different frequencies.

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Engineers *v.* Musicians.

No doubt the information gained will be of great interest to the academically-minded, but, from what I can gather, it can be put to little practical use at present, there being a strong musical faction at Savoy Hill which is resolutely opposed to the introduction of more echo in the transmissions.

Most of the engineers are in favour of introducing more of the "hall effect," arguing that it adds brilliancy to the performance of the average loud speaker. But the musical gods, who hear almost perfect reproduction on moving-coil loud speakers in the spacious apartments at Savoy Hill, are apt to overlook this fact.

Anyhow, there is conflict on the point, and we may hear more of it before very long.

How to Plumb Public Taste.

The citizens of Liverpool are now complaining that the centralisation of northern programmes at Manchester has deprived them of the local news which 6LV used to send out. This is rather hard on the B.B.C., because a number of Liverpudlians used to find local news rather tedious, and said so!

It would appear that the best method of discovering whether an item is popular or not is to cut it out.

FUTURE FEATURES.

London and Daventry.

DECEMBER 2ND. — Twenty-fifth Annual Scottish Festival Service from St. Columba's, Pont Street, S.W.1. Address by the Rev. Archibald Fleming.

DECEMBER 4TH.—Two Plays by W. W. Jacobs: "The Grey Parrot," and "The Monkey's Paw."

DECEMBER 5TH.—"A Sea Change," by Sir George Henschel.

DECEMBER 6TH.—Hallé Concert from the Free Trade Hall, Manchester.

Daventry Experimental (5GB).

DECEMBER 3RD.—"Paddly Pools," a fantasy by Miles Malleson.

DECEMBER 4TH.—"Fireside Singing," an hour with old songs and choruses.

DECEMBER 7TH.—A Lecture on "How It Strikes Me," by G. Bernard Shaw, relayed from the Private Theatre of Royal Academy of Dramatic Art.

DECEMBER 8TH. — Chamber Music.—A Czechoslovakian Programme.

Cardiff.

DECEMBER 2ND.—Sunday in a Welsh Home.

DECEMBER 4TH.—"On Approval," a Vaudeville Programme.

Manchester.

DECEMBER 6TH.—Hallé Concert from the Free Trade Hall.

DECEMBER 7TH.—Programme of Minuets and Gavottes.

Newcastle.

DECEMBER 2ND.—Service from St. Nicholas Cathedral.

DECEMBER 7TH.—"Dropped from Heaven," by Dion Titheradge.

Glasgow.

DECEMBER 3RD.—Programme of Spanish Music.

DECEMBER 7TH.—Glasgow Bach Society Chamber Concert.

Aberdeen.

DECEMBER 3RD.—"Ayont the Grampians," A Scottish Variety Programme.

Belfast.

DECEMBER 3RD.—"L'Enfant Prodigue," an opera by Claude Debussy.

And Quite Right, Too.

A cheerful genius, probably the one who made the same proposal last year, suggests that H.M. King should be prevailed upon to broadcast a message to the Empire just before the Christmas Dinner at Buckingham Palace.

"We should never think of making such a request," a B.B.C. official told me. With which sentiment most of us will agree. The Royal Family, like humbler families, is surely entitled to keep that one day to itself.

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Prognostication.

Without consulting the stars or posing as Old Moore, I venture to suggest that listeners who are in a position to use their sets during the daytime should mark December 7th on their calendars as a date on which an important broadcast *may* take place. All will depend upon whether consent can be obtained from someone who ranks very high in the land.

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An Arnold Bennett Play.

Arnold Bennett's one-act play, "The Stepmother," a farce which pokes fun at the popular woman novelist, and a Christmas sketch by F. Morton Howard entitled "Those Good Old Days," are in 5GB's programme on December 14th.

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Great Problem Solved.

There is a hint of genius behind the decision to make the call of the cuckoo the signal for Yugo-Slavia's new 566-metre station at Laibach. The idea is original and full of the most wonderful possibilities. It solves all difficulties in station identification with one colossal sweep.

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Station Identification Made Easy.

Why have we never thought before how simple and effective it would be to give every station an animal call? Animals know no language; the cry of the pussy cat is recognisable as such by people of all nationalities.

Appropriate Calls.

All that remains to be done is to allocate zoological calls to the various European stations, having regard to the types of animal most appropriate to particular transmitters

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Round the Zoo

Under the able guidance of Mr. Arthur Burrows, the members of the Union Internationale de Radiophonie might tour the nearest Zoo and listen attentively to the cries of all creatures, great and small, classifying them according to volume and frequency.

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Difficulties.

It is not for me to suggest on what basis the various calls should be assigned; no doubt every station would clamour for the honour of the lion's roar, and difficulties would undoubtedly arise in allotting such derogatory, if distinctive, sounds as the laugh of the hyena and the bray of the ass.

Anyway, Yugo-Slavia has given us the right idea. Geneva should now get busy on the new list of "stations, frequencies, and animal cries."

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A Spanish Classic.

The next production in the World's Great Plays series is Calderon's "Life's a Dream." It will be broadcast from 5GB on December 11th, and 2LO, 5XX, and other stations on December 12th. The play is representative of Spain's contribution to the world's drama.

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Audition Horrors.

I hear that there may be a decided diminution in the number of stage-struck young ladies after the 20-minute broadcast on Friday next, November 30th, when we shall hear a theatrical audition from a room in the Palace Theatre. Aspirants for places in the chorus of No. 1 touring company of "Virginia" will be parading their talents before the judges—Herman Clayton, Jack Waller, William Mollison, and Ralph Reader—and the comments are to be outspoken in more than one sense. Strict anonimity will be observed, which is rather a good thing, considering how busy the courts are at present with libel actions.

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An Idea for the B.B.C.

But this audition idea might be developed by the B.B.C. themselves. We should like to hear some of the raw stuff which blows in at Savoy Hill on the off chance of securing a contract. If we had a whole evening given over to the people who think they can sing, or recite, or be funny, but have never been tried, it would do the B.B.C. programme department an enormous amount of good. We might then hear fewer complaints from "Fed-up," "Bored to Tears," and all those other persons who know what is wrong with the programmes but can never suggest how to set things right.

They would then have a faint glimmering of the refining processes which are at work before a real programme ever gets near the microphone.

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"Fed-up" Speaks.

One of the fraternity aired his views to me a few days ago. "There's nothing worth listening to," he stated. "The B.B.C. hasn't got the right "touch" if you know what I mean. Somehow they don't seem to 'get there.'"

"And what," I asked, "did you object to in last night's Schubert concert?"

He looked annoyed.

"Oh, I haven't had a chance to listen since my aerial came down!"

I remember when that aerial came down. It was last August

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Discontent in Scotland.

In view of the growing discontent among Scottish listeners regarding the new regional programme system in Scotland, the B.B.C. have thought it advisable to explain the situation in a letter to the Scottish Radio Traders.

It will be remembered that the Glasgow station is virtually the only main station in Scotland at the present time, Edinburgh, Dundee, and Aberdeen taking only the Glasgow transmissions. These may or may not originate in London.

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An International Cause.

In the course of the letter referred to, the B.B.C. admits that the conditions in Scotland leave much to be desired, but that the primary cause is the international situation.

After explaining the necessity of a common wavelength among the relays, the writer says:—

"At present in Scotland (and elsewhere to an equal degree) every relay transmitter is heterodyned and limited to almost negligible distance. Most main stations are practically useless beyond a radius of fifteen miles. . . .

"It is essential that the same evening programme shall be radiated by Edinburgh as by all the other relays and Bournemouth, because it is impossible to radiate different programmes at the same frequency without risking mutual interference."

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Blessings of the Regional Scheme.

The letter insists that the common wavelength plan is merely a temporary palliative pending the completion of the regional scheme. "If the regional scheme had been proceeded with three years ago we should be independent of the Continent, and there would be no cause for complaint in Scotland or elsewhere. But the P.M.G. did not see his way clear. . . ."

What a lot hangs upon the regional scheme!

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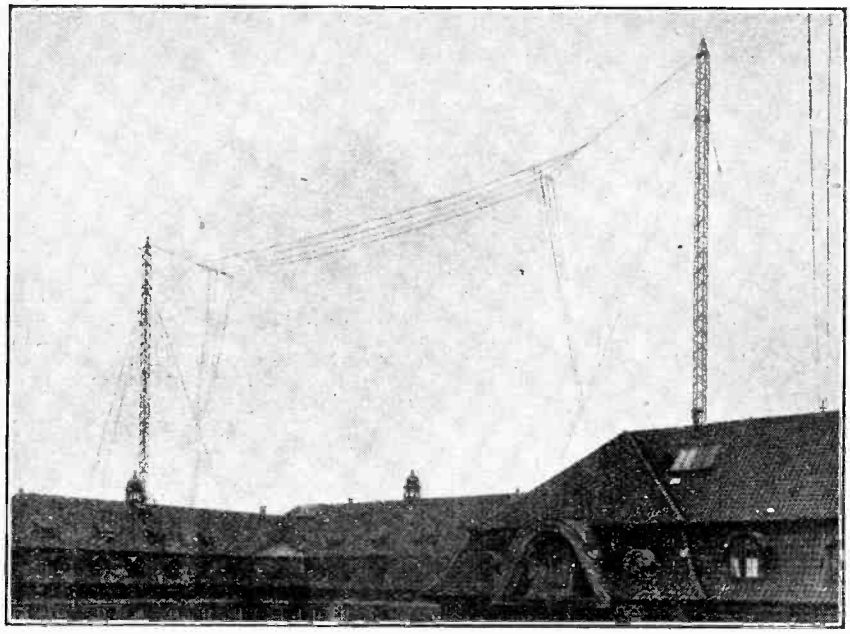
Illustrating Broadcast Programmes.

The B.B.C. has just indicated the way in which the present series of picture transmission by the "Fultograph" system may ultimately develop. On Saturday, November 17th, one of the four pictures supplied by them for that day for broadcast purposes was a portrait of an artist who appeared on the Daventry programme only an hour later.

The portrait was that of Mable Constanduros, who was on the 5GB programme from Daventry at 3.30 p.m.

On the Thursday a photograph of the outside of the Savoy Hill headquarters was transmitted.



DENMARK'S CAPITAL. The aerial system of the Copenhagen station is unscreened by bricks and mortar. The station broadcasts nightly on 337 metres and is usually relayed by Kalundborg on 1,680 metres.

LETTERS TO THE EDITOR.

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.

LOUD SPEAKER "ATTACK."

Sir,—In the correspondence on "attack" and the reproduction of sudden "noises" (such as a shot), no one appears to have suggested that there may be a physiological difference between the mechanism by which we hear a "noise" and that by which we hear a musical note.

According to the generally accepted Helmholtz theory of hearing, the ear is provided with "resonators" each tuned to a particular audible frequency. If, say, middle C and its third harmonic (or fifteenth) are sounded together, resonators corresponding to frequencies of 512 and 1,500 are affected, and from the relative intensity with which they are affected we judge the relative intensity of the fundamental and harmonic. The ear, in fact, performs a harmonic analysis, *but it is not affected by the phase relation between fundamental and harmonic.*

It can easily be shown by drawing the curves that if the harmonic is in phase with the fundamental we have a "peaky" wave form, whereas if the harmonic is antiphase to the fundamental we have a "flat topped" wave, yet provided the relative amplitudes of the fundamental and harmonic are unaltered, we hear the same note precisely.[1]

But is the same true of a sudden "noise"? I suggest that the effect produced by the "noise" of a shot, say, in shock excitation of *all* the resonators, and the precise "quality" of such a noise, depends to a very large extent on the *steepness of the wave-front, i.e.*, by time rate of change of air pressure. Now if we suppose that the actual wave-form of the air pressure produced by such a "noise" is harmonically analysed over a sufficiently long period, and that the *phases* of the components are then altered at random, keeping the relative *amplitudes* unaltered, we shall obtain a curve having an entirely different steepness of wave-front, probably a very much less steep wave-front. If my suggestion, that the quality of the noise depends on steepness, is correct, the alteration of phase will give untrue reproduction of a sudden noise, although it may be of no effect when listening to the reproduction of a musical note or notes.

Now in practice, any land-line must introduce phase change, which cannot be corrected subsequently as can amplitude distortion; also there is practically certain to be phase change in any transformer, whether in transmitter or receiver, hence the random change of phase suggested in the last paragraph is what actually does occur (and even if the transmission and amplifier could be freed from this, it will still be introduced by the loud speaker).

It would then appear that to reproduce a "noise" accurately is a problem of an infinitely more difficult nature than that of reproducing a musical sound, in our present state of knowledge it may even be insoluble, as it would require the elimination of phase-change. I hope some of your readers with a knowledge of physiology will comment on this suggestion.

Cambridge. C. R. COSENS.
November 7th, 1928.

5SW AND EMPIRE BROADCASTING.

Sir,—There appears to be quite a lot of talk just now about 5SW and its expense, and suggestions are made that the Dominions should help pay for its maintenance.

We are told that 5SW costs £10,000 a year. I could find a use for £10,000 a year myself, but surely this is a very small sum to the B.B.C. I might as well say—"it costs me £10 a year in stamps and stationery to write to my friends and send little presents—what about asking my friends to subscribe towards this?" You reply "Yes, but your friends write to you and you get some return." Quite true, but imagine I am the "rich uncle," and send rather a lot of presents! Let the B.B.C. be the "rich uncle," and the Colonies the "poor nephews and nieces."

But to turn to another aspect: Why do the B.B.C. run 5SW? Why do they carry on conversation for an hour or so twice a week with 2XAD? Are the Colonies expected to pay for this, too? (Oh yes, I admit we listen to it.) Why do people in England use SW sets? To listen to 5SW? No! But do they contribute to SW stations in other parts of the world? No! Presumably 5SW is their way of paying for the pleasure of listening to 2XAF, PCJJ, 3LO, etc., etc.

And what about the B.B.C.'s latest activity, broadcasting pictures? Is this what the subscribers pay their licences for?

As a matter of fact I do not suppose any one of the Colonies would mind paying the B.B.C. a licence equal to:—

$$\frac{\text{Present licence} \times \text{cost of 5SW per annum.}}{\text{Total expenditure of B.B.C.}}$$

The difficulty would be to find currency in which to pay it!

Let us hear a little less about the Colonies paying for 5SW; it is not a very generous or sporting suggestion. Many or rather most of us go to England for our holidays and spend our money freely: we might even pay for a year's licence while in England and only use it a few months.

One more aspect: here in India, what do you suppose the average listener, and the majority are Indians of course, cares about 5SW; not two pins. 5SW does not produce the kind of programme the Indian likes, and the I.B.C. would certainly not be justified, poor as they are, in paying one penny to the B.B.C.

No, let the B.B.C. and the English subscribers who grumble at the cost of 5SW be satisfied that they do get some return in a very small way, and if that does not satisfy them they might remember that a large number of subscribers have friends and relatives in the Colonies, and would like them to hear 5SW at their, the subscribers', expense.

Of course, if the Colonies should pay, I expect they would have a word or two to say about times of transmission and wavelengths. BM/RBR.

Negapatam (South India).
October 22nd, 1928.

"MODERN NOISE."

Sir,—The peremptory manner in which Mr. Ernest Newman, the B.B.C. music critic, addressed us on Saturday, November 3rd, during his discourse on "Modern Noise," which he is pleased to call music, augurs a bad outlook for those people who are paying the piper, but who, apparently, have no voice in calling the tune. Can nothing be done to force an issue on this important matter, *i.e.*, whether we are paying for noise or music? Apart from this pet idea of the B.B.C., I firmly believe we have the finest broadcasting organisation in the world. I listen to a good many distant stations, but I still maintain our stations will compare favourably with any other, but there is this "fly in the ointment" which needs immediate attention unless we are to become a nerve-wracked lot of listeners. From letters which have already appeared in your valuable weekly and other papers it is quite apparent that the public prefer Beethoven to Bartok and other moderns. Then why should the B.B.C. persist in their policy? I should like to hear the views of your readers on this matter. MUSICUS.

W. Eastleigh, Hants.
November 5th, 1928.

PICTURE BROADCASTING.

Sir,—It is hardly to be expected that people are going to the expense of installing Fultograph or similar apparatus in their homes when the possibility of the B.B.C. discontinuing transmissions is present. It seems to me that the public are watching the B.B.C. and the B.B.C. is watching the public, and neither will make a move until they are sure of the other.

November 13th, 1928. D. C. A. WALKER.

[1] For arguments in favour of the statement that phase-difference between notes does not affect the ear, see "A Vindication of the Resonance Theory of Audition," by H. Hartridge and the writer, *British Journal of Psychology*, Vol. XII, p. 48, July, 1922.

PICTURE BROADCASTING

Sir,—Mr. E. J. Crampton is not fair to the B.B.C. in his letter of October 20th, for they have no axe to grind by their recent ban on television, and are merely acting in the interests of the listener.

If the sample recently exhibited in Oxford Street is an example, then television is certainly not *at present* in a sufficiently advanced state to broadcast to the 10s. per annum brigade, who expect entertainment—which, however, they do not always get—for their outlay. D. A. T.

Palace Gate, London, W.8.
November 15th, 1928.

Sir,—The value of the suggestion made by your correspondent, Mr. E. J. Crampton, in his letter regarding the relative merits of picture broadcasting, or television, depends on an assumption that wireless television is already practicable for broadcasting.

The B.B.C. and the foreign stations which have adopted picture boardcasting have decided that it is not, and are surely in a position to judge.

What is the good of asking the public if they want television when those who have actually seen it demonstrated are unanimous in considering that it has not yet reached the stage where it has entertainment value?

No doubt the public would like television of interesting events taking place outdoors in natural colours, but at present all that could conceivably be offered them is a blurred and very imperfect impression of the face of an individual or an object of approximately the same size.

As far as the suggestion is concerned that amateurs might be able to improve television reception if the B.B.C. started transmission, this again presupposes reasonably good transmissions. The imperfections exist, however, just as much in the transmitting system as in the system of reception, and until the former has been brought to a reasonable degree of efficiency it is not much use to experiment with reception.

Thornton Heath, Surrey. W. McDOWELL.
November 17th, 1928.

TRANSMISSION QUALITY

Sir,—Your correspondent, Mr. A. K. Gordon, wishes to know whether other listeners in Sussex have any complaint of the quality of transmission from 5XX. My experience is the same as his. Sibilants, which are apparent in 2LO's transmission, are lacking in that from 5XX. There is considerable variation in the quality of 5XX's transmission in this neighbourhood, some of which is no doubt due to local interference. Mr. Gordon's letter has encouraged me very much. I was beginning to think that I should never succeed in building a set that gave a uniform response to the normal band of frequencies, and his letter indicates that the fault may not be mine.

Kingston-Gorse, P. B. JOUBER.
Nr. Littlehampton.
November 18th, 1928.

Sir,—I should like to confirm every word of Mr. A. K. Gordon's letter (November 14th). The response frequency of 5XX gets steadily worse, and fully 90 per cent. of the transmission is deficient in the higher frequencies. In order to check my receiver I rigged up the simplest possible arrangement, using an old plug-in 150 coil, a P.M.5X valve, and a pair of well-tried headphones. The result was the same, music being dull, woolly, and consequently uninteresting, while speech was of the "hot potato" variety.

A very interesting item of news occurs in a letter from Amsterdam (in your same issue), where Mr. Wigman mentions that the Hilversum concerts are performed in a small concert hall. Most listeners must have noticed the immense superiority of Hilversum musical programmes over those of 5XX. And now we know the reason!

In the name of all common sense why cannot the B.B.C. condescend to learn something from their foreign rivals? The idiotic "control" is at last being scrapped (at least we hope so) after years of agonised protests by musicians, but the padded cell still remains. Is there nothing also to be learned from the Eastbourne transmission and other outside broadcasts? I wonder if Mr. Eric Coates had any idea of how his little concert of last night sounded to 5XX listeners!

Perhaps I had better add that, owing to the Morse nuisance and the bad land-line distortion from 6BM, 5XX is really the only English station available to us south coast unfortunates.

H. BRAITHWAITE.

Southbourne, Bournemouth.
November 14th, 1928.

Sir,—I have read with interest the letter from A. K. Gordon in the November 14th issue of *The Wireless World* with reference to the great variation in quality of some of the B.B.C. transmissions.

I have been listening to-night to both 5GB and Cardiff, the former being really good, the "sibilants" especially being sharp and clear, while Cardiff, on the other hand, is "muffled" and altogether low pitched. This state of affairs seems to vary from night to night, and 5GB especially seems to be the worst offender, varying in quality from good to bad quite noticeably several times during an evening.

The receiver I am using is fairly flatly tuned, very little reaction used, and is capable of really good reproduction.

The difference in transmission is most marked when an "S.B." is being given from Cardiff and Bournemouth (both local stations). Speech appears hollow and "drummy" from one, while being practically perfect from the other.

I think that what Mr. Gordon has noticed coincides with what I am getting here, the transmissions and not the receiver being to blame. R. L. A. BELL.

Yeovil, Somerset.
November 14th, 1928.

Sir,—I can fully confirm your correspondent's remarks in the November 14th issue of *The Wireless World re* the quality of 5XX transmissions, because I have, myself, proved conclusively that there is very considerable attenuation of the higher audio frequencies. One has only to listen to the announcer's voice during the news bulletin, first from 5XX and *via* 5GB to realise the truth of this.

I recently wrote to the B.B.C. complaining of the attenuation of the higher audio frequencies, both from 5NO and 5XX. The B.B.C. in their reply ignored my remarks *re* 5XX, but, referring to 5NO, stated:—

"You will appreciate that our modern transmitters, such as 5GB, are capable of giving more equal frequency response than was the case with older stations, such as Newcastle. At the same time we would point out that it is extremely unlikely that this difference in frequency response would be detected aurally, except by an extremely small percentage of receivers."

Where is the incentive to build a perfect receiver, so long as the majority of B.B.C. transmitters cannot do justice to it?

C. C. V. HODGSON.

Fenham, Newcastle-on-Tyne.
November 15th, 1928.

RANGE v. QUALITY.

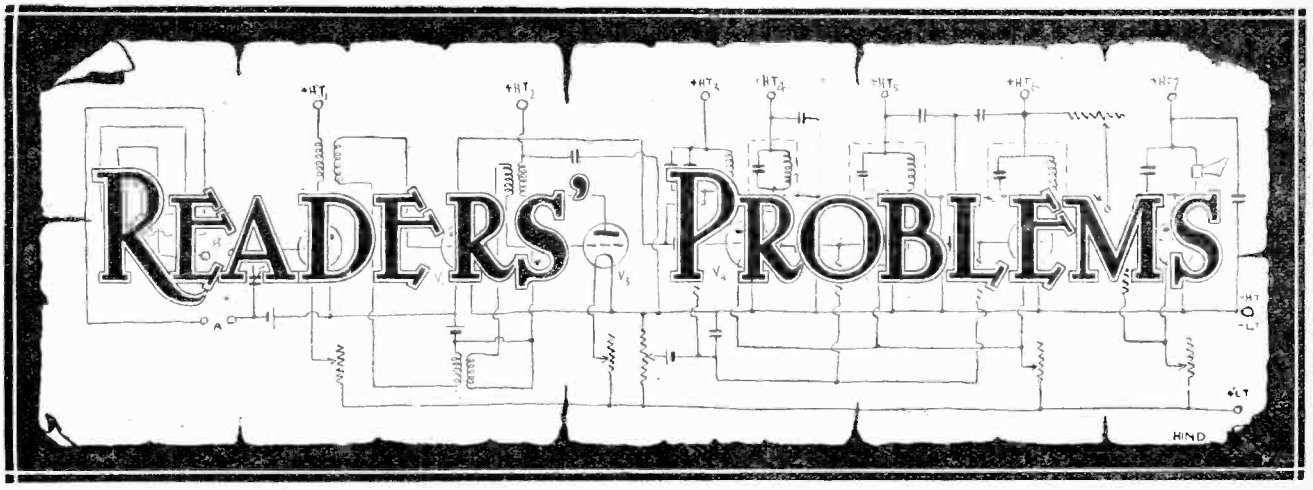
Sir,—It must be evident to your correspondent Mr. Blonet that the qualifications which he postulates cannot readily be obtained either cheaply or with simplicity.

It is a matter of opinion as to whether any single set has yet been provided for us by your designers which will completely fulfil his requirements, but any regular reader of your journal will agree that by the intelligent employment of established *Wireless World* practice a radio receiver can be built to suit almost any individual requirement

If your correspondent considers it worth ten minutes' walk I shall be delighted to introduce him to a set in which *Wireless World* practice is used throughout and which will give him even a little more than he demands.

I might suggest that he makes it an early evening call, for the simple reason that no principles yet described, either in *The Wireless World* or elsewhere, will provide anything to outride the local o-v-2 enthusiasts when they have got properly into their stride. CHAS. BOWLES.

10, Audley Gardens,
Seven Kings, Essex.
November 16th, 1928.



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

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

Pentode Connections.

In the circuit diagram of the "Megavox Three" receiver, a decoupling resistance connected in series with the screened grid of the pentode is shown. I propose to adapt my two-valve set for use with a pentode, and would like to know if this refinement should be retained. S. D. W.

As your set presumably comprises a detector valve followed by an L.F. amplifier, for which you now propose to substitute a pentode, the use of this decoupling resistance would be generally unnecessary. It is specially required when L.F. impulses are capable of being passed back to the grid of the detector, as, for instance, in cases where it is preceded by an H.F. stage with tuned anode.

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A Portable "Megavox."

Would the circuit of the "Megavox Three" receiver be suitable for a self-contained receiver with a frame aerial? I realise the need for modifications in the grid circuit of the H.F. valve, but should be glad to know if any other alterations would become necessary. F. S. S.

This circuit arrangement should lend itself very well for use in a three-valve self-contained set, but if the frame aerial is included as a part of the receiver, we consider it would almost certainly be necessary totally to screen the H.F. stage in a metal box.

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The Simplest H.F. Oscillator

Instead of depending on actual signals, I have decided to build an H.F. oscillator to help me in making some simple comparative measurements. Will you please give me a circuit diagram of the simplest arrangement? I believe it is possible to use a single tapped coil in conjunction with a valve. R. W. S.

The circuit you require is given in Fig. 1, and, as you will see, a single coil only is required. This should preferably have a number of tappings; it will be convenient finally to fix the lead connected to the positive terminal of the H.T. battery at a point which just produces self-oscillation over the whole of the tuning scale. The grid leak should have a comparatively low value.

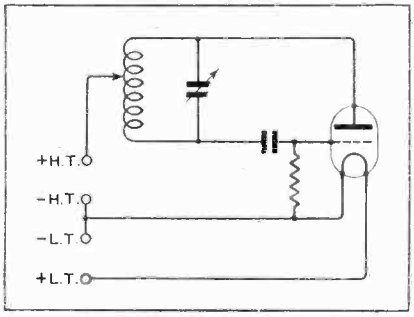

Fig. 1.—A single-coil Hartley oscillator.

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.

Damped but Distortionless.

Several references have been made in recent issues of "The Wireless World" to diode rectifiers, but as this system does not seem to be widely used, I assume that it has disadvantages. It seems to be generally admitted that it is insensitive; are there any other serious drawbacks? T. E. S.

An ordinary detector valve contributes something towards the total amplification obtainable from the receiver, but a 2 electrode rectifier does not. This applies equally to the original valve as to the more modern arrangement in which the grid is used to neutralise the space charge. Lack of sensitivity, however, is not so great a drawback as the damping imposed on the input circuit by the 2-electrode arrangement, which is of low impedance, and consequently draws a considerable amount of energy from the tuned circuit across which it is connected. It is thus somewhat unsuitable for use in ordinary circuits.

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Motor-boating

Since fitting an eliminator to my four-valve receiver, I have been troubled with a low-pitched rattling sound in the loud speaker, which can only be prevented by reducing the H.T. voltage applied to the valves. The addition of extra by-pass condensers across the H.T. terminals does not improve matters to any extent, and I should be glad if you would suggest a simple cure. H. S.

Your trouble is almost certainly due to interstage coupling brought about by the resistances and impedances in the eliminator, and we think you would be well advised to try the simple arrangement which was described with full details in our issue of September 26th under the heading of "Back Coupling in Battery Eliminators."

A.C. Valves.

If you approve of the plan, I propose to modify my "Everyman Four" by fitting indirectly heated A.C. valves. Are there any special precautions to be observed. M. V.

We fear that you will find it difficult to attain perfect stability if you use two high magnification L.F. stages with the new valves, although the modified set might work satisfactorily if you reduced the amplification of the first stage by fitting a low value of anode resistance. Probably, however, our best advice to you is that you should omit one of the L.F. valves, and follow the general circuit arrangement of the "A.C.3" described in *The Wireless World* for September 5th, 1928.

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Switched Hartley Circuits.

With reference to the throttle-controlled Hartley circuit used in the "Everyman Portable," would it not be possible to simplify matters by using an ordinary single-pole break switch for waveband changing instead of a double-pole component as specified? As far as I can see, all that this switch does is to short-circuit the long-wave loading coil. The set I propose to make is for use with an open aerial, and not with a frame. F. L. C.

Your statement is right as far as it goes, and the purpose of the switch is to short-circuit the loading coil for reception on the medium band. You have, however, ignored the fact that for either wave-range it is necessary that the filament connection should be taken from the centre point of whatever inductance may be inserted, and this combined operation cannot properly be carried out by means of a single-pole break switch. If this is used, a careful consideration of the diagram will show you that the coil would be connected to filament through the inductance of the loading coil when receiving medium waves, and the circuit arrangement would in effect be that of Fig. 2 (a), in which the unwanted inductance is shown at L.

The desired effect could be achieved by using a switch having two fixed contacts and a moving arm for short-circuiting them. The centre tap of the long wave loading coil and the filament connection would be joined to this arm in the manner shown in Fig. 2 (b). We doubt if such a switch is available commercially in a suitably compact form, but would add that an electric light switch may sometimes serve the purpose, particularly if it is of a type in which it is convenient to make an electrical connection to the moving blade.

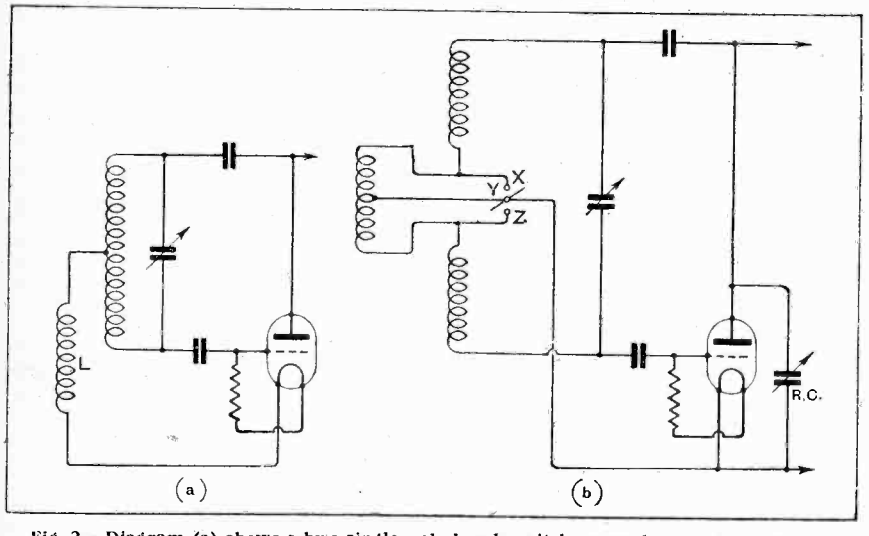

Fig. 2.—Diagram (a) shows why a single-pole break switch cannot be used in a throttle Hartley circuit. In diagram (b) are given the connections of a special switch having fixed contacts X, Z, which are bridged by a moving blade Y.

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Discharge Rates.

Although it is generally considered safe to discharge L.T. accumulators at a rate equal to about one-tenth of their total ampere-hour capacity, I notice that this is not the case with regard to H.T. batteries; the makers in many instances recommend that they should not be discharged at more than about one-hundredth of their full capacity. I have always imagined that the two types of cells are essentially the same, differing only in size, and would like to know the explanation of this apparent discrepancy. R. P. S.

The safe and economical discharge rate of an accumulator cell is governed mainly by the area of its plates, and as a rule those used for H.T. supply are small and comparatively massive. This accounts for the fact that a heavy current cannot be drawn from them effectively. A similar state of affairs exists with regard to the "mass" type of L.T. cell, which is used to supply comparatively small filament currents.

Although these plates are not suitable where current demands are heavy, they have an important advantage in that they are not susceptible to damage from sulphating when the discharge is spread over a long period.

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A Two-station Receiver.

Will you please refer me to a published constructional description of a simple receiver which would be capable of giving good loud speaker signals from the two Daventry stations? I have an aerial which is well up to the average, and would prefer a set without home-made parts, as I have no workshop facilities. T. N. R.

We see that you are situated at a distance of nearly sixty miles from Daventry, and, assuming that your conditions are even moderately good, we think that the "Pentode Two" receiver, described in our issue for October 17th, should be quite suitable. As coils for this receiver may now be obtained commercially, you should not find any difficulty in its construction.

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L.F. Switching.

The provision of a switch for cutting-out an L.F. amplifying valve seems to have gone out of fashion, but in spite of this I am tempted to include it in my set. What is your advice? M. L. W.

In this matter we are in full sympathy with present practice, and consider that the inclusion of a switch is only justified in exceptional circumstances. An L.F. amplifier is nowadays so designed that the output valve will be fully loaded up when the H.F. voltage applied to the detector is roughly that at which it works best, and the drastic expedient of cutting out a complete stage is likely to introduce serious complications, apart from the fact that the necessary complicated wiring may produce instability.

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Accumulator or Eliminator?

My D.C. mains supply is at 240 volts pressure. Will you advise me whether it would be preferable to buy an accumulator H.T. battery and to charge it from the mains through a resistance or to obtain an eliminator? My set has a total of four valves, and circumstances make it impossible for me to reproduce at very great volume; in fact, the output obtainable with 120 volts (at present supplied by dry batteries) is as much as I require. D. R.

It is not altogether easy to give a definite expression of opinion as to which form of supply would be the most suitable for you. There is always the possibility that a D.C. supply will require elaborate and expensive smoothing devices, and other difficulties are sometimes encountered, particularly if the positive pole happens to be earthed. Accumulators, on the other hand, require a certain amount of attention; in the lack of it their life is not likely to be long. On balance, however, we are inclined to recommend accumulators to those having D.C. mains.