NEW MOVING COIL SPEAKER

The Wireless World AND RADIO REVIEW

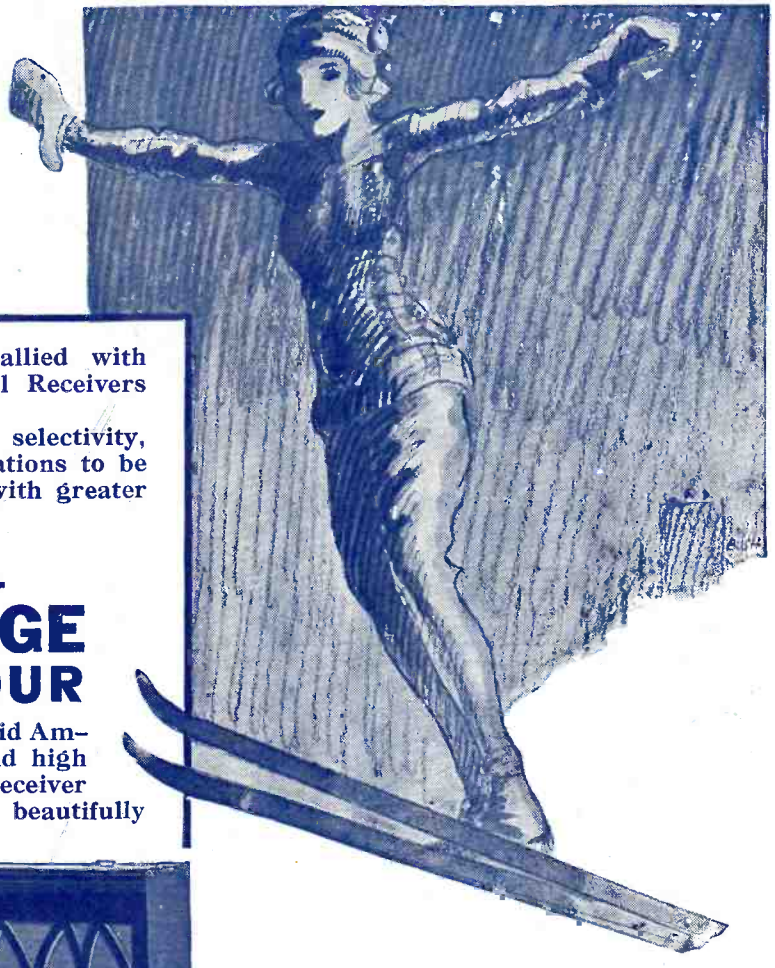
4D

The Paper for Every Wireless Amateur

Wednesday, January 15th, 1930.

No. 542. Vol. XXVI. No. 3.

EXACTNESS THAT COUNTS...



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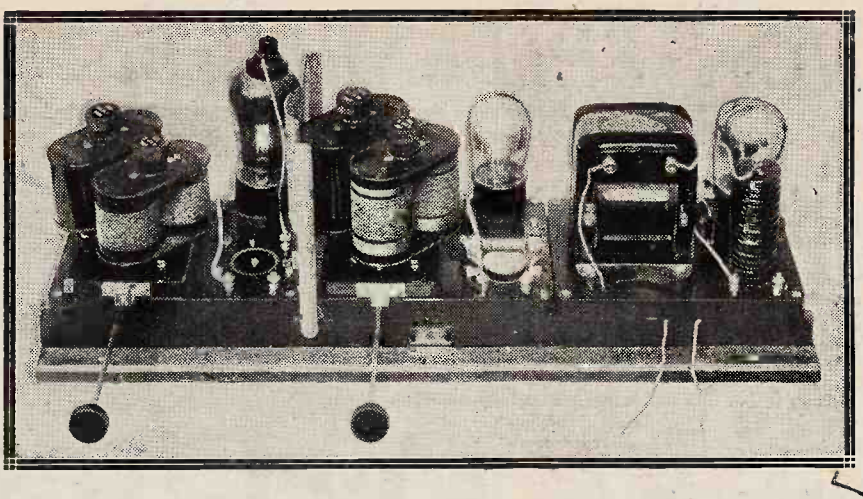

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(17th Year of Publication)

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CONTENTS OF THIS ISSUE.

A WIRELESS LICENCE SCANDAL.

A WIRELESS receiving licence costs but 10s. a year, and this is not a large sum when we consider the hours of programmes to which it entitles us. *The Wireless World* has always supported the authorities in their insistence that the licence should be regularly paid, and we have approved of the attitude of the Post Office in bringing to book those who deliberately neglect to pay the annual fee. We have gone to considerable trouble to explain to readers who have written to us, and we have also published an interpretation of the regulations concerning the use of more than one wireless set in the same building.

Our Statement Officially Approved.

The Post Office has officially approved of the wording of the paragraph in which we have expressed the position as follows: "A single receiving licence will cover the installation of more than one set, provided that the sets are all in the same house, flat, etc., that is to say, tenants of separate flats or sub-let premises in the same building are not entitled to share the benefits of one licence, nor may extensions be made from a licensed set whereby the occupiers of other houses, flats, etc., may listen without taking out separate licences."

In view of this statement of the position officially approved by the Post Office, we were astonished to read in the daily Press recently that the Post Office had agreed that a single 10s. licence was sufficient to cover a wireless receiving installation which supplied 200 separate luxury flats apparently for the reason that they happened to be all within one building.

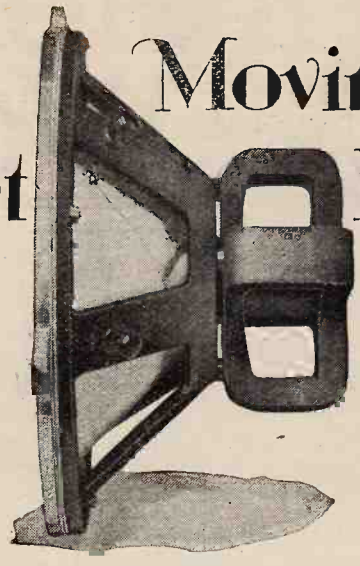
An Irregular Decision.

We cannot believe that this is a proper interpretation of the licensing position, and we draw special attention to this case because we feel that it should at once be looked into by the Post Office, and, even if fresh regulations are necessary to meet the situation, they should be made in order that individual tenants of the flats may be called upon to pay separate licences for broadcast listening.

We believe that legally the Post Office would find it difficult to enforce the payment of a licence fee on apparatus capable of receiving wireless broadcasting but which, in fact, was not being used by the owner for that purpose. This seems to point to the monopoly of the Post Office covering the *use* of apparatus for the purpose of listening rather than the *ownership* of the apparatus, so that we contend that in a building where one receiving set is installed it is even more important that the licence should be paid by those residents in the building who have separate loud speakers or telephones which they use for the purpose of listening than that the receiving installation itself should be licensed. Furthermore, it might be argued that under the Telegraphy Act, 1869 (Sections 4 and 5), the Post Office is entitled to a rental in respect of the extension lines to the individual flats.

If the Post Office attempts to justify their action in accepting one annual payment of 10s. for a licence for the installation in question which supplies 200 luxury flats, then we regard the position as little short of a scandal. The cottager and even the family living in one room is, under the present regulations, required to pay the 10s. licence, however difficult it may have been to raise the necessary money for the wireless set and to pay the annual licence, and this being so, why should residents in luxury flats enjoy the advantages of broadcast reception with first-class quality from an ideal and expensive receiving set without being called upon to contribute in any way towards the cost of programmes, whilst the poorer members of the community enjoy no such privilege?

Permanent Magnet Moving Coil Loud Speaker

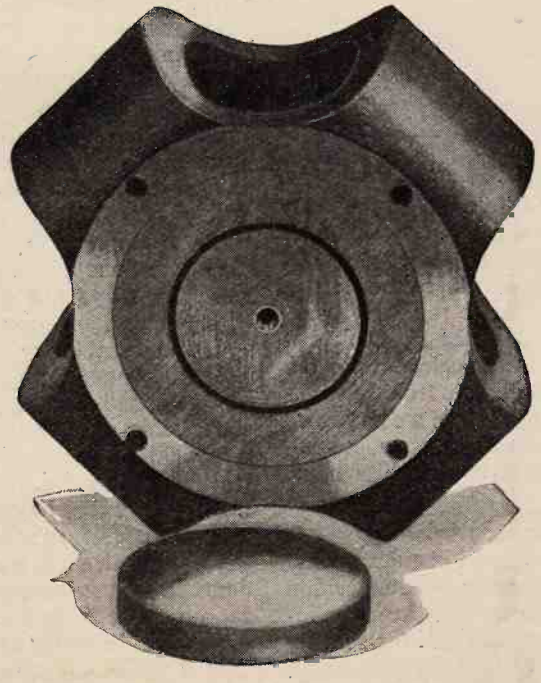


A Solution to the Field Current Problem.

By F. H. HAYNES.

WHILE it is now nearly three years ago since this journal first introduced moving-coil loud speaker designs little attention has been drawn to the possibility of dispensing with the field-energising current by the adoption of permanent magnets. In consequence the moving-coil loud speaker is restricted in its use to where electric supply mains are available, as the current demanded by the electro-magnetic field cannot be maintained by a portable accumulator. Attempts to use permanent magnets have proved unsatisfactory inasmuch as the flux density produced has invariably been inadequate. There is little point in using a weak field and hoping to make up for the loss of signal strength by the use of a generous winding on the moving coil, fed with the output from several parallel-connected power valves. In so doing the behaviour of the loud speaker may become less linear over the frequency range due to an increase in the mass, inductance and capacity of the winding, the current consumed by the output stage can only be provided by the use of supply mains, while the smallness of the gap and the largeness of the coil impose a limit beyond which one cannot go.

A minimum flux density of 10,000 lines to the square centimetre has been assessed in respect of the electro-magnetic type of field, and to produce this value in a gap of sufficient width and area requires a field winding dissipating up to some 30 watts. In this case the gap has a width of $\frac{5}{32}$in. and an area of about 20 sq. cms. To halve the width of the gap about one quarter of the field wattage is needed to produce the required field strength. Similarly with permanent magnets, to halve the area of the gap will nearly double the amount of available magnetic flux, while to halve its width will, in a well-designed magnet, increase the flux nearly four times. A compound permanent magnet that is intended to produce a high flux density across a small gap is by no means easy to design. Special forms of cobalt steel must be utilised to create the necessary high flux within a magnetic circuit of reasonable size and cross-section. Precautions must be taken to ensure that the flux can be carried by the iron where the cross-section narrows towards the gap, while the magnetic leakage is governed by the shape, and saturation is kept to a minimum so that the field is concentrated within the space to be occupied by the moving coil. Many instances have come to the writer's notice of attempts to construct a compound permanent magnet in which it was hoped that the total flux when added would produce the required density at the gap. Measurement has shown, however, that the flux density is much lower than was anticipated, while the performance of the finished loud speaker was inferior in quality to an electro-magnetic type working from a given output stage.



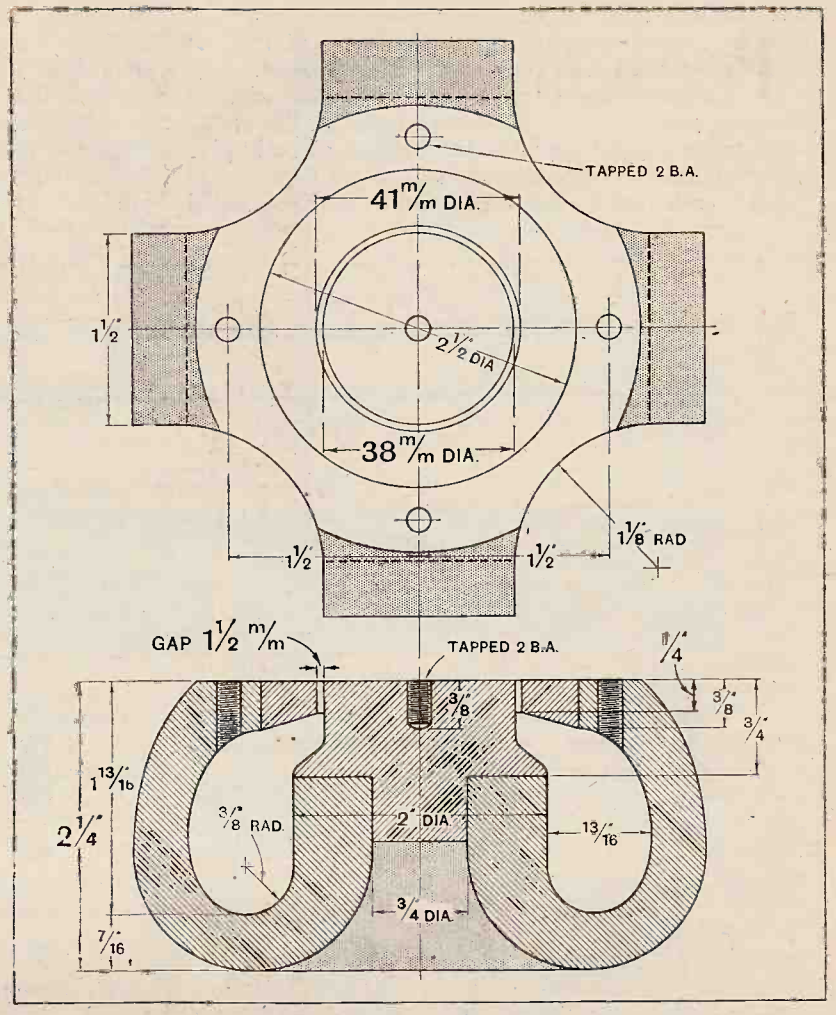
Permanent magnet with 1.5 mm. gap and fitted with soft iron pole pieces. Flux density 8,000 lines to the sq. cm.

It was not until the Exhibition of last September that attention could hopefully be turned to the possibilities of a reasonably compact permanent magnet. Many readers must have examined with interest the moving-coil loud speaker magnets, then just produced, and shown at the stand of Swift Levick.[1] These magnets

[1] Designed by G. D. L. Horsburgh, Swift Levick & Sons, Ltd., Sheffield. Obtainable, together with other materials required in the construction of the complete loud speaker, from the Epoch Radio Manufacturing Co., Ltd., 3, Farringdon Avenue, London, E.C.4, and A. M. E. Sherwood, 150, King's Cross Road, London, W.C.1.

Permanent Magnet Moving Coil Loud Speaker.

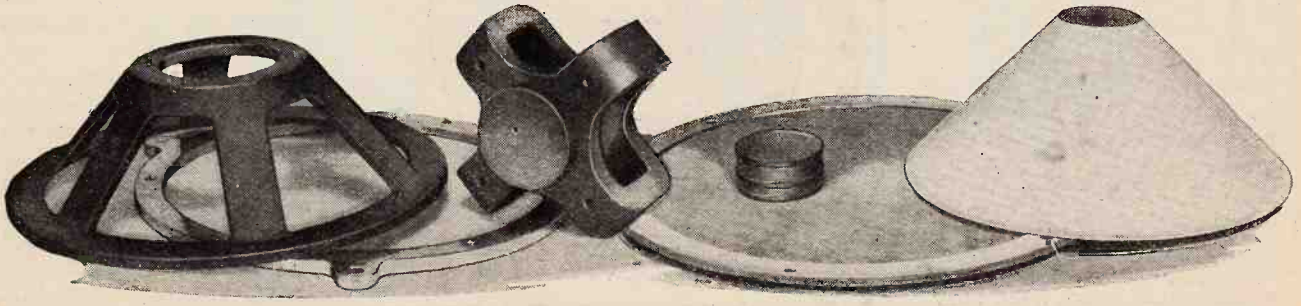
were of only moderate size, of unique shape as regards casting and machining, and were stated to possess flux densities of the order of 5,000 lines to the square centimetre. Subsequent development by way of a small increase in size and cross-section, minor modifications in shape and the insetting of mild-steel poles to convey the concentrated flux to the gap, has now resulted in the production of magnets of an assured flux density of 8,000 lines to the square centimetre when the gap width is 1.5 mm. and the area 7 sq. cms. This area permits of a pole diameter of 1½in. with a gap length of ¼in. We now have a permanent magnet which promises to satisfactorily replace the electro-magnet. As width of gap has so great an effect on flux density the dimensions decided upon must be no larger than is required to just accommodate the coil. On the other hand the reduction of diameter reduces the area of the gap, with consequent increase of flux, but the number of turns on the moving coil must be increased in proportion to the reduction of their diameter.



Detailed drawing of the larger type magnet with a gap of 1.5 mm. and a flux density of about 8,000 lines to the sq. cm. A smaller type magnet is available having a 2 mm. gap and giving a flux density of some 5,000 lines to the sq. cm.

Coils for Small Gaps.

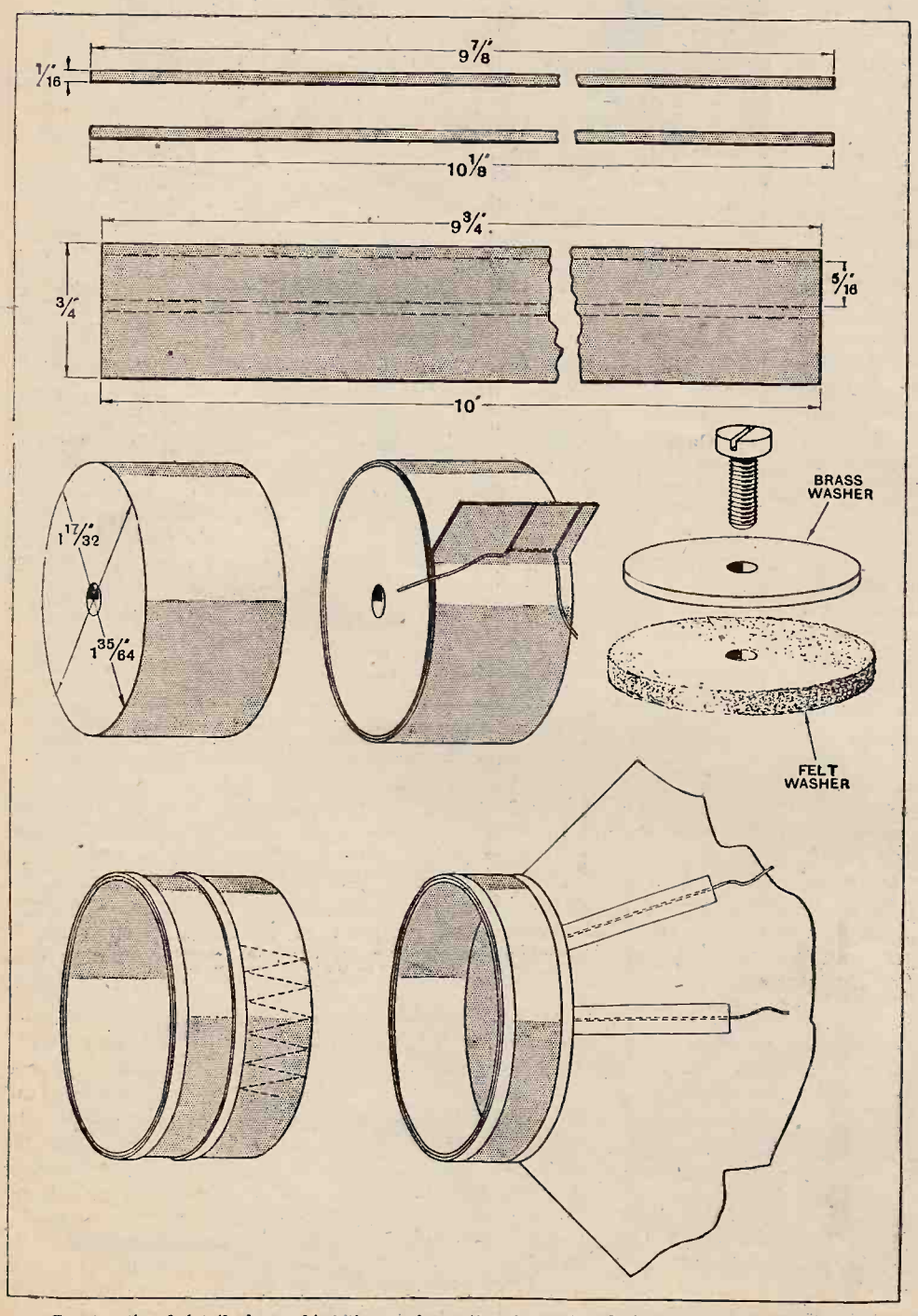
Our problem is now that of filling the gap to the utmost with the moving-coil winding, for if there is any space to spare this should obviously be taken up by decreasing the width or area of the gap. There is no question that the best method is that of building the moving coil as a single layer of edge-wound strip, as has long been done by the Gramophone and Western Electric Companies. Somewhat special tools are required to effect this, but the resulting coil is exceedingly stiff, requires little support, and can be relied upon to maintain its shape. For lightness the strip used may be aluminium, carrying a single covering of silk or enamel, wound so that it stands edgewise on its former. Another winding that suggests itself is three layers of No. 36 enamelled wire, operated like the strip-wound coil, through an output transformer. For the home constructor there is another possibility in that with reasonable care he can wind a high-resistance coil, thus obviating the dangers of distortion incurred by the output transformer. A high-resistance coil designed to handle a given value of signal watts occupies a slightly greater volume than the corresponding low-resistance winding actuated



Components used in the construction of the model having the 2 mm. gap. The surround material is secured without stretching to the cardboard rings and the spare material is cut away after the diaphragm has been attached.

Permanent Magnet Moving Coil Loud Speaker.—through a transformer owing to the increased ratio of insulation and space to conductor. Nevertheless, there is just sufficient room for a high-resistance winding possessing the maximum number of turns for the undistorted power output specified for a valve that will give ample volume for home conditions.

Test reveals that a 1,300-turn coil of No. 48 enamelled wire gives practically faultless results when fed from a P.625 valve. It is owing to the fact that No. 48 enamelled wire is the finest that can be conveniently handled that it has been adopted, though its signal-carrying capacity is considerably in excess of that produced in the anode circuit of the P.625 valve. Incidentally, the output from a valve such as the L.S.6A can be carried by the winding. It might be noted here that the vast improvements that have taken place in the past year in the power output of L.F. valves makes it possible to produce adequate signal strength with less distortion, coupled with a more compact moving-coil winding.



Constructional details for making the moving coil and centring device. Two dimensions are shown on the brass former, the smaller being applicable to the narrow gap (1.5 mm.).

A thin paper ("detail paper," thickness 0.004in.) former is constructed to carry the winding. It is made exact to size by wrapping round a smooth brass cylinder. Dimensions for cutting out the paper, which should be of a thin, smooth, non-shiny variety, are given in the diagrams. Two layers are wrapped round the brass cylinder, a thin coating of seccotine completely covering the faces which adhere together. Seccotine must be kept away from the interior and outside surfaces to obviate the sticking of the former to the cylinder and to permit of a subsequent treatment with shellac varnish before winding on the wire. As the turns are to be put on in a bank-wound fashion across the former, and not layer by layer, the cross-over lead of No. 42 or 44 wire is taken through under the end of the paper before sticking on the end strips which form a support to the winding.

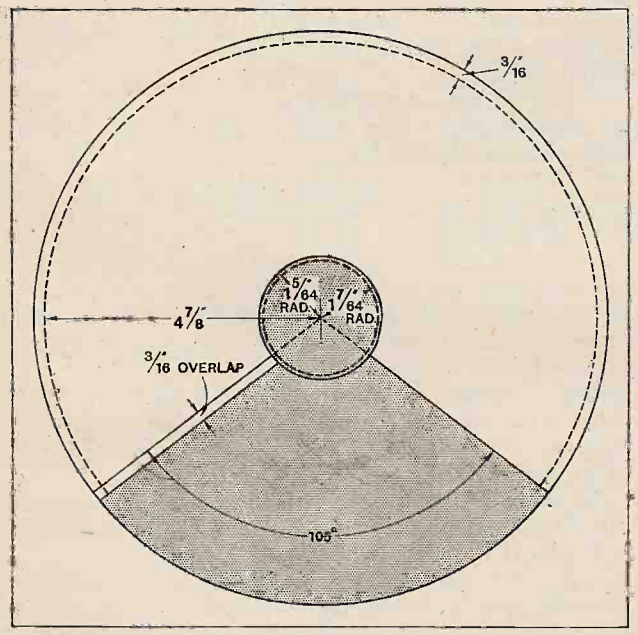
A spindle and crank handle such as can easily be made up is used to rotate the cylinder, and care must be taken to see that the former and end pieces run true on the cylinder or otherwise the wire may ride over the edges when winding is

Permanent Magnet Moving Coil Loud Speaker.—

commenced. The reel carrying the No. 48 wire is lightly mounted in line with the former and away from the operator. By the use of fine "blue-back" emery the enamel covering of the wire is removed and is lightly soldered, without need for twisting, to the lead out wire already provided. Allowing the wire to lightly pass through the fingers of the left hand and turning the crank with the other 200 turns are run on into one-sixth of the winding space. With care there is little danger of breakage, and a magnifying lens is useful for examining the condition of the winding. Owing to the careful attention required in handling the wire it is helpful to note down each 100 turns as completed in order to guard against an error in counting. If on completing the winding space there is room for another 100 turns, or if the former is filled with 100 turns short of the required number, there is no need to leave a space or, alternatively, to cramp the turns, but to aim at filling the former with an approximate winding. Test the former frequently to make sure that it can be released from the smooth brass centre-piece. Test the winding, also, for continuity, on completion, with a milliameter and 1.5-volt cell. The current will be 0.75 mA. It is worth while making a pair of coils while the winder is set up.

Right Angle Cones for 1.5 mm. and 2 mm. Gaps.

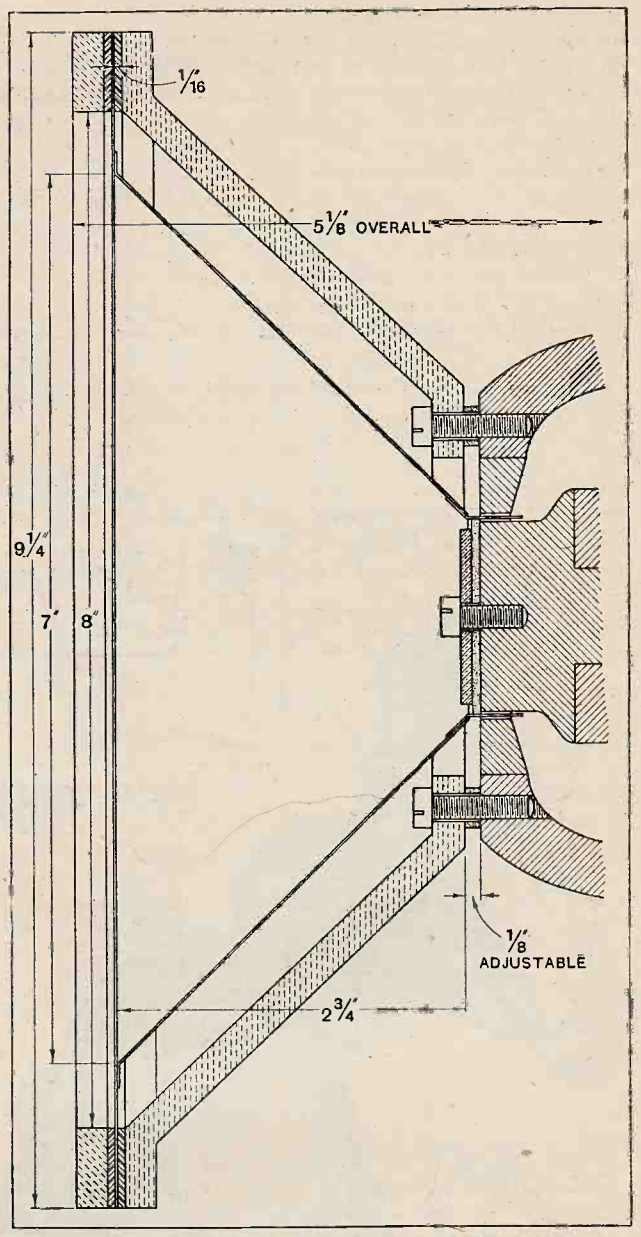
Impregnate the winding with good shellac varnish, leaving it on the cylinder to dry and frequently sliding it to ensure freedom, taking care not to burr up the



Details for cutting out the diaphragm. The centre hole has a larger radius when used with the magnet having a 2 mm. gap.

ends of the former or to crush it while forcing it free. When thoroughly dried out in front of a fire cover the winding, end-pieces with a single layer of shellac impregnated absorbent tissue paper.

What is known as "two sheet" (thickness 0.010in.)

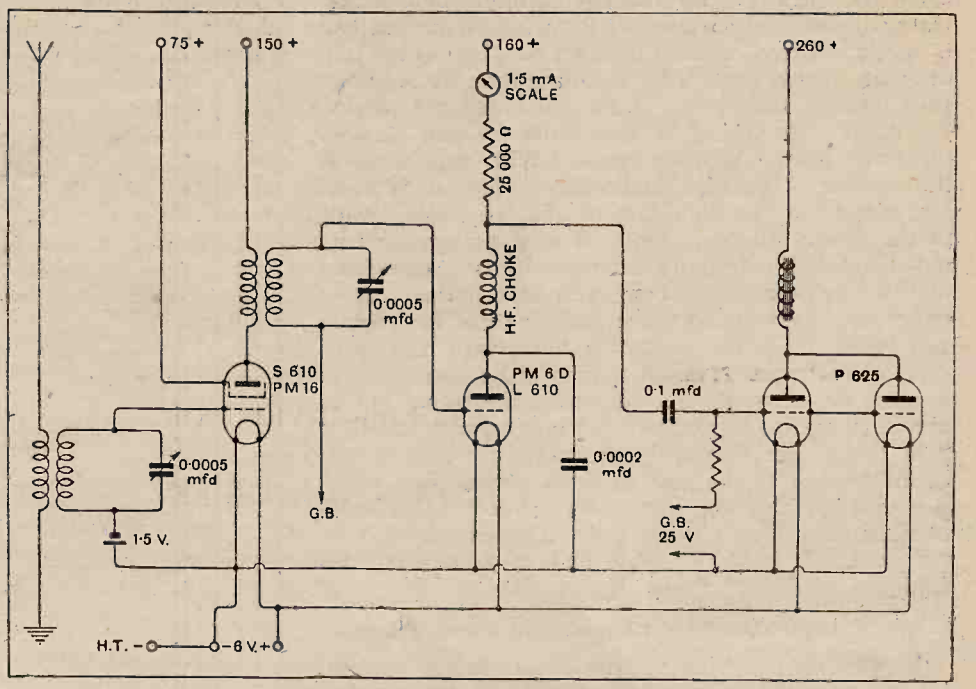


Sectional view of the finished diaphragm and cradle. Spacing washers are inserted in order that the winding of the moving coil may fall centrally within the gap.

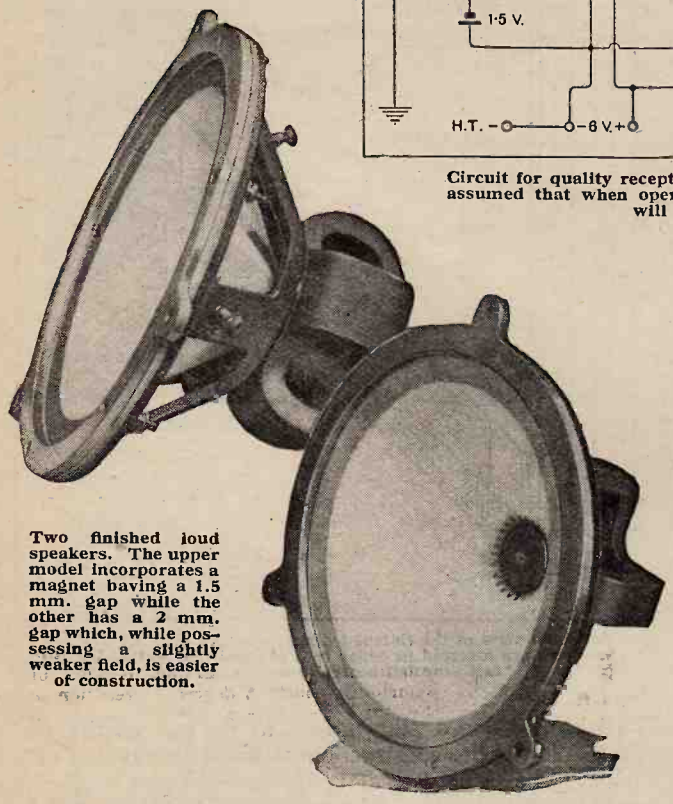
"Bristol" board still proves to be one of the best materials for the construction of the diaphragm. The edges to be secured together are bevelled and roughened with a smooth file. A stick of wood with a saw-cut end is used to turn over the front for attaching to the surround. With a pair of sharp side-cutting pliers the points are made on the end of the former at intervals of about $\frac{1}{8}$in., taking care not to injure the leading out wires. While held on the brass cylinder shellac is removed from the outer face of the points, and these are then roughened with the file. A tight fit should result when the former is brought up to the diaphragm, and, assuming the end ring has been carefully mounted,

Permanent Magnet Moving Coil Loud Speaker.—the axes of coil and diaphragm will coincide. While still holding the coil with the aid of the brass cylinder the joints are turned back on to the seccotine-coated rim of the diaphragm, and after, perhaps, a quarter of an hour they will be found to hold in position. The blade of a penknife can be used to press them down, following round from point to point until the seccotine has hardened. One loose or split point will give rise to rattle.

A pair of cardboard rings are cut and secured with seccotine, coinciding on the two sides of the surround material. While leather is still regarded as one of the most satisfactory materials for constructing the surround thin rubberised cloth (" Britcam ") is used in this instance as it is convenient to work and can be made to lie flat without tensioning. With the card rings securely fixed the diaphragm is attached concentrically, the edge being " ironed " down. When dry, cut a rough hole in the centre of the rubberised cloth and then follow round carefully with the sloping edge of a razor where diaphragm and surround meet, being careful that the grain in the cloth does not cause the edge of the razor to wander from the circle. In planning the diaphragm and its aluminium flange allowance has been made to permit of the insertion of spacing washers so that the coil winding can be brought centrally within the gap.



Circuit for quality reception from a local station. Suitable values are given and it is assumed that when operated from an eliminator the voltage regulating resistances will be arranged to avoid interstage coupling.



Two finished loud speakers. The upper model incorporates a magnet having a 1.5 mm. gap while the other has a 2 mm. gap which, while possessing a slightly weaker field, is easier of construction.

The provision of centring is, of course, essential in so small a gap. Any form of attachment by paper spider effectively ties down the movement of the coil, and if loosely mounted is of little use. The centring adopted consists of a brass ring and baize pad so that the coil actually rides on the edge of the baize which fits into the centre of the coil former. This form of centring does not produce an increasing restriction on the movement with increase of amplitude. At the same time it allows the coil to take up a position in the gap as determined by the surround apart from the centring device. Leading-out wires are seccotined down to the sides of the diaphragm under strips of tissue paper some 1½in. in length and then taken on to terminals carried in insulating bushes on the aluminium frame.

To ensure good results attention must be given to the circuit of the receiver, and experience shows that a single H.F. stage with either neutralised triode or screen-grid valve, transformer-coupled to an anode-bend detector and followed by a resistance-coupled L.F. stage, is about the best when using a good outside aerial. This circuit, with suitable values, is given. Such a set is a local-station receiver, and it will quickly be realised that good-quality reception cannot be obtained from distant stations if only for the reason that a sensitive set introduces background noises. Owing to the impedance of the loud speaker being somewhat low in value, the use of a pair of parallel-connected output

Permanent Magnet Moving Coil Loud Speaker.—

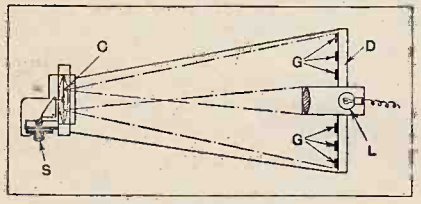
valves gives an appreciable increase in volume. Two P.625 valves produce a sensitive output stage in view of the comparatively high amplification factor and the relatively low impedance. If the grids are fully loaded the power output of the pair of valves is nearly two watts when combined with the moving coil described, while with a single valve this output is more than halved.

To those accustomed to the use of a moving-coil loud speaker where the field excitation is derived from a rectifier this loud speaker is to be specially commended. Although the background ripple coming from a rectifier used to energise a field magnet may be practically inaudible, its removal makes a vast difference to the quality of reception, particularly as quite large 50-cycle amplitudes may be built up without an appreciable sound resulting. Moving-coil loud speakers are, moreover, particularly responsive to these low frequencies, whereas a reed-driven cone invariably gives no response below 100 cycles. Tested over the frequency range with audio-oscillator and calibrated microphone using valve voltmeter as a means of measuring the amplitudes transmitted and received, the finished speaker reveals a characteristic as good as any other model, possessing, at the same time, the well-defined brilliancy only to be found in speakers of the moving coil type. The base response is as good at 40 cycles as at 200, while a falling off does not occur until a frequency of 6,000 is reached, which is a condition with all types of loud speakers and, incidentally, of the associated amplifier as well.

RECENT INVENTIONS OF WIRELESS INTEREST.

AN OPTICAL PICK-UP.

The drawing illustrates an ingenious method of converting the mechanical movements of a gramophone stylus into a fluctuating electrical current of corresponding value (patent No. 314,126). At the centre of the diaphragm C is a small spot of deposited silver, acting as a reflector to a beam of light projected from a lamp L. The lamp is mounted in the centre of a disc D carrying a series of light-sensitive cells G. The movements of the stylus S as it follows the track of the gramophone record vibrates the diaphragm C, and so varies the intensity



Converting the movements of a gramophone needle into fluctuating currents by means of a reflector and light-sensitive cell. (No. 314,126.)

of the light reflected back on to the cells G from the "silver spot" mirror, thus giving rise to corresponding current changes in the circuit of those cells. The component parts shown are all mounted on the tone arm.

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INDIRECTLY HEATED VALVES.

The sensitised cathode of a valve is energised by heat generated when the current from A.C. mains is applied to a condenser of which the cathode forms one plate (Patent No. 307,325). A highly refractory dielectric is used, such as zirconia, thoria, or silica. The sensitised cathode is in the form of a tube containing the dielectric, which contacts in turn with two semi-cylindrical metal plates to which the alternating mains voltage is applied. The arrangement in effect forms two condensers arranged in series, the external cathode being the common or central plate, so that it remains at a constant potential.

In another arrangement (Patent No. 307,326) the sensitised cathode is heated by ionic bombardment set up across the gap between its inner surface and a central auxiliary electrode, the A.C. mains being directly connected across the two. The tubular cathode forms an electrostatic screen for the other electrodes.

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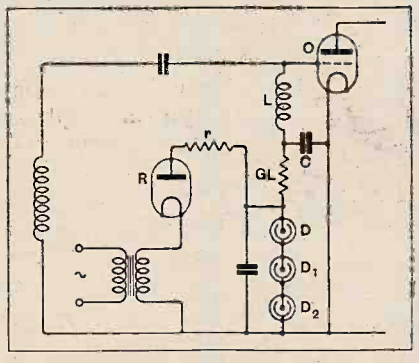
SAFEGUARDING POWER OSCILLATORS.

During normal operation the passage of grid current automatically maintains the grid of a transmitting valve at a safe negative bias. Should the valve cease to function, the negative grid charge tends to disappear, and if no precautions were taken this would in most cases cause the transmitter to burn out. In order to prevent such a contingency, the arrangement shown in the figure has recently been protected (Patent No. 308,085).

The ordinary grid condenser C and grid leak G L are supplemented by a



Maintaining a safe negative bias on a transmitting valve. (No. 308,085.)

choke L, and by one or more discharge tubes D, D_1, D_2 designed to flash over at a voltage corresponding to the minimum "safe" grid potential of the oscillator valve O. So long as the transmitter is in operation the correct working grid bias is maintained, any excess voltage escaping *via* the tubes D-D_2. Should the valve cease working, so that the grid current stops, a rectifier valve R comes into action and provides sufficient negative grid bias to prevent any damage to the power valve.

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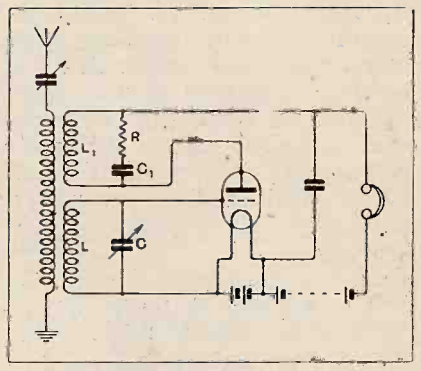
A CONSTANT-COUPLING CIRCUIT.

It is well known that in the ordinary type of back-coupled receiver the coupling factor tends automatically to increase for



A constant reaction scheme with shunt circuit RC_1. (No. 283,121.)

the shorter wavelengths, and to fall off for the longer waves, even if the spacing between the two coupling coils is maintained constant. A simple method of ensuring a constant degree of reaction in this type of receiver, even over a wide variation in tuning, is illustrated in the accompanying diagram (Patent No. 283,121).

The plate or reaction coil L_1 is shunted by a reistance R in series with a condenser C_1. When the input circuit L C is tuned to a short-wave station, the shunt circuit R C_1 tends to bypass a larger proportion of the plate current than when the set is tuned to a long-wave station. The effective current flowing through the reaction coil L_1 is accordingly regulated so as to offset automatically any fluctuation in the degree of reaction as the tuning of the input circuit is altered.

HIGH SELECTIVITY

Hints on the Operation of Ganged Filter Circuits.

By W. T. COCKING.

(*Concluded from page 35 of previous issue.*)

IN Fig 6 are given full details of the medium-wave coils which have been used in experiments with the band-pass filter. While it is not claimed that they are the best which can be made, in practice they give extremely good results, and they have the merits of being both compact—an important point—and inexpensive. The inductance of each coil is 240 microhenrys, and the calculated H.F. resistance at 500 metres is 5 ohms; the tuning condenser should have a capacity of 0.00035 mfd.

The Use of Trimming Condensers.

Each coil consists of 76 turns of No. 26 enamelled wire on a 2in. diameter ebonite former. The formers are placed side by side in the position indicated, and as close as possible without the wire of one coil touching the former of the other; and in a position such that the distance between the end turn of one coil and the end turn of the other is exactly one inch. The value of coupling given by this arrangement has been found to be very satisfactory under all conditions; in some cases, however, a different value may give better results, and the effect of varying the coupling should certainly be tried. The two ends of the coils which come together in this method of mounting should, of course, be the low-potential (earthed) ends in order to reduce the possibility of capacity coupling.

In order to obtain the best results from the filter circuit it is essential that the two condensers in each filter be ganged; and, if this is done, there is no difficulty in ganging all the tuning condensers and making a single-control set. Ganging filter circuits is quite a different proposition from ganging the condensers of the usual cascade tuning circuits; the difficulties encountered are the same, but they are present in a very much smaller degree. Slight imperfections in the ganging do not make very much difference to the signal strength; instead, they make the tuning curve asymmetrical.

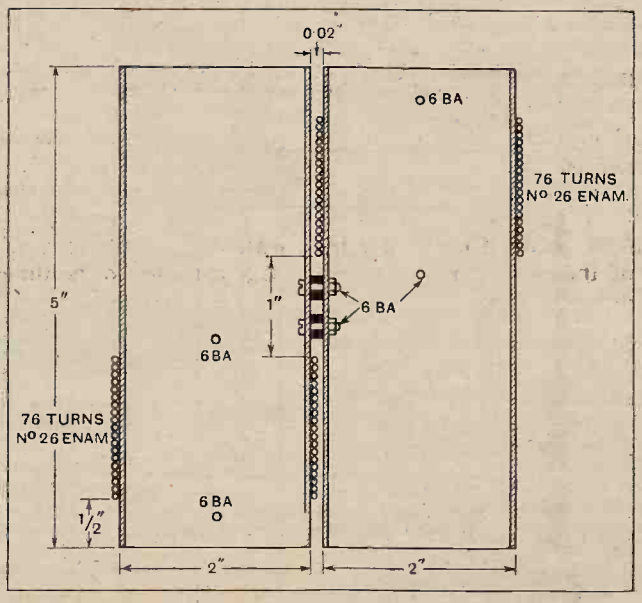


Fig. 6.—Dimensions of medium-wave coils which have proved successful in band pass filters. The inductance of each coil is 240 microhenries.

The greatest difficulty with ordinary tuning circuits lies in the aerial circuit, owing to the extra capacity thrown on to it by the aerial. Since the inductances of all the coils can very easily be made almost identical, the chief point in ganging the condensers of any set is to make the stray capacities across each tuned circuit the same. In the ordinary tuning arrangement this is difficult; each circuit usually has a very different minimum capacity. With filter circuits, on the other hand, the capacities are more evenly divided; indeed, sometimes the circuits are so nearly alike that almost perfect ganging can be achieved without the least trouble.

In certain cases, when volume control is carried out by means of a high-resistance potentiometer shunted across the secondary coil of the aerial filter, it is found that this circuit has the highest minimum capacity of any. Therefore, the capacity across every other coil must be increased; and this is best done by connecting in parallel with each tuning condenser a small adjustable condenser with a maximum capacity of about 50 mmfd. In any circuit this method of matching the minimum capacities may be adopted with good results. While it is easiest to connect an adjustable condenser in parallel with each tuning condenser, it is wasteful, for in every case there is at least one circuit in which an extra condenser is unnecessary. By adopting the following procedure it is quite a simple matter to find out which circuits have low minimum capacities, and these are the only ones which need additional condensers: Tune in a station on about 500 metres by adjusting each section of the gang condenser separately. Tighten the couplings between them, and tune in a station on as short a wavelength as possible. Loosen the couplings, and, having noted the positions of the rotors, tune in the station to its best on each condenser separately. That circuit which requires the vanes of its tuning condenser to be enmeshed the *least* has the *highest* minimum capacity. Therefore, unless capacity can be

High Selectivity.

removed from this circuit, all the other circuits must have a small condenser connected across them.

The operation of adjusting the capacities of these equalising condensers is quite simple. Set them all at minimum, and tune-in a station on the higher wavelengths (500 metres or so) by altering the positions of the rotors of the ganged condensers. Tighten up the couplings, and tune-in another station at the other end of the scale. This time do not loosen the coupling, but tune it in to its best by the small adjustable condensers. Now return to the longer wavelengths, and aerial lead a series condenser for adjusting the minimum capacity of this circuit, and to include a different condenser for each waveband.

Tuning Appears Flat with Band Pass Filter.

All these equalising condensers are shown in the circuit of Fig. 7, and also the recommended method of switching for waveband changing. Reaction is shown, but can, of course, be omitted if desired. The reaction winding should consist of a few turns of thin wire, wound at the earthed end of the secondary coil of the anode filter. Care should be taken to ensure that

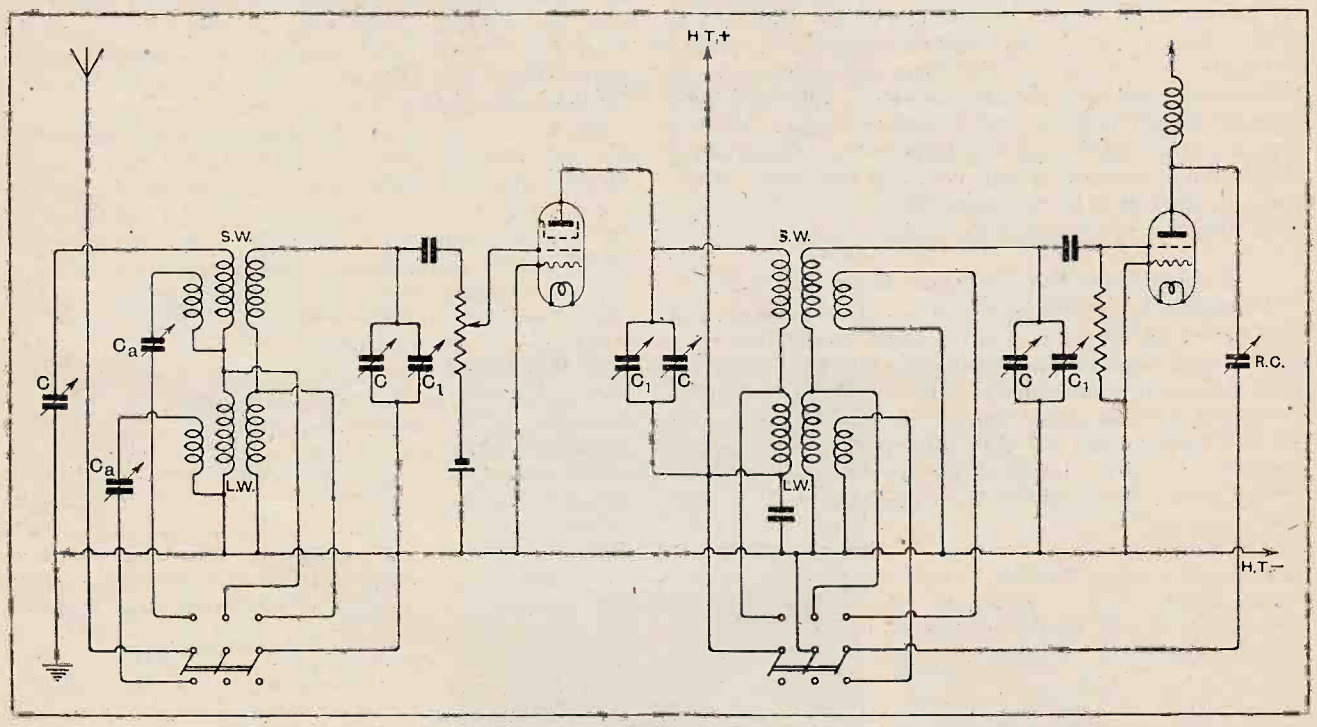


Fig. 7.—Circuit showing ganged filters, equalising condensers and a suggested method of waveband switching. C, ganged tuning condensers 0.00035 mfd.: C_1, equalising condensers of 50 mmfd. and C_a series aerial condensers.

again tune-in a station by altering the positions of the rotors. Tighten up the couplings and go back to the short wavelengths; tune-in a station on the adjustable condensers. Repeat this until no adjustments are necessary at any part of the scale. Usually it need only be done two or three times, but the oftener it is carried out the more perfect will the ganging be.

The Series Aerial Condenser.

The operation of ganging, if carried out on these lines, is by no means difficult, and, fortunately, once the condensers are properly ganged on the medium waveband, the ganging still holds good when the long-wave coils are switched in. This is provided that the long-wave coils all have the same inductance and self-capacity, which is usually the case. The only circuit likely to give trouble in this respect is the primary coil of the aerial filter. There will be no trouble if the aerial winding is suitable, but, unfortunately, this is different for every aerial; the best remedy is to include in the it has a very low capacity to the tuned winding, otherwise either howling will result on the long waveband or the ganging of the last tuning condenser will be affected. This is not peculiar to the filter circuit, for it will occur with any circuit in which the reaction winding has a large capacity to the tuned grid circuit. On first operating a set employing band-pass filters the results may at first seem a little peculiar. As the single tuning control of a properly designed set is rotated a station will suddenly be heard, it will remain at constant strength over a condenser movement of several degrees, and then, as the control is further rotated, it will suddenly disappear. At first the tuning seems very flat, for when listening to a station quite a large movement of the dial produces little or no change in strength; but on each side of this band the station is suddenly cut out. The effect is due, of course, to the relatively flat-topped tuning curve obtained with these circuits. When trying out a new set it may be said that, after all the condensers are properly ganged, if a station can be tuned-in sharply

High Selectivity.

at one distinct setting of the dial, the coupling between the coils is too loose. On the other hand, if a station can be tuned-in sharply at two distinct settings of the dial the coupling is too tight. The coupling is correct when every station is audible over a small range of dial settings, but cuts off sharply outside that range. If it is noticed that the selectivity is less on one side of a station than it is on the other, it is a sign that the ganging is imperfect; the remedy is obvious.

The most satisfactory layout for a set using filters is undoubtedly one which is more or less symmetrical. The aerial circuit filter can be enclosed in a metal box, and the anode circuit filter in another box of the same dimensions. The layout of components in each box should be the same, in order to keep the stray capacities as far as possible alike in each circuit. The H.F. valve can very well be placed between the screening boxes. With a layout of this kind there is very little danger of instability, due to the anode circuit coils coupling with those of the grid circuit, but it is, of course, necessary to insert the usual decoupling devices in the battery leads.

Remarkable Selectivity and Good Quality.

The writer has found that a set built to the diagram of Fig. 7, with a layout on the lines indicated, gives very good results when followed by a two-stage L.F. amplifier (one R.C., one transformer). The coils used in the experiments were made to the specification given earlier in this article, and all four tuning condensers were ganged. As an indication of the selectivity obtainable, it may be said that with a P.M.12 valve for the H.F. and a slight amount of reaction to counteract the detector damping, Toulouse can be received at full loud speaker strength without any jamming from Brookmans Park, although it is only about nine miles away. This could not be done with the same H.F. valve and two tuned circuits, at the same distance from the old London station. The separation of 2LO from Toulouse is only 58 kc., so this indicates a very high order of selectivity, and the valve used has both a lower A.C. resistance and a lower amplification factor than the A.C./S.G., for which the calculations were carried out.

On the long waveband it is not possible to receive Koenigswusterhausen without jamming from both 5XX and Radio-Paris. This is hardly surprising, since the separation is only 9 kc.; Radio-Paris, however, is quite clear of Daventry. The most noticeable improvement on the long waveband is the exceptionally good quality.

On both wavebands the amplification is noticeably less than with the same valve used with only two tuned circuits; this is inevitable, and represents the price which has to be paid for the high selectivity and good quality. The loss in amplification, however, is not serious, since by the use of the indirectly heated cathode screen-grid valve the amplification can be made the same as, or nearly equal to, that with a battery type valve with two tuned circuits. It may be said, therefore, that the filter circuit offers real advantages, not only for the improvement in quality but also in providing the high selectivity necessary under modern broadcasting conditions. In addition, a not inconsiderable advantage which it offers is the greater ease with which a really single-control receiver can be made.

International Amateur Telephony.

The Federal Radio Commission of U.S.A. has recently granted permission for the use of amateur telephony on 14,100 to 14,300 kc. (21.28 to 20.98 metres) by those holding extra first-class operators' licences or otherwise able to show special technical qualifications. The privilege, however, is in every case subject to the endorsement of the licence by the A.R.R.L., as the waveband is so restricted that the Supervisors of the League wish to limit the right to amateurs of demonstrated technical ability.

The Editor of our esteemed contemporary, *QST*, fears that the language barrier may prove a difficulty in transatlantic conversations, but he is, we think, unduly pessimistic when he writes: "Even when we talk to our cousins in the far-flung lands of the British Empire we cannot be too sure that our harsh American accent will convey much intelligence to the carefully attuned British tympanum. We may need a new international abbreviation to mean 'I hear you perfectly, but I haven't the slightest idea what you are talking about!'" We suspect that Mr. Warner is trying to "pull our legs" but hasten to assure him that, provided his followers do not indulge in too high flights of ultra-Americanism, we do not anticipate any great difficulty in understanding them.

TRANSMITTERS' NOTES.

International Amateur Radio Union.

It may be of use to our readers if we give a list of the various branches of the I.A.R.U. and the addresses to which communications may be sent. The Headquarters are the offices of the American Amateur Relay League, Hartford, Connecticut, where the business of the Canadian Section is also conducted. The affiliated societies are:—

Gt. Britain.—Incorporated Radio Society of Gt. Britain, 53, Victoria Street, London, S.W.1.

Australia.—Wireless Institute of Australia, 51, Castlereagh Street, Sydney, N.S.W.

Belgium.—Reseau Belge, 11, rue du Congres, Brussels.

Denmark. — Experimenterende Danske Radioamatorer, 5, Holmens Kanal, Copenhagen K.

France. — Reseau Emetteurs Français (R.E.F.), P.O. Box 11, Boulogne-Billancourt (Seine).

Germany. — Deutschen Amateur Sende und Empfang Dienstes (D.A.S.D.), Blumenthalstrasse 19, Berlin, W.57.

Holland. — Nederlandsche Vereeniging voor Internationaal Radioamateurisme (N.V.I.R.), P.O. Box 400, Rotterdam.

Italy.—Associazione Radiotecnica Italiana (A.R.I.), Viale Bianca Maria 24, Milan.

New Zealand.—New Zealand Assocn. of Radio Transmitters, P.O. Box 779, Auckland.

Norway. — Norwegian Radio Relay League, Voksenlia, Oslo.

South Africa.—South African Radio Relay League, P.O. Box 7023, Johannesburg.

Spain.—Associacion E.A.R., Mejia Lequerica 4, Madrid.

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American Time Signals.

A slight alteration in the code of signals from stations in U.S.A. will be made as soon as the transmitting clocks have been altered. The new code will consist, as before, of the transmission of a dot for each second of the five minutes preceding the actual time signal, omitting the last four dots (at the 56th, 57th, 58th, and 59th second) of the 55th to 58th minute, and the nine dots immediately before the dash which indicates the hour; the 29th dot in each minute is also omitted. The new feature will consist of the omission of the dots at the 51st second of the first minute of the signal, at the 52nd second of the second, the 53rd second of the third, and the 54th second of the fourth minute. The dots following these gaps indicate the number of minutes to go before the final dash.

CURRENT TOPICS

Events of the Week in Brief Review.

1 IN 2½.

Cambridge is believed to be the most "wireless" town in Britain, according to the local Post Office authorities. The number of wireless licences exceeds 13,000, representing one licence for about two-and-a-half inhabited houses.

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SHORT-WAVE BED-TIME STORIES.

Even the tiny tots are discovering the value of short waves, to judge from an innovation at the Radio Experimental Station, Paris. This station now transmits a Children's Hour on 31.65 metres. It is intended specially for the benefit of children in the Colonies.

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WIRELESS FOR WAR VETERANS.

The *Daily News*, which was instrumental in securing wireless for the principal London hospitals, completed another happy enterprise on Wednesday last, when Viscount Cowdray presented a wireless installation to the Chelsea Pensioners' Hospital, the cost having been borne by readers of the newspaper. The installation, on which nearly £700 has been spent, includes 576 points for headphones.

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HAVE YOU TRIED IT?

"Sonorous perspective effects" are claimed by M. P. Hemardinquer, a French wireless amateur, in experiments he has conducted with two pick-ups and two identical gramophone records played simultaneously. By slightly retarding one record and carefully adjusting its volume, M. Hemardinquer states that a genuine stereoscopic effect is obtained, especially when two loud speakers are employed.

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SHORT WAVES AND A SOLAR ECLIPSE.

General Ferrié, the chief of the French military wireless service, has just communicated to the Academy of Sciences the results of radio observations which he conducted in Indo-China in May last during the total eclipse of the sun.

During the period of totality there was a considerable diminution of signal strength on the short waves and 30 seconds elapsed between the direct signal and the receipt of the characteristic "echo." The General made no attempt to explain the delay, writes our Paris correspondent.

LONG WAVES FROM ICELAND.

"Utvarpsstoed!" will be the password of Iceland's first broadcasting station, to be opened at Reykjavik in the early summer. The aerial power will be 16 kW. and the wavelength 1,200 metres.

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A USE FOR "JUNK."

Most amateurs find it necessary to start a junk box within a few weeks of beginning their wireless career. Many of the components which make up these museums

CHELSEA PENSIONERS' WIRELESS. Through the enterprise of the *Daily News* a Marconiphone receiver with 576 headphone points has been installed at Chelsea Hospital. A unit system amplifier with eight valves is used. The photograph shows how the service is "laid on" to each cubicle.

are obsolete but perfectly sound, and it is with this fact in mind that the Stretford and District Radio Society has issued an appeal in connection with the Manchester Station Wireless for the Blind Fund. Members of the society feel confident that the nation's junk boxes will yield ample material to construct serviceable sets for the blind poor.

Wireless amateurs or others who wish to contribute to this most practical effort are cordially invited to send their surplus apparatus, be it ever so old, to the Hon. Secretary, Manchester Station Wireless for the Blind Fund, Town Hall, Manchester, or to the Stretford and District Radio Society, 6, Derbyshire Lane, Stretford, Manchester.

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I.E.E. ANNUAL DINNER.

The annual dinner of the Institution of Electrical Engineers will be held at the Hotel Cecil, Strand, W.C.2, on Thursday, February 6th, 1930, under the Presidency of Col. Sir Thomas F. Purves, O.B.E.

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INDEX AND BINDING CASES.

The index for Volume XXV of *The Wireless World* is now ready, and copies are obtainable, price 3d. (post free 4d.), from the publishers, Dorset House, Tudor Street, London, E.C.4. Binding cases for the volume can also be supplied, together with the index, price 3s. 1d., post free.

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RADIO TRAIN CONTROL.

The London and North-Eastern Railway has recently conducted experiments in the use of wireless for handling goods trains in shunting yards, the object being to provide a means of communication between the engine-driver and the operator in charge of the control tower from which shunting operations are directed.

The results, which are not yet published, are being considered by the Ministry of Transport, and are expected to be dealt with in an official report on various methods of automatic train control.

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WAR IN THE ETHER.

In defiance of the cheerful theory that broadcasting makes for international amity comes a disturbing report from a Stockholm correspondent indicating a radio feud between Sweden and an unnamed "Central European country."

The message tells of the establishment of a special control station in the little town of Eskiltuna, in Central Sweden, with the object of overcoming interference to Swedish listeners from outside sources. "It has been found," says the report, "that a wireless transmitting station in a certain capital of a Central European country has not respected the International Radio Convention, which it had signed, but arbitrarily changed its wavelength, with the result that it conflicted

Part XVII.—Parallel Tuned or Rejector Circuits.

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

(*Continued from page 44 of previous issue.*)

IN last week's issue a tuned circuit was considered where the inductance and capacity portions were connected truly in parallel so that the alternating voltage applied between the ends of the circuit was common to each branch. Under these conditions it was found that when the circuit was tuned to resonance with the frequency of the applied voltage and that once the oscillating current flowing round the closed loop had been built up to a steady R.M.S. value or constant amplitude, no current whatever was drawn from the source of supply.

The system was likened to a pendulum or weight-loaded spring in vacuo where all sources of energy loss had been eliminated. Once the mechanical oscillations are started they will continue indefinitely without diminution under conditions like this where there is no loss of energy. Similarly in the imaginary perfect tuned circuit the oscillations of current round the closed loop would theoretically persist with undiminished amplitude even after the closed circuit has been disconnected from the source of E.M.F. This obviously must be so as there is no means of escape for the stored energy. Oscillations of any kind, electrical or mechanical, which continue with undiminished amplitude are called undamped oscillations. If the oscillations are self-maintained, as explained above, they are called free oscillations and their frequency is called the *natural frequency* of the circuit (or mechanical system). In the case of undamped free oscillations the natural frequency is the same as the resonant frequency of the circuit, being given by $f = \frac{1}{2\pi\sqrt{LC}}$ cycles per second.

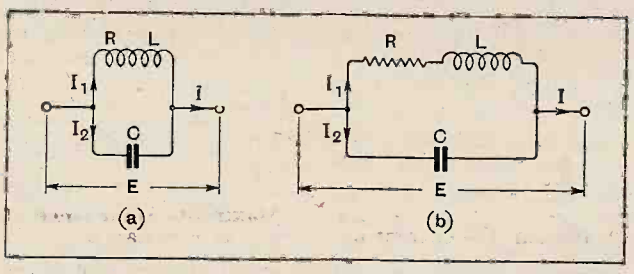

Fig. 1.—(a) Parallel circuit where resistance is present in the inductive coil. (b) Equivalent circuit.

The Effect of Resistance.

Now in practice it is impossible to obtain any vibrating system, whether it be mechanical or electrical, which is absolutely free from energy loss. For instance, in the case of a pendulum, even if it is suspended in a vacuum, there are some small losses in the suspension spring when the pendulum is in motion. The result is that as soon as the driving impulses are withdrawn the oscillations will begin to die away at a rate depending on the magnitude of the energy losses. If the pendulum is suspended in air at ordinary atmospheric pressure instead of in a vacuum the air resistance to the motion of the bob would have a considerable *damping* effect and the decay of oscillations would be very much more rapid. Where it is required to maintain the oscillations at a constant amplitude in spite of incidental losses, it is necessary to give the pendulum a small impulse once every swing to make good for the energy lost per swing. This is what is done by the driving mechanism of an ordinary clock.

Turning now to the electrical circuit, we find that the same conditions have to be fulfilled. The inductance coil L is bound to have some resistance and this is always far greater than that possessed by the condenser and connecting leads. For this reason we are justified in assuming that the whole of the resistance in the circuit is concentrated in the inductive branch. The actual circuit under consideration is shown in Fig. 1 (a), where L is the inductance of the coil in henrys and R is its resistance in ohms; C is the capacity of the condenser in farads.

Suppose that an alternating voltage whose R.M.S. value is E is applied to the ends of the circuit and that the circuit is tuned to resonance. As before, an oscillating current will traverse the closed loop, but heat will now be generated in the coil, due to its resistance. This means that the circuit is absorbing energy from the source of supply, and should this supply be cut off the oscillations would die away in the same manner that a clock pendulum will come to rest when the clock spring runs down. At the present time we are not concerned with the decay of oscillations but with the conditions obtaining when the oscillations are being maintained by the source of E.M.F. We require to know the general behaviour of the circuit when it is tuned to resonance with the frequency of an applied E.M.F. of constant amplitude.

Wireless Theory Simplified.—

We have already seen that a coil of inductance L and resistance R is electrically equivalent to a pure inductance L connected in *series* with a resistance R, and therefore the parallel circuit of Fig. 1 (a) is equivalent to the circuit of Fig. 1 (b), where the coil L has no resistance and the resistance R is non-inductive. Each branch then consists of a simple circuit whose principles have already been dealt with in this series. By combining the known laws of each in the proper manner we can determine the resonant frequency of the circuit and find the impedance at any frequency or when tuned to resonance.

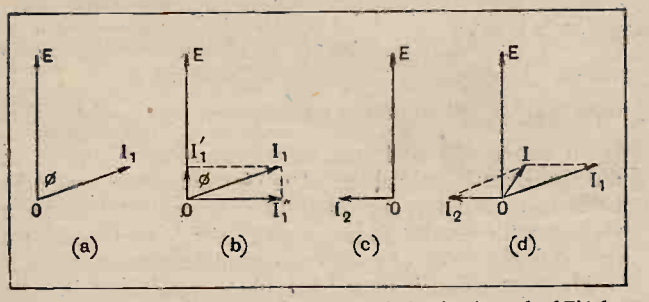

Fig. 2.—(a) and (b) vector diagrams for inductive branch of Fig. 1. (c) for condenser branch and (d) for the complete circuit.

Currents in the Branch Circuits.

The current I_1 taken by the coil is given by

$$I_1 = \frac{E}{Z} \text{ amperes} \quad \ldots\ldots (1)$$

where $Z = \sqrt{R^2 + (2\pi fL)^2}$ ohms is the impedance of the coil. This current lags behind the applied voltage E by an angle ϕ where $\cos\phi = \frac{R}{Z}$ as explained on page 523 (November 26th issue) and the simple vector diagram showing the phase difference between the current and voltage for the upper branch of the circuit is given in Fig. 2 (a).

The current I_1 in the inductive branch can be considered as being the resultant of two component currents, I'_1 in phase with the voltage, and I''_1 lagging behind the voltage by 90°. This idea is clearly shown by Fig. 2 (b), from which it is easy to see that

$$I'_1 = I_1 \cos\phi \text{ and } I''_1 = I_1 \sin\phi,$$

and from the impedance triangle of the inductive coil, shown in Fig. 3, we see that $\cos\phi = \frac{R}{Z}$ and $\sin\phi = \frac{X}{Z}$.

Referring now to the condenser branch, the current in it is given by $I_2 = \frac{E}{X_c}$ amperes $\ldots\ldots (2)$

where $X_c = \frac{1}{2\pi fC}$ is the reactance of the condenser. This current I_2 leads the voltage E by 90° as shown in Fig. 2 (c).

To find the current taken by the combined circuit, i.e., the current drawn from the supply, we must add by the vector method the two currents I_1 and I_2 in the respective branches. This is done by drawing the two current vectors OI_1 and OI_2 from a common origin O in their correct phase positions as shown in Fig. 2 (d). We see at once that the two currents I_1 and I_2 are not opposite in phase as they were in the case of the circuit without resistance, and the resultant therefore cannot be found by simple subtraction. The resultant current is given by OI, the diagonal of the parallelogram formed with OI_1 and OI_2 as adjacent sides. The impedance of the complete circuit is simply equal to the ratio of voltage to current. The formula giving the current at any frequency is rather complicated, but fortunately we can deal with the circuit from a graphical aspect to get a clear conception of its general behaviour.

Minimum Current at Resonance.

As the frequency is raised the current I_1 in the coil decreases, whilst the current I_2 in the condenser branch increases; but if on the other hand the frequency is kept constant and the capacity of the condenser is varied, only the current I_2 will change. This simplifies matters a great deal and accordingly let us suppose that the capacity C is varied over a wide range, everything else being fixed. The current I_2 is directly proportional to the capacity and therefore the resultant current I will vary both in phase and magnitude as the capacity is changed. Let OA, OB, OC, OD and OF be several values of condenser current represented as vectors in Fig. 4 (a) corresponding to different values of the capacity, OI_1 being the fixed current in the inductive coil. The broken line vectors 1, 2, 3, 4 and 5 in the diagram show the resultant currents for the respective capacity values. Of these, No. 3 is in phase with the voltage and is obviously the shortest.

It is thus clear that there is one particular value of capacity which will make the total current a minimum, and this minimum current is exactly in phase with the voltage. When this happens the circuit is tuned to complete resonance with the applied frequency, because all components of current at right angles to the voltage balance out and the circuit as a whole behaves as though it were a pure resistance. The vector diagram showing the conditions for complete resonance is given in Fig. 4 (b).

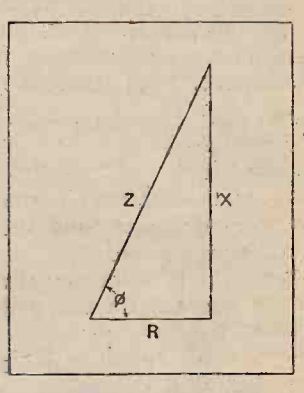

Fig. 3.—Impedance triangle for inductive branch of Fig. 1. $X = 2\pi fL$ and $Z = \sqrt{R^2 + X^2}$

Maximum Impedance at Resonance.

Since the current is smallest at the frequency of resonance it follows that the impedance of the circuit must be a maximum when tuned to resonance. These conditions are exactly the reverse of those obtaining in a series circuit, where the impedance was found to be a minimum at the resonant frequency. And so the parallel circuit has the property of partially rejecting or refusing to pass currents whose frequencies lie within a band near the resonant frequency whilst allowing currents at frequencies outside this band to pass comparatively freely. For this reason the parallel tuned circuit is very often called a "rejector circuit," especially when used in a filter circuit designed to cut out a powerful local station.

with that of Sweden. The country in question has been officially requested to change its wavelength to conform with the convention, but, so far, without result. The Swedish radio authorities, owing to the lack of space in the maze of ethereal traffic, are unable to change their own wavelength. *They have now, however, given the Swedish radio listeners the comforting assurance that as soon as the latest and most powerful of the Swedish sending stations is completed it will be strong enough to get the better of the disturber of the peace, who will then be forced to surrender to the ultimatum of the victor and adopt the wavelength once allotted to it.*"

A similar situation recently arose between Great Britain and Spain, but the question was amicably settled through the mediation of the British Post Office. It seems a pity that Sweden cannot adopt the same peaceful tactics.

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JAPANESE PROGRAMME DILEMMA.

Japan's broadcasting system, which was inaugurated in 1926, has considerably developed during the past three years. To-day (writes a correspondent) it is run by four separate organisations, which together control over ten transmitters. The principal stations are installed at Hiroschima, Osaka, Sapporo, Sendai and Tokio, with relays at Daiyen, Seoul (in Korea), Nagoya, and on the Island of Formosa. Of these, six are transmitters capable of developing an energy of over ten kilowatts. All studios except one are interconnected by pupinised cable with the capital and main transmitter, the exception being that of Hokkaido, which takes its programme by wireless link.

The system is now providing a regular service to nearly 700,000 listeners, and the licence tax fee has recently been reduced to 1 yen monthly.

The broadcasting organisers experience great difficulty in making up programmes capable of entertaining the various classes of listeners, for in Japan, more, perhaps, than in any other country, the older generation steadfastly upholds tradition. On the other hand, the modern element, represented by the younger generation, demands entertainment on European and American lines. The programme builders are perpetually confronted with the problem of pleasing everybody and have therefore to provide two distinct programmes in the course of a transmission.

FORTHCOMING EVENTS.

WEDNESDAY, JANUARY 15th.

Institution of Electrical Engineers, Wireless Section.—At 6 p.m. At the Institution, Savoy Place, W.C.2. Lecture: "A Method of Measuring the Overall Performance of Radio Receivers."

Golders Green and Hendon Radio Society.—At 8.15 p.m. At the Club House, Willifield Way, N.W.11. Ordinary meeting.

Edinburgh and District Radio Society.—At 8 p.m. At 16, Royal Terrace. Demonstration of Gramophone Reproduction by Mr. J. L. Minto.

Muswell Hill and District Radio Society.—At 8 p.m. At Tollington School, Tetherdown, N.10. Lecture and Demonstration: "The Neutrosonic Six-valve Short-wave Receiver," by Mr. Alford, of The Igranic Electric Co., Ltd.

North Middlesex Radio Society.—At 8 p.m. At St. Paul's Institute, N.21. Lecture: "The Power Valve," by Mr. G. Parr, of the Edison Swan Electric Co., Ltd.

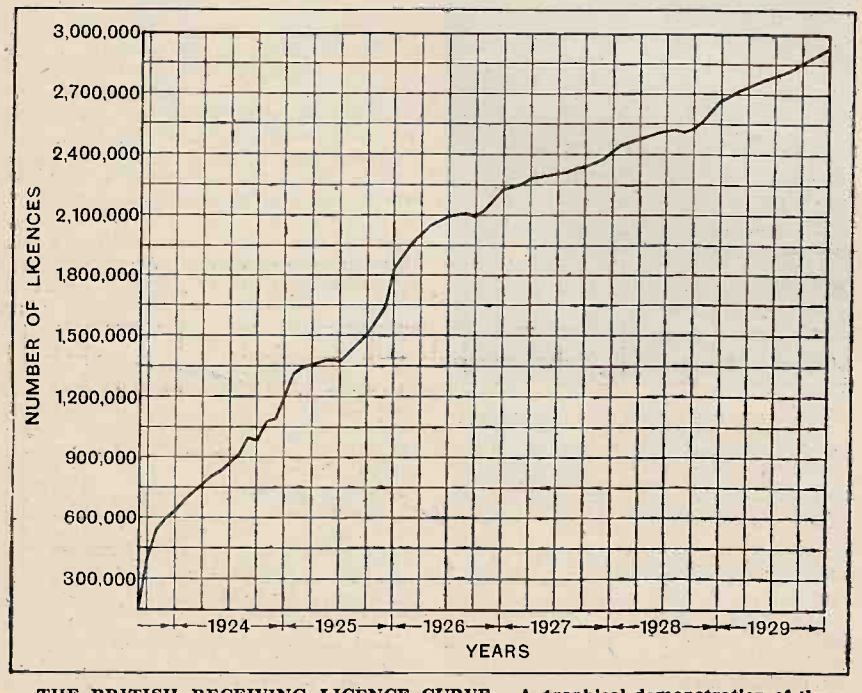
THURSDAY, JANUARY 16th.

Ilford and District Radio Society.—At the Wesleyan Institute, High Road, Ilford. Demonstration by Philips Radio, Ltd.

MONDAY, JANUARY 20th.

Newcastle-upon-Tyne Radio Society.—At 7.30 p.m. In the English Lecture Room, Armstrong College. Lecture: "A Further Step Towards Common Sense Radio Reception," by Mr. S. Burns, M.I.E.E., M.Inst.M.E.

Croydon Wireless and Physical Society.—Lecture: "Selectivity," by Mr. A. J. Webb.



THE BRITISH RECEIVING LICENCE CURVE. A graphical demonstration of the steadily increasing popularity of broadcasting. It will be noticed that the only appreciable decline occurred in the autumn of 1924. Will Radio Week complete the third million?

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WARNING TO WIVES.

Discomfort for the "gude wife" when the Scottish Regional broadcasting station opens is predicted by a Northern newspaper, which says that wives may expect a "shocking" time as a result of electrical energy in the ether. "They may find it difficult to pick up metal kitchen utensils without getting mysterious electric shocks," explains the writer. However, he concludes with the comforting assurance that these shocks are not sufficiently strong to do any harm and are only received in certain circumstances. He might have added that the necessary circumstances include living under the aerial and fairly near to the transformers.

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FIRE.

We are asked to state that there is no truth in recent reports that the factory of Messrs. A. C. Cossor, Ltd. (manufacturers of Cossor valves and wireless apparatus), had been burnt out. The fire in question took place at the works of Messrs. A. C. Cossor and Son, scientific instrument makers. There is no connection between the two firms.

BOOKS RECEIVED.

Le Strobodyne, by L. Chrétien. A booklet giving the theory and practical construction of this popular French receiver. Pp. 78, with 45 illustrations and diagrams. Published by "La T.S.F. Moderne," Paris. Price Fcs. 10.

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Le T.S.F.M., 1930, by L. G. Veyssière. The design and construction of a modern superheterodyne receiver, with explanation of the nature and function of each component. Pp. 75, with 57 illustrations and diagrams. Published by "La T.S.F. Moderne," Paris. Price Fcs. 10.

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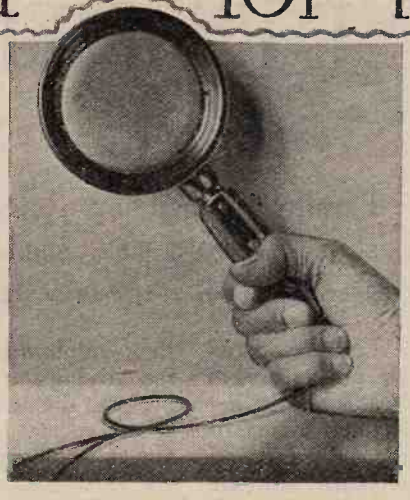
Wireless and Gramophone Trader Year Book and Diary, 1930.—The sixth edition of this most useful book of reference includes all the features which have proved so valuable in the past carefully revised, enlarged, and brought up to date. The Directory Section contains a full alphabetical list of Manufacturers, Agents, Associations, and Publications connected with the wireless and gramophone trades in Great Britain; Wireless and Gramophone Factors; a Classified List of the Manufacturers of Wireless and Gramophone Sets and Accessories, and a list of Proprietary Names of various apparatus. The General Information, Trade Information, Technical Data, and Gramophone Sections have also been considerably enlarged. Manufacturers and traders will especially welcome the abstract of the new provisions of the Marconi Licence. Published by the Trader Publishing Co., Ltd., Salisbury Square, E.C.4. Price 5s. 6d. post free, or at a reduced rate to subscribers to the "Trader" journals.

An Aid for the Deaf

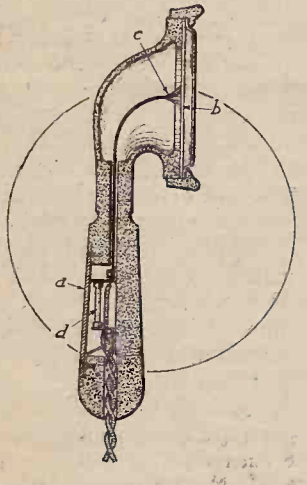
The Construction of an Electrostatic Earpiece.



BY OUR GERMAN CORRESPONDENT.

DESPITE the fact that many deaf people suffer agonies from being shouted at, practically all the existing electrical devices for the deaf are based on the principle of amplifying the sound to an extent unbearable to the normal ear.

To find a better means of influencing the inner organs of the ear, Dr. Gustav Eichhorn, of Zurich, has experimented for a number of years with a system which now appears in commercial form under the name of the "Radiophone." From the results obtained with this interesting instrument the inventor concludes that the flesh surrounding the ear is forced, by an electrostatic effect, to set up oscillations, which are not transferred to the skin of the ear drum, but direct to the organs of hearing.



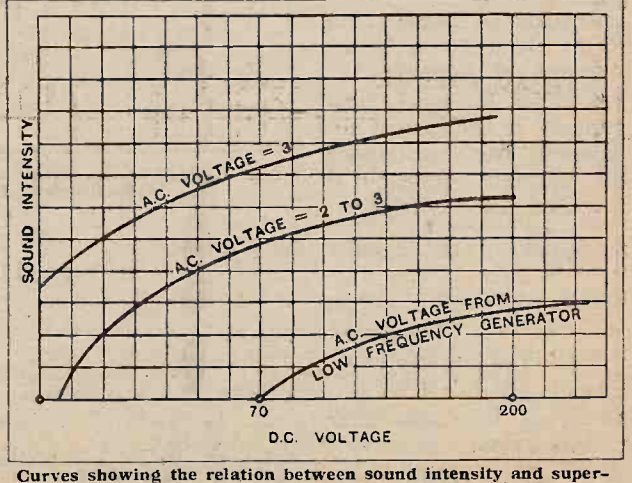
Internal construction showing (a) Contacting plate. (b) Diaphragm. (c) Flexible lead. (d) Shunt resistance.

The distinguishing feature of the "Radiophone" is the inclusion of the listener himself in the plate-circuit of the L.F. valve of the wireless receiver. This is done by connecting the user through the hand holding the device (*a*) to the positive output terminal of the receiver, while the negative terminal is connected with stranded flex to a thin metallic plate (*b*) in a special sound-box placed against the ear. The sound-box is provided with a movable cover of cardboard, thin wood or similar non-conducting material, upon which the metallic plate is fastened on the inner side. The individual wires (*c*) of the flex lead are splayed over the surface of the metal sheet, and upon this connection a second sheet of metal foil is pressed tight.

It is common knowledge that in the telephone-circuit of a wireless receiver we have to deal with the direct current in the plate-circuit and the modulated alternating currents superimposed thereon. Dr. Eichhorn's experiments have shown that the sensitivity of his instrument is essentially dependent upon the voltage on the plate, which must be proportionately greater when the alternating voltage is reduced. In all tests in which the superimposed voltage was low audibility increased rapidly with increases in plate voltage up to between 120 and 150 volts.

Used with a typical three-valve set, the "Radiophone" gives signals which are nearly as powerful as those with the usual headphones. If the hand is removed from the metallic surface on the handle no signals can be heard; this is also the case when the polarity is reversed by connecting the sound-box to the positive terminal of the receiver. From this the inventor deduces that the small tin-foil sheet is set in oscillation by the low-frequency currents, the speech and music being amplified to some extent by the sound-box.

In the lower recess in the handle a metal strip making contact with the hand is connected to the positive lead to the receiver. The negative lead is taken through to the metal disc in the sound-box, while across the two leads in the lower recess is a resistance of about 100,000 ohms (*d*). This resistance has been found to eliminate fluctuations in sound intensity due to the fact that the polarising potential derived from the valve circuit is not constant. The optimum plate potential depends upon the type of valve used, one working with an anode voltage of between 70 and 100 being recommended.



Curves showing the relation between sound intensity and superimposed D.C. voltage for various A.C. potentials.

Wireless Theory Simplified.—

A parallel circuit is used for tuning purposes where it forms part of a circuit which normally has a very high resistance, as, for instance, in the anode circuit of a valve. The details of such a circuit will be discussed later, but it can be mentioned here that the conditions for maximum selectivity are practically the same as those relating to the series tuned circuit, namely, low coil resistance and high ratio of inductance to capacity.

The vector diagram of Fig. 4 (b) enables us to find the impedance of the circuit at the resonant frequency and

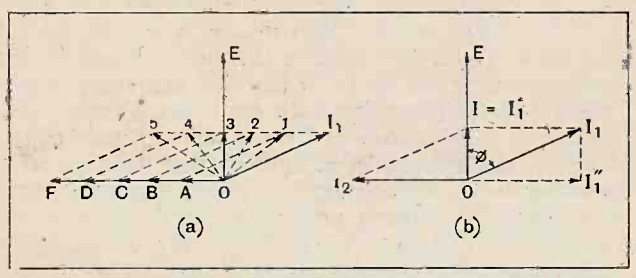


Fig. 4.—(a) Vector diagram showing that the resultant current is least when in phase with the voltage. (b) Vector diagram for parallel circuit tuned to resonance.

the value of the resonant frequency itself. The resultant current I is in phase with the voltage, showing that I_2 and I''_1 balance out. Hence $I_2 = I''_1$, from which the exact resonant frequency can be found. But in practice the resistance of the coil is so low compared with its reactance at the high frequencies used that the angle of lag, ϕ, is nearly equal to 90° and therefore I''_1 is almost equal to I_1 and a negligibly small error will be introduced if we assume $I_2 = I_1$. When this assumption is made, the conditions are the same as those for the circuit without resistance, and therefore the resonant frequency is $f = \frac{1}{2\pi\sqrt{LC}}$ cycles per second approximately (see appendix).

At the resonant frequency the circuit behaves like a pure resistance, and the impedance under these conditions is called the " the dynamic resistance " of the circuit. It is the actual resistance offered to currents at the resonant frequency, being thus an extremely important quantity.

Finding the Dynamic Resistance.

The value of the dynamic resistance is given by the ratio of voltage to current when the circuit is tuned to resonance. Denoting the dynamic resistance by R_D we have $R_D = \frac{E}{I}$ ohms, where I is the current taken by the complete circuit when tuned to resonance. But from the vector diagram of Fig. 4 (b) we see that

$$I = I_1 \cos\phi = \frac{E}{Z} \times \frac{R}{Z} = E \times \frac{R}{Z^2}.$$

Hence dividing the voltage E by this current we get for the dynamic resistance $R_D = \frac{Z^2}{R}$ ohms, where Z is the impedance of the coil.

Now, since in practice the resistance R of the coil is small compared with its reactance $2\pi fL$, the impedance of the coil is very nearly equal to its reactance and we may therefore write $2\pi fL$ in place of Z to give an approximate result. Hence $R_D = \frac{(2\pi fL)^2}{R}$ ohms approximately. But at resonance the frequency is very nearly $f = \frac{1}{2\pi\sqrt{LC}}$, and substituting this value of f in the last equation we get dynamic resistance $R_D = \frac{L}{CR}$ ohms. This is an expression of fundamental importance and is not an approximation but an exact formula (see appendix) in spite of our having made two approximations in arriving at the result. It happens that the two slight errors introduced are of opposite sign and balance out.

The conclusion is that the dynamic resistance or maximum impedance is actually *inversely* proportional to the ohmic resistance of the coil, and proportional to the ratio of inductance to capacity. If the resistance of the coil were zero the dynamic resistance of the circuit would be infinitely great and no current would enter or leave it, as we have already discovered.

Appendix.

I. Resonant frequency of Parallel Circuit.

From Fig. 4 (b) $I_2 = I_1 \sin\phi$,

$$\omega CE = \frac{E}{Z} \times \frac{\omega L}{R}, \text{ where } \omega = 2\pi f,$$

or $$C = \frac{L}{Z^2}$$

Whence $$Z^2 = \frac{L}{C} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

$$R^2 + (\omega L)^2 = \frac{L}{C}$$

or $$\omega = \sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$$

$\therefore$ Resonant frequency $f = \frac{1}{2\pi}\sqrt{\frac{1}{LC} - \frac{R^2}{L^2}}$

II. Dynamic Resistance.

$$R_D = \frac{E}{I} = \frac{E}{I_1 \cos\phi} = \frac{E}{\frac{E}{Z} \times \frac{R}{Z}} = \frac{Z^2}{R}$$

But from (1) above $$Z^2 = \frac{L}{C}$$

$\therefore$ $$R_D = \frac{L}{CR} \text{ ohms.}$$

(To be continued.)

RADIO WEEK.

In a few days' time the jury, i.e. the non-listeners, will retire to consider their verdict on the question, " Is Broadcasting Worth While? " Listeners can help to secure a favourable answer by letting their non-wireless friends listen to good reproduction of the B.B.C.'s special programmes, remembering that *a bigger listening public means a better broadcasting service.*

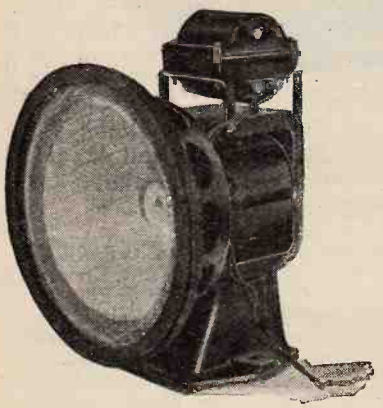
LABORATORY TESTS.

A Review of Manufacturers' Recent Products.

MARCONIPHONE MOVING COIL LOUD SPEAKER UNITS.

These units are now being supplied uncased to provide the home constructor with a model suitable for building into a piece of furniture, or for incorporating in radio-gramophone cabinets.

Two types are available: one with a 10-ohm field winding for use with 6-10 volt accumulators, and the other with a 3,000-ohm field coil intended for mains excitation. The last mentioned would be used on D.C. mains direct, but in conjunction with a rectifier unit for A.C. supplies. Both models are sensibly the same, the only difference being in the method of exciting the field coil. The chassis submitted for test was of the low-voltage type.



Marconiphone moving coil loud speaker unit.

Before being given a practical test it was fitted to a large baffle board, 3ft. square, with a hole of suitable size cut in its centre. Measurements showed that when energised from a 6-volt accumulator a current of 0.57 amp. was required. With a 10-volt battery the energising current was a little under 1 amp. Although the sensitivity, when used with a 6-volt accumulator, is noticeably lower than that of a mains excited model of the same make, it is ample for all practical needs, the volume being in excess of that required to fill a room of average size, using a good super-power output valve with a generous high tension supply.

These tests were made with a receiver designed to have a straight line amplifier characteristic. The very low notes in the bass, although not overpowering, were reproduced with full-throated volume. The response of the middle register and the higher frequencies was good, and a slightly better balance of output was obtained by the employment of a baffle of smaller size. As the unit will, in general, be fitted in a cabinet, this is perhaps a minor point. The reproduction of music and speech is crisp and clear.

These models are fitted with cone diaphragms 7in. in diameter, which are pressed from stout fibrous material, the centring device being integral with the cone and provided with a stepped ring on which fixes the speech coil. An input transformer is mounted on top of the chassis. A supple surround of soft velvet supports the periphery of the cone.

The makers are the Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1, and the prices are as follows:—6-10 volt model, £4 10s., and D.C. mains model, £5. A rectifier unit for A.C. mains use costs £4 15s., including valve and royalty.

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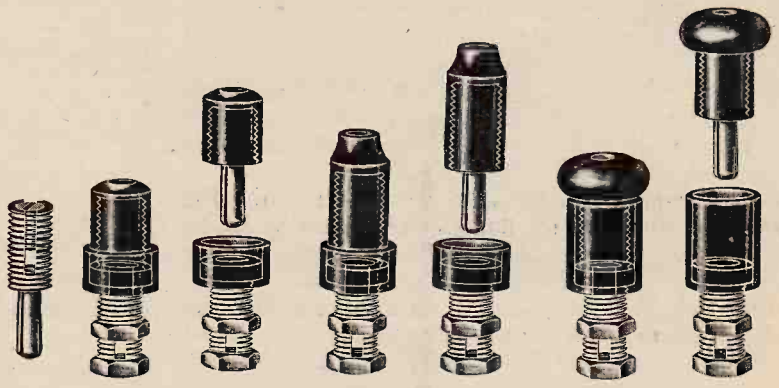
EELEX INSULATED H.T. CONNECTORS.

The new range of insulated plugs and sockets introduced by Messrs. J. J. Eastick and Sons, 118, Bunhill Row, London, E.C.1, have been designed especially for use in connection with battery eliminators and mains-operated receivers.

Greater care is required in handling the H.T. leads, and consequently the insulation on the plugs and sockets has been very carefully thought out. All metal parts hitherto exposed are fully protected, and the risk of shock due to accidental contact with live leads has been reduced to a minimum. Provision is made also to grip the braided covering on "flex" leads, thereby giving a tidy appearance to the connecting leads.

These "All Shrouded" plugs and sockets are offered at 6d. per pair.



Eelex "All-Shrouded" plugs and sockets for use in mains equipment.

LOTUS JACKS AND JACK SWITCHES.

The body of these jacks consists of a bakelite moulding on which is mounted genuine nickel silver springs each tipped with a pure silver contact. A faulty connection should be very rare indeed. Hitherto contact with the springs was made by soldering the leads on to tags, but in the latest version the soldering tags have given way to small terminals carried on fantail extension lugs. A single-hole fixing bush is provided.

"Lotus" radio jack, jack plug and jack switch. Terminals are now fitted to all jacks and switches.

Five types are available, ranging from a single circuit open jack to a single circuit open double-filament control type. The price is according to type, the cheapest being 2s. and the last mentioned 3s.

These jacks demand a jack plug with a longer stem than is usually fitted so that it is necessary to employ the "Lotus" version. This costs 2s. Loud speaker tags or "flex" can be gripped firmly by the aid of the special cam-lock fitted. The "stem" and the "ball" connections are clearly marked on the bakelite cover.

A range of five jack type push-pull switches from a single-pole make-and-break to a double-pole double-throw is now available, the general design following closely that of the jacks. The same quality material is used throughout. Single-hole fixing is provided and the bush is insulated from all contact springs. These switches cost 2s. 9d. for the single type and 4s. for the D.P.D.T. style. The prices of other types are S.P.D.T. 3s. 3d. and D.P.S.T. 3s. 6d.

Southend Wireless Show

Society's Record Success.

A WIRELESS festival, to the fitting accompaniment of open-air and indoor loud speaker reproduction, was held at Southend on Saturday, January 4th, when the Southend and District Radio Society attracted thousands of visitors to their Sixth Annual Radio Exhibition, held at the Boys' High School, Victoria Circus. The occasion was a triumph for amateurs and professionals alike, and their joint efforts resulted in a contribution of at least £70 to the Victoria Hospital Wireless Maintenance Fund.

Several magnetic influences were at work. In the first place, many enthusiasts were drawn to the competition stands, on which were displayed some excellent examples of amateur craftsmanship. The casual passer-by was also attracted by the compelling invitation of a battery of loud speakers facing Victoria Circus, these being erected and operated by Messrs. S. H. Davis and Son, of Westcliff. And in the Exhibition Hall itself Mr. F. H. Haynes, Assistant Editor of *The Wireless World*, provided a continuous demonstration of quality reproduction, with loud speaker "points" on each stand. The set employed consisted of the Schools Demonstration Receiver, followed by six independent output stages each fitted with choke condensers and two P 625 valves.

An admirable feature of the competitions was the introduction of a new method of classification enabling entrants every chance to succeed having regard to their opportunities and qualifications. Three classes of competition were instituted—A, B, and C—the first for *bona fide* amateur members of the Society, the second for other members, and the third for *bona fide* amateurs who were non-members. The scheme worked well.

Through the generosity of the trade, prizes were offered for a variety of home-made apparatus, and this formed the basis of the amateur side of the Exhibition. The apparatus submitted included portables, short-wave receivers, one- to three-valve and multi-valve receivers, loud speakers, battery eliminators, wavemeters and wavetraps, receiving set cabinets, and various mechanical and non-mechanical units. Much careful and painstaking work was indicated, and the standard of craftsmanship increased the difficulties of the judges, Mr. F. H. Haynes, Mr. H. B. Dent, and Mr. H. L. Lobb.

The list of prize-winners is as follows:—

	Class.	Prize.	
Complete Set by High School Boy	—	1st	Mr. C. Stockell.
		2nd	Mr. R. Kramer.
		Cons.	Mr. J. Hill.
Portable Sets	A	—	No Entries.
	B	1st	Mr. W. A. Webb.
	C	—	No Entries.
Short Wave Receivers	A	1st	Mr. E. W. Lockhart.
	B	1st	Mr. B. Costin.
	C	—	No Entries.
1 to 3 Valve Receivers	A	1st	Mr. H. A. Clinton.
		2nd	Mr. E. T. Wiseman.
	B	—	No Award.
	C	—	No Entries.
4 or more Valve Receivers	A	1st	Mr. W. J. Fletcher.
		2nd	Mr. H. R. Ireland.
	B	—	No Award.
	C	Cons.	Mr. S. R. Wilkins.
Loud Speakers	A	Special	Mr. H. R. Ireland.
		..	Mr. W. J. Fletcher.
	B	—	No Entries.
	C	Special	Mr. D. J. Lewis.
		,,	Mr. M. J. Anthoney.
Battery Eliminators	A	1st	Mr. P. Green.
	B	—	No Award.
	C	—	No Entries.
Wavemeters and Wavetraps	A	1st	Mr. E. W. Lockhart.
	B	—	No Entries.
	C	—	,, ,,
Receiving-set Cabinets	A	1st	Mr. H. R. Ireland.
		2nd	Mr. A. E. Atwood.
	B	—	No Entries.
	C	—	,, ,,
Various Mechanical Units	A	—	,, ,,
	B	1st	Mr. A. R. Knipe.
	C	—	No Entries.
Various Non-mechanical Units	A	1st	Mr. T. Holbeche.
		2nd	Mr. P. Green.
	B	1st	Mr. A. R. Knipe.
		2nd	Mr. A. C. Horsnell.
	C	1st	Mr. W. B. Briggs.

Southend Wireless Show.—

Three sets, not for competition, were exhibited by the chairman, Mr. H. H. Burrows. One of these was an imposing six-valve instrument having two screen-grid H.F. stages, detector, and two stages of L.F., the last consisting of two power valves in parallel. The total value of the components alone was estimated at £25. The set was given in connection with a shilling competition in aid of the Hospital Wireless Fund.

Interest in amateur television was demonstrated by the curiosity aroused in Mr. A. Knipe's experimental television receivers, in which considerable ingenuity was displayed both in the synchronising gear and the method of marking out and constructing the disc. For his collective exhibit of television gear and a carbon microphone with control units, Mr. Knipe was awarded the Pocock Silver Championship Cup, presented by the Editor of *The Wireless World* for annual award for the entry of most outstanding constructive merit.

The total number of entries in the amateur section was fifty-four, and the value of the prizes distributed was £45.

The trade exhibitors included Messrs. S. H. Davis and Son (organisers of the outdoor loud speaker demonstrator), J. Bridge and Son, T. Davis, F. Jeffery, E. K. Cole, Ltd., and H. C. Revell.

The Exhibition was open for eleven hours—from 11 a.m. to 10 p.m.—and during this time there were no fewer than 4,684 visitors. Is this a record for a wireless society show?

CORRESPONDENCE.

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

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

B.B.C. TRANSMISSIONS.

Sir,—Much has been written recently about the effect of land lines on the quality of B.B.C. transmissions, and the following figures relative to the London-Bournemouth land line may be of interest.

The attenuation factor per 50 miles of land line is approximately 1 ounce of suet pudding in the mouth of the silvery-voiced announcer. It is regretted that no figures relative to orchestral transmissions can be given as none have been definitely identified as such.

C. E. WOOD.

Parkstone, Dorset.

Sir,—Whatever the faults of land-line transmissions may be, surely Mr. Jas. Hudson, of Manchester, does not mean that the output from 2ZY's aerial is a good sample of perfection, even from the fine new studio, or otherwise. A more "tin-canny" output is not to be heard from any station in Europe.

Bolton. A. GREGSON.

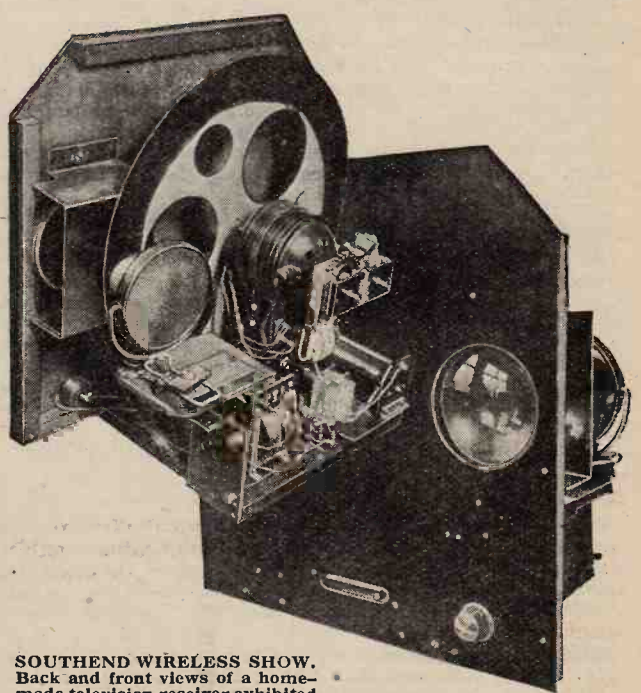
THE PROGRAMME DIFFICULTY.

Sir,—The article concerning a Low-power Synchronised Transmission Scheme, by Major Humphry MacCallum, in your issue of December 25th, provided food for much thought. The outcome is that the views expressed are certainly worthy of more than passing attention. Eight out of ten people with whom I come into contact appear to be dissatisfied with the general run of programmes, whilst agreeing that the whole business of programme "building" is something of a problem. The eight, including myself, have not been clever enough to formulate a really practicable scheme. The one suggested has great possibilities and appears to be quite practicable from a technical point of view as far as wireless is concerned. I am not so sure, however, as regards the land-line system involved. Judging by last night's (December 30th) transmission over the lines from Manchester, there remains much to be done in this direction. The cut-off in the lower register was very pronounced. This on a receiver which normally gives most faithful reproduction. With this difficulty overcome, the scheme presented would be welcomed by the great majority of, and probably all, listeners, whilst, in addition, one can visualise a boom in the radio industry. Given a scheme on the above lines, and the Robinson Radiostat, we shall be wondering what to do with all our spare ether channels!

H. A. HANKEY.

Sir,—I have read with considerable interest the article under the above heading in your current issue, but I cannot help thinking that the suggested scheme is "too good to be true"! If not, how is it that someone has not thought of it before? There must be a snag somewhere, though the writer states his case very convincingly. If there is no "nigger in the wood pile," it would seem that the MacCallum Scheme provides a complete solution of the programme difficulties, and its adoption should bring real prosperity to the radio industry and satisfaction alike to the listener and the B.B.C.

Oxhey, Herts. W. E. WARRILOW.



SOUTHEND WIRELESS SHOW.
Back and front views of a home-made television receiver exhibited by Mr. A. Knipe. It is fitted with the standard arrangement of toothed wheel synchronisation. The cathode of the neon lamp glows on both sides, a concave mirror being provided to bring the light emitted from the reverse of the electrode to the scanning disc.

Sir,—Major MacCallum's article in your issue of December 25th was most interesting. He refers to the probable objection of the absence of "local colour" in his scheme, but I cannot see why there should be. What does it matter where the programme comes from as long as it is good?

Schubert's "Unfinished Symphony," for example, will be just the same whether it is played at John o' Groats or Tim-

buctoo. It matters little if a lecture on the peculiarities of fish has its origin at Savoy Hill or Glasgow, providing there is no land-line distortion. That is the trouble: the mutilation of programme matter by chronic land-line distortion.

However, the article was, as stated, not without interest, and I hope to see more of this kind of reading.

London, N.1. F. H. HEINEMAN.

Sir,—I venture to put forward the following four propositions as raising questions of some interest and importance to provincial listeners :—

(1) It is not possible in practice for a number of transmitters, even though using low power and radiating one programme, to operate within a restricted area on the same wavelength without mutual interference.

(2) There is mutual interference between B.B.C. common wave transmitters.

(3) All B.B.C. transmissions on the common wavelength are therefore of bad quality.

(4) In the matter of oscillation interference, the B.B.C. are themselves the chief offenders.

It will be borne in mind that as many as eleven transmitters in Great Britain, from Dundee in the north to Plymouth in the south, share at present the common wavelength of 288.5 metres. If the regional scheme in its present shape is brought to completion, subsidiary stations, for which there will be no independent wavelength available, will be needed at Aberdeen and Newcastle.

There are two essential elements in a good wireless programme—good quality transmission and good quality programme matter. The two are complementary, one being as necessary as the other. In the case of the indifferent programme, good quality transmission may make poor programme matter tolerable, bad quality transmission can reduce the best programme matter to the level of the worst. It may be said, therefore, that a symphony concert relayed from the London Queen's Hall is a good programme only for those within the service area of the London transmitter. For listeners elsewhere, the quality of transmission is impaired or destroyed by the use of land-lines and the inherent defects of common wave transmission.

These clear and simple considerations indicate the terms in which the provinces should formulate any demand for a better service. The demand should be for—

(*a*) Direct transmissions of (*b*) *good programme matter on* (*c*) *an independent wavelength.*

It is certain, however, that any such demand would have a chance of success only if it were pressed with energy and determination. Present signs—among them in particular the salving of the London Promenade Concerts, the formation of the National Orchestra in London, the scheduled expenditure of some half a million pounds on the erection in London of Broadcasting House—all clearly foreshadow the permanent centralisation of the service in London and a continuation of the evil system of land-line transmission to the provinces.

Newcastle-on-Tyne. K. McCORMACK.

OSCILLATION.

Sir,—It seems to me that the only way out of the trouble (oscillation) is for the Post Office or British Broadcasting Corporation authorities to make a standard test of the impending listener's set before same is licensed, and, unless such a radio installation came up to a proper standard, the licence should be refused.

This law would speedily rid the radio business of the "all and sundry" that have come into it without any qualifications whatever, to the absolute detriment of the service and public alike. HERBERT W HAYDON, G.2ZL.

Gloucester.

OVERSEAS BUYERS.

Sir,—As an interested subscriber to your valuable paper, may I suggest that you can render extremely valuable assistance to overseas experimenters and assist the popularity and prosperity of wireless in parts of the world where business is not sufficiently great for the establishment of local enterprise by maintaining an overseas buying department

I speak from experience when I say that one of the greatest difficulties experienced is that of obtaining a supply of parts for the construction and maintenance of sets.

I submit that you are in a unique position to meet this difficulty, and, moreover, you would be able to *test* parts before despatch, thus reducing the possibility of failure and disappointment to a minimum.

So far as I am aware, there is no dealer in wireless material in the whole of this country, so that you would not be intruding into a sphere which, in ordinary circumstances, you would be disinclined to do.

The purchase of wireless material through friends at home is not always a success, and it is exceptional to have a friend in the position to purchase and test apparatus before despatch, to say nothing of the trouble entailed by the latter.

Northern Nigeria. WILFRED H. MILES.

[The above suggestion, although entirely outside the sphere of *The Wireless World*, might well be considered by the appropriate sections of the radio trade.—ED.]

THE BRITISH MANUFACTURER.

Sir,—Two letters in your January 1st issue do, I think, need a little backing up or amplifying. I refer to those over the signatures of A. H. Gregson and F. Nichols.

One reason why the Germans and Americans hold their market in this country is that they deliver the goods within a reasonable period of their being ordered. There are only about two British firms that ever do this. I have proved this by bitter and costly experience. My business is to make good-quality receivers and do general repairing and modernising of any set. Needless to say, I need a large variety of different valves and components, and in order to do the best work I carefully follow the advertisements and technical articles in *The Wireless World*. In all cases I try out new components and circuits before recommending them to customers.

Now when some new component is advertised or recommended I have to decide where to get it. I naturally consider the factor, as it saves time to order from him along with other stuff; but it would appear that this gentleman does not keep himself up to date by reading, and does not order new goods for stock until there has been a continual large demand for them for several months.

I then fall back upon the manufacturer, and the following is an actual case that has happened to me recently, and is typical of what happens in *very* many cases.

Ordered article September 27th; no acknowledgment of order.

Ordered a second one November 15th, and asked that they should be expedited.

Received letter November 27th stating could not deliver until early in December.

Sent postcard December 12th; no reply.

Telephoned double long distance call December 30th, and spoke to sales manager.

Goods arrived December 31st.

Now, if they could post them off at once like that, why not have done it before? This latter is a very favourite trick—to send goods when telephoned for—and reduces my profit by the price of a double trunk call. I literally cannot afford to deal with firms who treat my orders in this manner.

Mr. Gregson's remark that the makers have to see what the demand is likely to be before producing in quantity does not point to much confidence in the goods on the part of the maker, and, anyhow, this does not apply in the case of such things as valves of proved superior qualities, as there is sure to be a demand for such at once and in large quantities, if they really are good.

One firm wrote me that their orders had been so large that their packing staff could not deal with them!! What about increasing the packing staff for the busy season?

I am not sure that the Exhibition should be held any earlier, as any suggestion that the dummy goods exhibited then will not be available for another three months or more will simply cause the public and provincial traders to treat the show as a joke, and those three months will be a general slack season.

My orders are going to those who deliver promptly—of any nationality. GUY S. M. ASHBY.

PICTURE RECEPTION.

Sir,—May I endorse the statements of Mr. Walter Addey in your issue of January 1st, 1930, on the subject of Picture Transmission? I have been constructing a picture machine after the pattern of *The Wireless World* design, and it is now just finished, only to find the transmission of pictures has been discontinued.

I was given to understand by Messrs. Wireless Pictures (1928), Ltd., that the B.B.C. would be transmitting for some time to come. (This was in August, 1929.) Therefore, the sale of instruments to the public is, in my opinion, ridiculous.

As Mr. Addey says, "Pictures are to be received from Vienna," but until we have adjusted our instruments and tested them on a reliable transmission we cannot hope to overcome fading effects, etc.

I shall be pleased to hear from any other readers in a similar plight, should you publish this letter.

Many thanks for your valuable paper—still splendid value at its increased price.

H. W. HOWLETT.

THE ROBINSON "STENODE RADIOSTAT."

Sir,—I read with considerable interest the article, under the above heading, which was published in *The Wireless World* of December 11th, 1929, but perhaps you will permit me to comment on the latter part of the article, in which the writer states he is puzzled by the fact that true reproduction can accompany almost perfect selectivity in a radio receiver. In recent years considerable misconception has arisen regarding the theory of the transmission and reception of radio frequencies modulated by audio frequencies, and it is probable that it was this misconception which was responsible for the writer being puzzled.

In modern wireless literature it is repeatedly stated that the modulation of constant frequency carriers produces "side bands" or subsidiary frequencies equal to the sum or difference of the modulation and carrier frequencies. This, however, is a statement which I believe to be neither borne out in fact, nor theoretically accurate. To take an example: If a carrier of 1,000kC. is modulated by 1kC., there will be only one frequency radiated, namely, 1,000kC., the *amplitude* of which, however, will fluctuate one thousand times each second. The production of beat frequencies, of course, cannot take place, as there is too great a difference between the primary frequencies. The study of an oscillograph record should make the matter quite clear; the modulation of 1,000 cycles per second by one cycle will produce a graph with the peaks of the waves having a figure 8 formation, but in no case will frequencies of 1,001 or 999 be traced. When two transmitters are heterodyning, a whistle of varying amplitude, but constant pitch, is produced, but if side bands existed the pitch would vary with the modulation.

This misconception has received considerable support in view of the fact that highly selective receivers have hitherto been unable to reproduce all the audio frequencies in correct proportion. This fault, however, is not because the receiver is selective and so "cuts the side bands," but because of the method whereby selectivity is attained. Such a receiver has employed one or more high-frequency resonant circuits and, from the nature of these circuits, it follows that the less resistance or damping employed the longer time will it take the current to change from one amplitude to another. In the case of high audio frequencies the amplitude changes have to be very rapid, with the result that the persistence of the current in the circuit tends to smooth them out. The matter can be reasoned from another angle. If side bands are necessary, as far as reception is concerned, a receiver designed to respond to one frequency only would be incapable of detecting any modulation. Such a proposition is out of the question, since, whether or not we hold that side bands are produced, it is unquestionable that the amplitude of a carrier varies as it is modulated.

Present-day receivers are affected by the heterodyning of two transmissions because both the frequencies are received, whereas, if the receiver responded to one only of the frequencies, however closely it approached the other, the heterodyne note would not be heard.

From the foregoing remarks it will appear that there is no theoretical reason as to why a receiver designed to be highly selective should not be entirely successful, providing that selectivity is not achieved wholly by the aid of undamped resonant circuits. Dr. Robinson is to be congratulated if he has succeeded in producing such an instrument.

London, E.10. F. STUBBINGS.

THE SUPERHETERODYNE.

Sir,—The reasons for the unpopularity of the superhet in England are these:—

1st.—The necessity for extreme selectivity is not so urgent. Transmitting stations are not so broadly tuned as they are in France.

2nd.—The British public have been accustomed to very simple tuning devices and seem afraid to buy a set that requires a little more attention to tuning in.

3rd.—A superhet requires more valves and consequently increases the price of the set. The price of a general-purpose valve in France is 37 frs. 50 (about 6s. 3d.), whereas in England it is 10s. 6d.

As a representative of British firms in France, I am up against the selectivity problem every day. The first question one is asked at the dealers is, "Is it a 'cbangeur de frequence?'" One has to stay no, and then many firms will not even trouble to listen.

It is quite impossible in Paris with the usual circuits used in England to eliminate Radio Paris and Eiffel Tower and obtain Daventry, which every Frenchman wants.

The screened grid is an improvement, but not as selective as the superhet, which in experienced hands is quite as good and pure as any straight circuit.

Why have British manufacturers neglected this market? What they have missed I am in a position to know.

I recently represented a large British portable set manufacturer who eventually started a factory in France. I tried to convince them that the superhet was the only circuit that would sell here, but they decided that the set was doing well in England and must be made to go well in France!

The result was that Daventry could never be received without interference from Radio Paris and Eiffel Tower. What hopes has a British firm of doing satisfactory business on these lines? Whatever British firms do to-day, if only they would build a superhet for the French market they would do ten times the business.

A. J. HILL.

Paris.

BOOK REVIEW.

Elements of Radio Communication, by J. H. Morecroft (Chapman and Hall, 1929. 15s. net. Pp. 269). Professor Morecroft's well-known standard work, "Principles of Radio Communication," has now passed through several editions and is an indispensable work of reference to the professional wireless designer, but is somewhat heavy reading for the student and the amateur. The present work is of a simpler character, and may be considered as an introducing volume to the larger book.

Though the treatment is elementary in that no mathematical equipment beyond a knowledge of algebra is required, yet the subject is dealt with in a more solid fashion than in the average popular exposition. The principle is to give first an account of the theory of alternating currents, with special reference to the requirements of wireless telegraphy and telephony and to follow this with the applications involved in modern practice.

The numerical information given is unusually complete. Thus, we are given figures as to the absorption of waves by steel buildings, the relative ranges and ship distances of transmissions on various wavelengths, and the comparative rectifying powers of crystals and valves using anode-bend or cumulative detection.

The chapter on receiving sets gives a most readable account of the good and bad points of modern sets. It begins with crystal circuits and treats of loud speakers, amplification units, superhets, various types of H.F. and L.F. amplifiers, and ends with mains-fed sets and filter systems.

R. T. B

Broadcast Brevities

By Our Special Correspondent.

The World Listens.—The Question of News Bulletins.—New Regional Tests.

The World's Biggest Broadcast.

If the International Disarmament Conference were being held in a studio at Savoy Hill, the powers that be could show no greater deference to the peculiar requirements of broadcasting than they will on January 21st. For the special benefit of the world's listeners, H.M. the King and ten representatives of the Great Powers will observe a rigid time-table which will bring all their speeches within the compass of two hours.

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Order of Speeches.

Immediately after the King's speech, which begins at 11 a.m., His Majesty will leave the Chamber, the chair then being taken by the Rt. Hon. Ramsay MacDonald.

I learn from an authoritative source that the subsequent speeches will be given in this order: (1) Mr. Ramsay MacDonald, (2) Mr. Henry Stimson (U.S.A.), (3) M. André Tardieu (France), (4) Signor Dino Grandi (Italy), (5) Mr. Kanami Wakasugi (Japan), (6) Col. the Hon. J. L. Ralston (Canada), (7) Mr. J. E. Fenton (Australia), (8) Hon. T. M. Wilford (New Zealand), (9) Mr. C. T. ter Water (South Africa), and (10) Sir Atul Chandra Chatterjee (India).

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B.B.C.'s Responsibility.

The delegates will be seated round a horseshoe table and each will be provided with a microphone extension. The B.B.C. control engineer will be discreetly inconspicuous just outside the door.

There can be little doubt, I think, that this broadcast will be the biggest of its kind ever staged. Ten nations have a direct interest in the proceedings of the Conference, while nearly every other country will hold a watching brief. Europe will be listening to Daventry, or *via* special landlines to Continental transmitters, and the rest of the world will be doing its best to hear 5SW. The B.B.C. has a big responsibility.

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Dreary News Bulletins.

"Brighter news?" was the question that leapt to everyone's lips at the announcement of a staff change in the Savoy Hill news department. I doubt whether the change will have any effect whatever, but the B.B.C. is scarcely to be blamed on that account.

Unlike a newspaper, the broadcasting machine gives no time even for a 'proof"; sub-editing is reduced to a minimum, as many items of news come in while the announcer is actually reading the bulletin. I believe a scheme of broadcast "headlines" was once considered with the idea of making the items more attractive, but it was not found practicable. Some means should be found, however, to brighten up one of the dullest features of the broadcast service.

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Special Radio Week Feature.

I see that one of the organs of the B.B.C. prints a sonnet "to be broadcast, with other poems, by Elizabeth Barrett Browning, on January 14th." Seeing that this is National Radio Week, the B.B.C. might have gone a step further by giving us a sonnet from the lips of Will Shakespeare himself.

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New Tests from Brookmans Park.

Only seven thousand letters have been received at Savoy Hill regarding the Brookmans Park tests. This is a negligible figure compared with the vast numbers who are known to be within the service area, and the inference might be that the twins are giving satisfaction. The real truth, of course, is that the really serious tests have yet to come. So far few people can have been inconvenienced by the simultaneous transmissions, but I hear that the tests will be much more drastic in a week or two, with music from both transmitters. Up to the present this has been attempted only at unimportant times: in the afternoon, for instance.

Not until the final test period begins will it be possible to say when the twin transmitters will begin their permanent service of simultaneous transmissions. The final tests will probably last three or four weeks.

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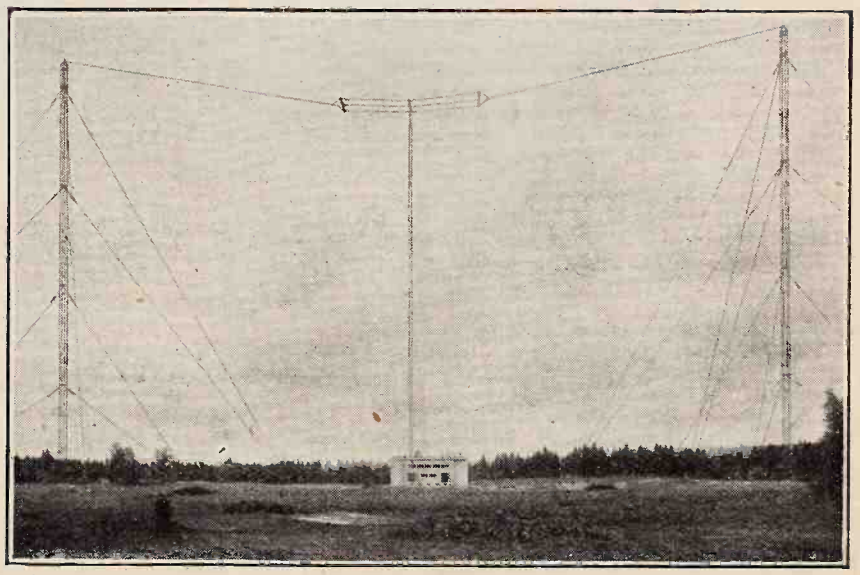
Present Schedule.

Until further notice, the arrangement of the alternative programme test transmissions from Brookmans Park is as follows:—

The published programme is transmitted by the National programme transmitter working on a wavelength of 261 metres and by Daventry 5XX, from 12 noon to 1 p.m. on Monday to Fridays, and from 1 p.m. to 2 p.m. on Saturdays. The whole of the late dance music which follows the studio programme each evening is transmitted also by the National programme transmitter on a wavelength of 261 metres and by Daventry 5XX. During the whole of these periods the 356-metre Regional programme transmitter radiates a contrasted programme. On Sundays there will be no test transmissions in the evenings, but the alternative programme test transmissions will take place as usual between 2 and 2.50 p.m.



THE NORWEGIAN GIANT. The new 60-kilowatt broadcasting station at Oslo, just completed by the German Telefunken Company. Operating on 493 metres, Oslo can be heard at most times of the day in Great Britain.

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.

Juggling with Grid Bias Cells.

I am using, as an anode bend detector, a high-impedance valve which apparently requires a bias of something between 1½ and 3 volts (the voltages of one or two dry cells). To avoid the need for fitting a potentiometer, I recently obtained one of the new 0.9-volt bias cells, and have connected it in series with an ordinary dry cell; although signals are louder, I think that the valve would work still better with slightly less negative on its grid. Is it safe to try the expedient of reversing the polarity of the low-voltage cell connections? D. D. L.

No harm can be done by trying this experiment, and we suggest that you should connect two ordinary dry cells in series and then join up the 0.9-volt cell in opposition. This would give an effective voltage of 2.1, which should be about right.

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An Extra Tuned Circuit.

I understand that the addition of a separately tuned and loosely coupled aerial circuit will increase the selectivity of my Kilo-Mag Four receiver. Is it reasonable to assume that this addition will also bring about an appreciable increase in its range? H. T. L.

Under average working conditions, it is safe to assume that a separate tuned aerial circuit will add to the range of a receiver, as compared with the "aperiodic" arrangement which it usually displaces. At any rate, it is quite safe to make this assumption if the comparison is to be made on a basis of equal selectivity; a two-circuit aerial tuner with coupling adjusted for loudest signals gives better results than an "aperiodic" arrangement similarly adjusted.

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When Valves Fail.

My present valves have been in use for well over two years, and as the signals given by my receiver are not as good as formerly, I have come to the conclusion that this falling off is due to a partial failure of valve emission; at any rate, a careful point-to-point and stage-by-stage test with the apparatus at my disposal fails to reveal any fault. Will you tell me if there is any simple and easy way of checking the emission of the valves without the need for any elaborate equipment? M. K.

A milliammeter with a range depending on the characteristics of the valves to be tested is sufficient equipment to enable you to form an idea as to whether your valves are in order in the matter of their emission. First connect the milliammeter in the anode circuit of the valve under test, taking care to short circuit any transformer primary or other resistance of appreciable value that may be in series. Next, having set grid bias and anode voltages at convenient values, observe if the anode current indicated is reasonably near (say within 25 per cent.) to that indicated by the manufacturer's published curve.

Even without any apparatus at all it is possible in some cases to form a very fair opinion as to the state of the valves, provided one can assume that the various batteries are in order. When it is found that an L.F. amplifying valve cannot be used with the full value of negative grid bias recommended by its makers without introducing obvious distortion, it can generally be assumed that emission has fallen off considerably.

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A Gramo-Radio "Kit Set."

Will you please give me some hints as to how the "'Wireless World' Kit Set" may be adapted for use with a gramophone pick-up? If possible, I should like to arrange matters so that the pick-up is permanently connected to the receiver, with a switch to put it into circuit when required. J. L. A.

We suggest that the pick-up should be inserted in the grid circuit of the detector valve in the manner shown in Fig. 1.

The single-pole change-over switch necessary for the conversion can conveniently be mounted on the upper part of the base, with its operating lever protruding into the lower compartment; it may be operated by a rod projecting through the front panel. It is here assumed that your set is constructed in the same manner as the original model described in these pages.

As a refinement, an extra pole may be added to the radio-gramophone switch, so that the H.F. valve filament will be automatically switched off when this valve is not in use. Of course, this operation can be carried out, if preferred, by means of the rheostat already fitted.

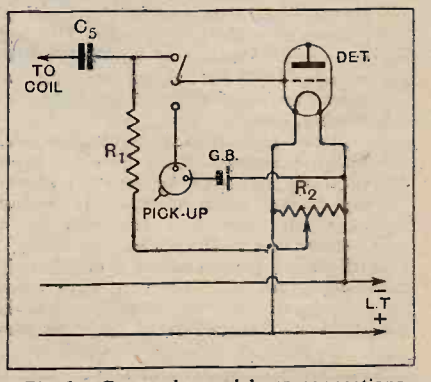

Fig. 1.—Gramophone pick-up connections for "The Wireless World" Kit Set.

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A Double-purpose Resistance.

Will you please criticise the circuit diagram of my proposed four-valve receiver? Valve types and resistance and capacity values are marked. Please say if these are suitable. S. P. S.

Your diagram shows a fairly conventional H.F.-det.-2 L.F. receiver; in general, it should give satisfactory results, but we expect you will find it necessary to alter the ratio of the H.F. transformer (shown as 1 : 1), or to add another tuned circuit. The set as it stands will lack selectivity for use in your locality.

The decoupling resistance in the detector anode circuit should be increased from 600 ohms (as shown) to about 20,000 ohms. It must not be forgotten that in this circuit we are dealing both with H.F. and L.F. currents; it is probably true to say that the latter are most likely to give rise to trouble, and they must be taken into account when determining the values of decoupling components. The associated by-pass condenser should be increased in capacity from 0.1 mfd. to 2 mfds.

RULES.

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

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

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

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

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

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

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

Detector Anode Milliammeter.

My receiver is a 1-v.2 combination, with anode bend detector coupled by a high-inductance choke to the first L.F. amplifier, which is coupled to the output valve by a transformer. A post-detection volume control is fitted, in the form of a quarter-megohm variable resistance shunted across the L.F. choke.

The set works well, but I have been puzzled, since fitting a detector anode milliammeter as an indicator, by the fact that quite good and very loud signals are obtained from many stations without any observable change taking place in anode current reading. So far as several nearer and more powerful transmissions are concerned, it is quite easy to get a maximum deflection of between one and two milliamperes; of course, in these conditions it becomes necessary to use the volume control to prevent overloading.

Even after dark, it is unusual to find any great number of stations whose signals bring about an increase of more than a small fraction of a milliampere.

Does the above suggest that anything is wrong? Grid bias has been carefully adjusted by ear; the standing current when no signal is coming in is, as near as I can read it, a quarter of a milliampere. E. F. R.

Without full particulars of your set, and, more important still, practical experience of your local receiving conditions, it is impossible to say definitely that the performance you describe is everything that can be expected. On the whole, we think that you can have little cause for concern, as the receiver seems to be working quite well.

It must be remembered that your two-stage L.F. amplifier probably provides a very large overall amplification, and, if so, very small signal voltage variations on the detector grid, with almost imperceptible changes in anode current, may well provide a sufficient input for considerable output volume. No doubt the post-detection volume control must be brought into use long before the detector becomes fully loaded (as indicated by a current reading of about one milliampere, assuming normal working conditions).

Although you give no particulars of your milliammeter, we are inclined to think that your apparent difficulty in taking fractional readings is a proof that the instrument is less sensitive than is desirable for this sort of work. Generally speaking, a scale reading of 0-1.5 or 0-2 milliamperes is to be recommended.

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A "Tune-stand-by" Switch.

I am planning a new receiver, which is to include a separately tuned aerial coupled to the grid circuit through a small variable condenser connected between the centre points of the two coils. Is it possible, without introducing any serious losses, to fit a switch for cutting out the tuned aerial circuit at will? My object is to simplify operation of the set when searching for transmissions of which the corresponding condenser adjustments are not known. N. G. P.

In the design of commercial and "Service" apparatus it has always been quite usual to include a so-called "Tune-stand-by" switch for this purpose, and, now that two-circuit aerial tuners are coming into more general use for broadcast reception, this is a practice that might well be imitated. It is very likely to be helpful in your own particular case, as we see that you live at a considerable distance from a transmitting station, and consequently you will not always need the higher selectivity conferred by the separately tuned aerial circuit.

For the arrangement you describe the form of connection shown in Fig. 2 (*a*) is suitable; an "aperiodic" coupling is provided when the switch is "down."

It may be pointed out that matters may be simplified if you change your circuit slightly, and adopt the arrangement suggested in Fig. 2 (*b*). Provided the coupling condenser (C.C.) has a suitably low minimum value, this is practically as effective, and requires nothing more than a single-pole on-off switch for its execution.

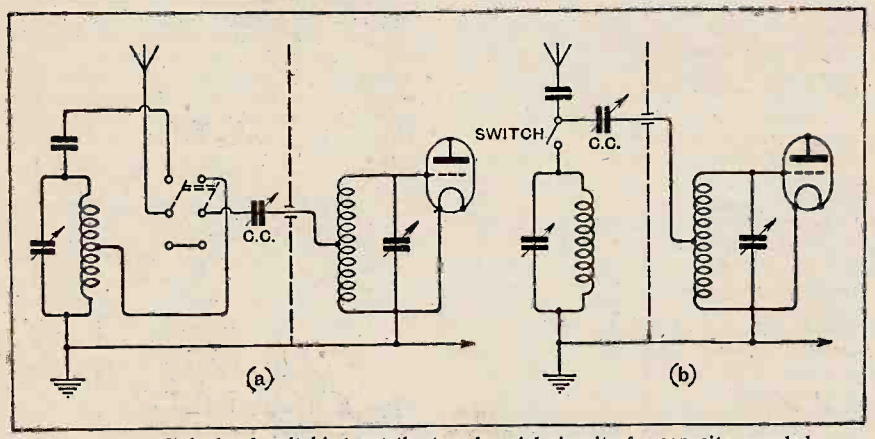


Fig. 2.—Methods of switching out the tuned aerial circuit of a capacity-coupled two-circuit tuner.

Transformer Primary Condensers.

With reference to your recent article on the subject of parallel-fed L.F. amplification, will you please tell me if there is any reason why an L.F. transformer with a built-in condenser in shunt with the primary winding should not be used in circuits of this sort? If not, would it be satisfactory to remove the condenser? W. L. S.

The effect of this condenser—from the "L.F." point of view—is allowed for by the manufacturers, and these transformers can most certainly be used with entirely satisfactory results. The condenser should not be removed.

oooo

Porcelain Connectors.

I recently saw some small porcelain blocks fitted with brass insets carrying nipping screws; these were used for securing some of the connections of an experimental receiver. Having had some experience of burning out valves through short-circuits between temporary leads, these little "gadgets" attracted my attention. Can you tell me what they are called and where they may be obtained?

These are known as porcelain connectors, and we are rather surprised that you should have any difficulty in obtaining them. They are usually stocked by dealers in small electrical fittings, and are made with one, two or three insets for similar numbers of conductors. We agree that they are very useful for making safe semi-permanent connections.

FOREIGN BROADCAST GUIDE.

KHARKOV

(Russia).

Geographical Position: 50° N. 36° 14′ E.

Approximate air line from London: 1,580 miles.

Wavelength: 1,304 m. Kilocycles: 230. Power: 12 kW.

Time: Eastern European (two hours in advance of G.M.T.).

Standard Daily Transmissions.

Time signal at 17.00 G.M.T. a long buzz followed by chimes on a gong to indicate 19.00 Eastern European Time.

08.00 and 09.00 morning concert; 18.00 and 20.00 main evening programme; 21.00 dance music (Saturdays only).

Frequently relays programmes from Moscow Komintern and Leningrad.

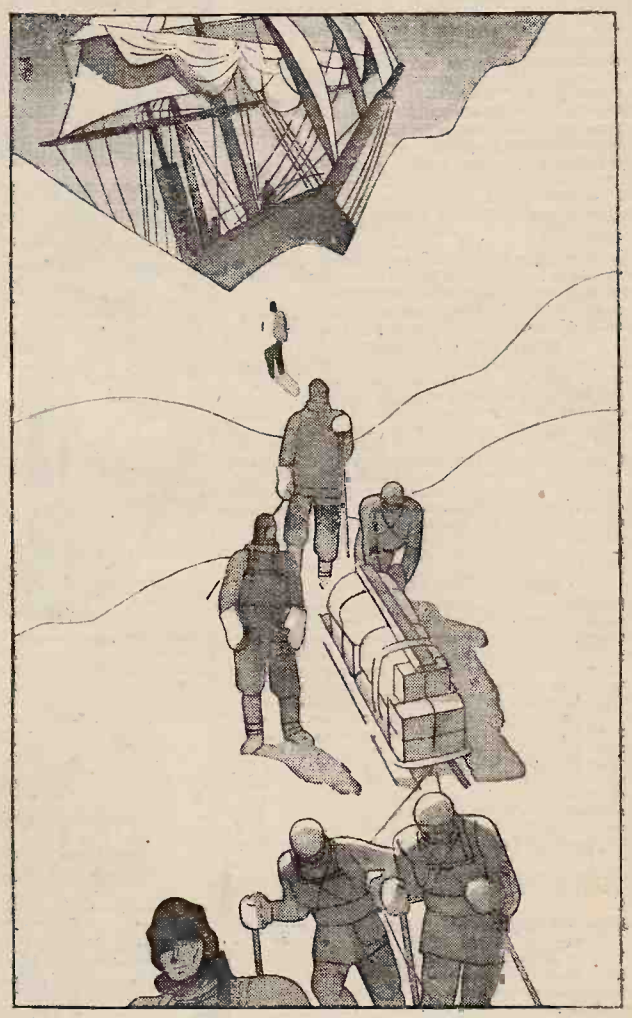
Man and Woman announcers. Call (phonetic): *Rhar-low* (thrice) *govoreet Kharkovska rah-dee-owe-mov-na stant-see-ya Narkom-potsch-tel,* Abbreviated call during intervals: *Rhar-low, rah-dee-owe Kharkov.*

Interval signal: gong.

These transmissions are also broadcast by a 4 kilowatt station on 426 m. (704.2 kc.).

SOUTH POLE speaks to LONDON!

IN FAR Antarctic wastes . . . Sir Douglas Mawson charts unknown continent. Sights new island. Wirelesses to London —*through Marconi Valves*. "Discovery" uses them—to keep touch with civilization, with supply ship, with accompanying airplane. Cable Service to Australia . . . Empiradio Beam Wireless . . . all British Broadcasting Stations . . . use Marconi Valves. For their wide range. For their long life. For their reliability.



In cases like these, when unfailing efficiency is essential — a matter of life and death even — men insist on Marconi Valves

FIT MARCONI VALVES TO YOUR RADIO SET

Give you clearer tone, greater volume, longer range. Cost not a penny more. Fit any set.

The first and greatest name in wireless

MISCELLANEOUS ADVERTISEMENTS.

NOTICES.

THE CHARGE FOR ADVERTISEMENTS in these columns is :

12 words or less, 2/- and 2d. for every additional word.

Each paragraph is charged separately and name and address must be counted.

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ADVERTISEMENTS for these columns are accepted up to FIRST POST on THURSDAY MORNING (previous to date of issue) at the Head Offices of "The Wireless World," Dorset House, Tudor Street, London, E.C.4, or on WEDNESDAY MORNING at the Branch Offices 19, Hertford Street, Coventry ; Guildhall Buildings, Navigation Street, Birmingham ; 260, Deansgate, Manchester ; 101, St. Vincent Street, Glasgow, C.2.

Advertisements that arrive too late for a particular issue will automatically be inserted in the following issue unless accompanied by instructions to the contrary. All advertisements in this section must be strictly prepaid.

The proprietors retain the right to refuse or withdraw advertisements at their discretion.

Postal Orders and Cheques sent in payment for advertisements should be made ~~& Co.~~ payable to **ILIFFE & SONS Ltd.**, and crossed ~~Notes being~~ untraceable if lost in transit should not be sent as remittances.

All letters relating to advertisements should quote the number which is printed at the end of each advertisement, and the date of the issue in which it appeared.

The proprietors are not responsible for clerical or printers' errors, although every care is taken to avoid mistakes.

NUMBERED ADDRESSES.

For the convenience of private advertisers, letters may be addressed to numbers at "The Wireless World" Office. When this is desired, the sum of 6d. to defray the cost of registration and to cover postage on replies must be added to the advertisement charge, which must include the words Box ooo, c/o "The Wireless World." Only the number will appear in the advertisement. All replies should be addressed No. ooo, c/o "The Wireless World," Dorset House, Tudor Street, London, E.C.4. *Readers who reply to Box No. advertisements are warned against sending remittance through the post except in registered envelopes ; in all such cases the use of the Deposit System is recommended, and the envelope should be clearly marked "Deposit Department."*

DEPOSIT SYSTEM.

Readers who hesitate to send money to unknown persons may deal in perfect safety by availing themselves of our Deposit System. If the money be deposited with "The Wireless World," both parties are advised of its receipt.

The time allowed for decision is three days, counting from receipt of goods, after which period, if buyer decides not to retain goods, they must be returned to sender. If a sale is effected, buyer instructs us to remit amount to seller, but if not, seller instructs us to return amount to depositor. Carriage is paid by the buyer, but in the event of no sale, and subject to there being no different arrangement between buyer and seller, each pays carriage one way. The seller takes the risk of loss or damage in transit, for which we take no responsibility. For all transactions up to £10, a deposit fee of 1/- is charged ; on transactions over £10 and under £50, the fee is 2/6 ; over £50, 5/-. All deposit matters are dealt with at Dorset House, Tudor Street, London, E.C.4, and cheques and money orders should be made payable to Iliffe & Sons Limited.

THE SALE OF HOME-CONSTRUCTED UNLICENSED APPARATUS.

A Service to our Readers.

We have made an arrangement with the Patentees whereby readers who wish to dispose of a home-constructed receiver not licensed under the patents made use of, can license the set by means of the Deposit System referred to above.

The person desiring to sell, in sending us particulars for his advertisement, will in every case make use of a Box No., and should add to the price which he requires the amount of royalty customarily paid by manufacturers.

If the purchaser is satisfied with his purchase, the sum realised will be forwarded to the seller, less the amount due in respect of royalties, which amount will be paid by "The Wireless World" to the owners of the patents concerned, and a certificate will be handed on to the purchaser of the set.

SPECIAL NOTE.—Readers who reply to advertisements and receive no answer to their enquiries are requested to regard the silence as an indication that the goods advertised have already been disposed of. Advertisers often receive so many enquiries that it is quite impossible to reply to each one by post.

RECEIVERS FOR SALE.

SCOTT SESSIONS and Co., Great Britain's Radio Doctors.—Read advertisement under Miscellaneous. [0264

3-VALVE All-wave Receiver, latest type, powerful, perfect; £4.—V. Taylor, 57, Studley Rd., Stockwell, London. [0274

RECEIVERS for Sale.—Portable 5-valve, suit case type, complete, as new, perfect; £9/17/6.—N. Taylor, 57, Studley Rd., Stockwell, London. [0323

WIRELESS Portable Sets, with 5 Cossor new process valves, for 9 guineas; less than components cost, comparable with any set double this price, Royalty paid; seen between 1 and 2 p.m., or particulars sent on receipt of stamped addressed envelope.—G. Hodgson, 53, Windsor House, Victoria St., Westminster. [7737

READ and MORRIS, Ltd., the mains pioneers, who in 1925 equipped the hospital with mains sets, still supreme in all-mains receivers and units.

LOW Tension A.C. Eliminators, permanently replacing batteries, now only £5/15; electrolytic condensers, 2,000 m.f., as used in above, 13/-; including postage.

BARGAINS.—Second-hand sets, units, meters, speakers.—Read and Morris, Ltd., 31, Eastcastle St. (facing back of Warings), Oxford St., W. [7769

SUPER Range 3-valve Set, guaranteed, genuine, complete with all accessories, new; 9 guineas; approval 7 days.—Box 4377, c/o *The Wireless World*. [7828

GREAT Opportunity.—Having many requests for famous Royal Air Force 3-valve receivers, we have now procured limited number; these receivers give excellent loud-speaker reception, each set specially tested before delivery to ensure satisfaction, all are guaranteed brand new and perfect; the original cost of these sets was £18; special travelling case with each set; we are sacrificing at the absurdly low price of 32/6.

GUARANTEED and Absolutely New McMichael Supersonic Kits, including mahogany cabinet, book instructions, blue prints; clearance price only £3; these sets can get the whole world; without cabinet, price £2.

J. B. HUMPHREYS and Co., 23, College Hill, Cannon St., London, E.C.4. [7802

PYE Portable 5-valve Set, latest model, never been used; £17/10 only.—Box 4435, c/o *The Wireless World*. [7875

MARCONI 51B, complete, 5-valve A.C. mains receiver, with Rice Kellogg speaker, in magnificent mahogany pedestal cabinet, as new; list price £90, special bargain price £37/10.—Mills, 63, Grainger St. West, Newcastle. [7874

LIBERTY Super Heterodyne, complete with 8 Mullard valves, never used; cost £31, sacrifice £12, or useful exchange.—Leaver, 38, Baker St., Sparkhill, Birmingham. [7873

MARCONI Three Valve Model 37, new; cost £5/10, accept 70/-; Brandes table talker, 10/6.—80, Claughton St., St. Helens. [7871

WE Offer You the Following Inducements to Purchase Your New Receiver or Other Apparatus from us.

FIRSTLY.—Unbiassed advice. The Principal of the firm has twenty years' professional wireless experience, having been at Government Experimental Stations in 1910. He has been Manager for the Sterling Telephone Co., radio expert to the G.E.C., and Chairman of the Technical Committee of the National Association of Radio Manufacturers. His advice has saved our clients many thousands of pounds, for, as everybody knows, there is no hobby on which more money is wasted on useless apparatus by the uninitiated.

SECONDLY.—We take your old apparatus in part exchange for new. Send us a list of your old apparatus, or, better still, send us the apparatus, and state your new requirement. We will then make our offer for your goods, and if you do not approve, which is unlikely, we will return the parcel, carriage paid.

IF You are in Doubt as to the Make of Receiver or other Apparatus you should Purchase, write to us, and we will advise you; we have no leaning towards any particular maker, and will tell you the particular instrument you should buy for your purpose.

SCIENTIFIC DEVELOPMENT Co., 51, Fishergate, Preston. Tel. : 1364. [0226

FOR Sale.—Four 3-valve receivers, equal to the best and guaranteed, complete, and ready to switch on; 55/- each; many other bargains.—Enquiries to Adams, 48, Tyrwhitt Rd., London, S.E.4. [7868

MARCONIPHONE All Mains 3-valve Set 37, used one month, reason, changing to A.C., as new; cost £12/7/6, take £9 or offer.—Box 4430, c/o *The Wireless World*. [7857

EKCO 3-valve All Mains Set, A.C., 200-250v., as new; £14; seen by appointment.—K. Rice-Axley, 55, Argyll Rd., Kensington. Tel. : Western 6176. [7852

Receivers for Sale.—Contd.

FOR Sale.—G.E.C. 8-valve set, superhet, indoor aerial, Exide batteries for H.T.; best offer accepted.—Apply 217, Gunnersbury Lane, W.3. [7837

5-VALVE Fada Neutrodyne (switch, 4 valves), 5 Mullard valves, H.T. battery, accumulator, and loud-speaker, £9; wanted part exchange, good portable gramophone and small billard table complete.—E., 75, Heath St., Hampstead, N.W.3. [7849

EUROPA Portable, with cabinet, less wiring, H.F. transformers, speaker and valves.—Enquiries to W. H. Sadler, Ottery St. Mary. [7842

SIMMONDS BROS.—Receivers constructed to your own or any published design; also repairs, reconstructions; and modernisations at moderate charges; best materials and workmanship guaranteed; numerous testimonials; quotations free.—Address, Shireland Rd., Smethwick. [5882

SUIT Beginner.—2-valve Brownie, complete coils (B.C.C., 5XX), valves and good accumulator; £4.—Behr, 2, Birch Grove, Lee, S.E.12. [7922

2-VALVE Burndept, complete with L.S. and 3 B.T.H. headphones, good working order; £2/15, or offer.—Box 4447, c/o *The Wireless World*. [7910

KILO-MAG 4-valve Receiver, exact specification, powerful, valves, loud-speaker; bargain, quick sale, £10; heard evenings 8 p.m.—Lynch, 2, Alvanley Rd., West Derby, Liverpool. [7900

MARCONI Straight Eight, complete with A.C. high tension eliminator, 6v. accumulator and Tungar charger, in perfect condition; £25.—A. Southgate, 79, Rochester Row, Victoria, S.W.1. Tel.: Victoria 4361. [7895

SELECTIVITY, Freed-Eisemann 5-valve Neutrodyne, model N.R.6, new Osram valves, fine reproduction, 40 stations recently, range 200-600 metres, suitable London district; £12.—Postlethwaite Bros., Kinver, Stourbridge. [7886

McMICHAEL 7-valve Superhet., complete with frame aerial, Amplion mahogany Radiolux (large), batteries, accumulators, and 10 spare valves: £20, cost over £70; seen after 7.—23, Englewood Rd., Clapham Common, S.W.12. [7884

ALL-MAINS (A.C.) 3-valve Set, new; £15.—6, Hauberk, Rd., S.W.11. [7881

APPLEBY'S.

APPLEBY'S Bargains.

THE Following Slightly Used Material is Offered subject to sale; every article will be severely tested before despatch, and guaranteed in workable condition; the following items quoted are nett cash and carriage paid in Great Britain:—

RESIDUE of Receivers.—One only left, McMichael Screened Dimic Three receiver, in oak, with set of three tested valves, as new, £10/15; one only left, Gecophone Superhet. receiver, complete with set tested valves and frame aerial, condition perfect, £12/15; one only left, Marconi 5-valve portable receiver, complete, £13/10; one only left, Aconic 5 valve portable receiver, complete, £8/10; one only, Gecophone 3-valve S. wave receiver, condition perfect, £7/10.

NOW.—Send now; many clients were disappointed by material having been sold previous to their application, for sets advertised a week or so ago.

APPLEBY'S, Number Forty-four Chapel St., Marylebone, N.W.1 (four minutes from Oxford St., London). [031

PYE Portable, as brand new, £17/10; Magnavox moving coil speaker, 6 volts direct current, 65/-. —105, Chatsworth Rd., N.W.2. [7853

SOLODYNE, handsome oak case, Cyldon triple gang, Lewcos long and short wave, 5 Osram valves, filter circuit, Pye transformer.—Cordingley, Hebden Rd., Grassington, Skipton, Yorks. [7889

MULLARD Columbus Set, Cyldon condensers, 5 Mullard valves, Colvern high and short wave; £6/10.—Cordingley, Hebden Rd., Grassington, Skipton. [7890

MULLARD Portable, all parts as specified, Exide accumulator; £7/10.—Cordingley, Hebden Rd., Grassington, Skipton. [7892

MARCONI Model 61, 6 valves (3 S.G., 2 L.F.), extremely powerful and selective, perfect condition; cost £60, bargain; write best offer.—Box 4452, c/o *The Wireless World*. [7920

ACCUMULATOR HIRE.

DON'T Buy Accumulators or Dry Batteries, join our C.A.V. low- and high-tension accumulator hire service, the largest and best in London; better and cheaper reception with no trouble; regular deliveries within 12 miles of Charing Cross; no deposit, payment on delivery or by subscription; over 10,000 satisfied users; explanatory folder post free; 'phone or write to-day.—Radio Service (London), Ltd., 105, Torriano Av., N.W.5. 'Phone: North 0623-4-5. [7596

C.D.E.S. Accumulator Hire and Maintenance Service (5 mile radius).—98, Cherry Orchard Rd., Croydon. [6374

BATTERIES.

WET H.T. Replacements.—Sacs (capped or uncapped), highest grade, No. 1, 10d. per doz.; No. 2, 1/9 per doz.—See below.

ZINCS.—Best quality (wired), No. 1, 8d. per doz.; No. 2, 9d. per doz.; orders valued 5/- carriage paid, otherwise 6d. for postage.—British Battery Co., Clarendon Rd., Watford, Herts. [0258

PENTODE Users.—Write for details of new size self-charging wet battery; 20,000 milliamps, 6d. per volt; illustrated catalogue giving data, post free.—U. Taylor, 57, Studley Rd., Stockwell, London. [0273

WET H.T. Batteries.—Parts per dozen, jars, No. 1, 2¼×1½ square, 1/3; No. 2, 1/6; zincs, No. 1, 10d.; No. 2, 11d.; sacs, No. 1, 1/2 dozen; No. 2, 1/9; terminals, 8d., 10d.; dozen cells (18 volts), complete with bands and electrolyte, No. 1, 4/1; No. 2, 5/-; post 9d.; high efficiency, long life, self charging, upkeep small; send 6d. for sample unit; illustrated booklet free, carriage free order 10/-; write for free list wireless bargains, trade supplied.—W. Taylor, 57, Studley Rd., Stockwell, London. [0039

CHARGERS AND ELIMINATORS.

VORTEXION Transformers, chokes, etc., wound to any specification; write or 'phone for quotation; best quality components only.—Vortexion, 72, Merton Rd., Wimbledon, S.W.19. Tel.: Wimbledon 2814. [0319

TANTALUM and Lionium for A.C. Rectifiers; make up your own inexpensive chargers; blue prints for H.T. and L.T., 1/- each; Lionium electrodes fitted with terminals, 2-3 amps. and 5-8 amps.—Blackwell's Metallurgical Works, Ltd., Speke Rd. Works, Garston, Liverpool. 'Phone: Garston 980 (2 lines). [6282

PHILIPSON'S Safety High Tension Battery Eliminators.

10/- Down and the Balance in Easy Monthly payments secures the finest high tension supply available.

PHILIPSON'S Safety Eliminators are Guaranteed for 12 Months.

PHILIPSON'S Safety Eliminators are the Cheapest to Install and the Cheapest to Run; prices: Model A.C.5 £4/17/6, A.C.7 £5/17/6, complete with full wave, rectifiers; D.C.4 37/6, D.C.5 45/-.

ALL Models Obtained for 10/- Deposit; take advantage of this and get constant high tension immediately.

WRITE for Our Booklet, "Radio Power" to Philipson and Co., Ltd., Radio Engineers, Astley Bridge, Bolton. 'Phone: 2038. 'Grams: Safety, Bolton. Est. over 50 years. [0318

CHEBROS.—Chebros for all types of transformers and chokes, high grade instruments at a very moderate price; enquiries invited.—Chester Bros., 244, Dalston Lane, London, E.8. [5290

TRANSFORMERS and Chokes for Battery Eliminators and for all wireless purposes, receiving or transmitting; enquiries invited.—Chester Bros., 244, Dalston Lane, London, E.8. [7587

FEL-ECTRIC High Tension Eliminator Kits, improved output 15 milliamps at 120 volts; complete; 25/-.

FEL-ECTRIC Eliminator Kits are the Best and cheapest in England; complete, 25/-.

FEL-ECTRIC Kits are Complete, except valve, and we recommend Philips 373; 15/-.

FEL-ECTRIC Kits have been Sold in Hundreds, and are guaranteed, satisfaction or money returned.

FEL-ECTRIC Kit will be sent c.o.d. if desired, state voltage and periods, also whether Philips valve is required at 15/- extra.

FEL-ECTRIC Eliminator Kit is Post Free; price 25/-.

FOLDER and Lists on Request to Fel-Ectric Radio, 56, Garden St., Sheffield. [7742

SAVAGE'S Specialise in Wireless Power from the Mains, reliable apparatus at reasonable prices.

SAVAGE'S Transformer Laminations and Bakelite Bobbins; intending home constructors should write for list.

SAVAGE'S Reliable Smoothing Condensers.—1,000 volts D.C. test, 2 mfd. 3/-, 4 mfd. 5/3; 500 volts D.C. test, 1 mfd. 1/6, 2 mfd. 2/3, 4 mfd. 3/9.

SAVAGE'S Super Smoothing and Output Chokes.—Many types available, write for list.

SAVAGE'S Mains Transformer for Westinghouse Rectifiers.—H.T.4, 18/6; A3, 17/-; A4, 20/-.

SAVAGE'S Mains Transformer for Westinghouse H.T.4 Unit, with additional winding, 4 volts 3 amps.; 23/-.

SAVAGE'S Mains Transformer.—V.T.31, 200-0-200 volts 60 m.amps, 2+2 volts 2 amps., 2+2 volts 3 amps.; 28/-.

SAVAGE'S Mains Transformer.—B.T.3 500-0-500 volts 120 m.amps., 3.75+3.75 volts 3 amps., 3+3 volts 3 amps., 2+2 volts 3 amps.; 51/-.

SAVAGE'S Mains Transformers and Power Chokes are carefully and individually constructed from first class materials with an exceptionally generous margin of safety.

SAVAGE'S, 146, Bishopsgate, London, E.C.2. 'Phone: Bishopsgate 6998. [6808

Chargers and Eliminators.—Contd.

TANALUM Strip for Rectifiers; 4/- per square inch.—C. L. James, 17, Brunswick St., Liverpool. [7864

CRYPTO A.C. to D.C. Converter, A.C. input 200-250 volts 50 cycles, D.C. output 75 watts up to 15 volts; price, complete with switchboard fitted with ammeter, Zenith resistance, switches, fuses, etc., £7/10, list price £11/15 without switchboard; condition as new; can be seen running.—Duruz, 11, Montagu Gardens, Wallington, Surrey. [7872

A.C.110. Ekco Eliminator, 220 volts 45m.a., tapped 110, £2/10; also D.C. eliminator, any voltage, £1/10.—Snow, 3, Kensington Gate, W.8. [7839

MARCONIPHONE All Power Unit, D.C.1, 240-200-volts.—Cordingley, Hebden Rd., Grassington, Skipton. [7891

CABINETS.

ARTCRAFT Radio Cabinets are Britain's Best Value. [0313

DIGBY'S Cabinets.—Table models in solid oak and mahogany; from 11/6 to 71/-.

DIGBY'S Cabinets, fitted with Radion or Resiston ebonite if required.

DIGBY'S Cabinets.—Pedestal model, with separate battery components; from 56/- to £12.

DIGBY'S Cabinets Made to Customer's Own Designs.

DIGBY'S Cabinets.—Write for new 16-page art catalogue.—F. Digby, 9, The Oval, Hackney Rd., E.2. 'Phone: Bishopsgate 6453. [0128

ARTCRAFT Radio Cabinets; Britain's best value; lowest prices consistent with highest quality; illustrated list free from actual manufacturers.—Artcrait Co., 156, Cherry Orchard Rd., Croydon. 'Phone: Croydon 1981. [0040

CABINETS, 16½in.×7½in.×11in., hand mahogany finished 7/6, unpolished 5/6; oval front, 10⅞in. ×6¼in., 6d. extra; portable cabinets, 16½in.×16½in. ×8in., £1/5; baseboard, 6d.; carriage free.—F. W. Ramsey, 63, Shaftesbury St., London, N.1. Clerkenwell 7139. [7584

ARTCRAFT Radio Cabinets are Britain's Best Value. [0311

KAY'S Cabinets, the greatest range of pedestal cabinets in the kingdom; original creative designs at prices 50% lower than elsewhere; quotations for specials by return; delivery at short notice guaranteed; moving coil, portable, baffle, vignette, radiogramo. electric pick-up, television, etc.; illustrated lists free. —H. Kay, Wireless Cabinet Manufacturer, Mount Pleasant Rd., London, N.17. 'Phone: Walthamstow 1626. [7745

ARTCRAFT Radio Cabinets are Britain's Best Value. [0310

A CONE Speaker Cabinet of Distinction.—Solid selected figured oak fret and case, 12in.×12in. ×5½in. inside, extra strong 6 mm. plywood back for fixing unit, rubber feet or baize, state which, polished rich dark oak, unless otherwise ordered, 8/9 each, carriage paid; unpolished, but quite ready for staining and polishing, 7/6 each, carriage paid.—Manufacturer, W. T. Tucker, 2, Vincent St., Balsall Heath, Birmingham. 'Phone Calthorpe 2435. [7850

ARTCRAFT Radio Cabinets are Britain's Best Value. [0309

TRANSPORTABLE Oak Cabinet, frame aerial fitting, loud-speaker, chassis and unit, practically new; 35/-.—"Wyncot," South Oak Lane, Wilmslow, Manchester. [7911

COILS, TRANSFORMERS, ETC.

NEW Kilo-Mag Four Coils, 37/6 set; ebonite formers (slotted), for winding, 12/6 set of 3; all post free; trade supplied.—Groves Bros., St. Mary's Place, Shrewsbury. [7750

1,000-OHM Decoupling Resistances for "Wireless World" Circuits; 1/6 each, post free.—Groves Bros., St. Mary's Place, Shrewsbury. [7833

SIMMONDS BROS.—Berclif coils, Record Three, 50/- pair; new kilo-mag. four, 50/- set; foreign listeners four, low, 30/-; long wave, 37/-; screened grid Regional, 40/-; Mullard S.G.P. dual range coils, 30/- pair; Berclif standard coils, for new all-wave four, standard four, A.C. three, Everyman four, etc., 63/6 set of 4, with bases; the same coils for the Lodestone series ("Wireless Magazine"), 65/9 set of 4, with bases; Titan unit, 15/-; decoupling resistances, 600 ohm. 1/6; 1,000 ohm, 2/-; all "Wireless World" and similar coils in regular production by the leading specialists; list free; trade supplied.—Simmonds Bros., Shireland Rd., Smethwick. Tel.: Smethwick 751. [6314

RADIOGRAPH.—W.W. coils, Record III, 35/-; new Kilo-Mag Four, 33/-; S.G. Regional, 37/6; foreign listeners' Four, 37/6 set; Europa Portable, 21/-; Europa III, 18/6; S.G. multi-valve portable, 22/6; new Everyman Four, 42/6.

RADIOGRAPH.—Litz wire, 9/40, 1/6; 27/42, 2/6 dozen yards; Redfern's deep ribbed or Recol tube, 5d. per inch, slotting 1/6 extra.—Station Rd., Handsworth, Birmingham. [7914

Coils, Transformers, Etc.—Contd.

600-OHM Decoupling Resistances for New Kilo-mag Four, foreign listeners' four, and all "Wireless World" circuits, hand made and tested in our own workshops; improved model, 1/6 each, post free.—Groves Bros., St. Mary's Place, Shrewsbury. [7832

GRAMOPHONE PICK-UPS, ETC.

ELECTRIC Pick-up, with arm, adaptable to any gramophone; pick-up 14/-, arm 7/-; c.o.d.; remarkable value.—G. Hodgson, 53, Windsor House, Victoria St., Westminster. [7738

R.I. Varley Pick-up, practically unused; 22/6.—Snow, 3, Kensington Gate, W.8. [7838

CELESTION Woodroffe Pick-up, cost £4/4, absolutely as new; £2/10.—Box 4448, c/o *The Wireless World*. [7909

B.T.H. Pick-up, almost new; 45/-, will sell 32/6.—J. Mullen, 158, Crosslet Rd., Dumbarton. [7923

LOUD-SPEAKERS.

6-VOLT ½ amp. M.C. Speaker, list £6, new last year, in perfect order, including transformer; 29/6; 7 days' approval against cash.—Brew, Pytchley, Kettering. [7845

200-250 Volt D.C. Mains Moving Coil Speaker, almost new, 29/6; also Zampa double cone chassis, new, cost 32/6, 15/-; 7 days' approval against cash.—Fox, 115, Avondale Rd., Kettering. [7844

OAK Cabinet, fret front, blue-silver cone, new double pole unit; 25/-; 14×13×9.—Kirkup, Fairholme Rd., Burnley, Lancs. [7856

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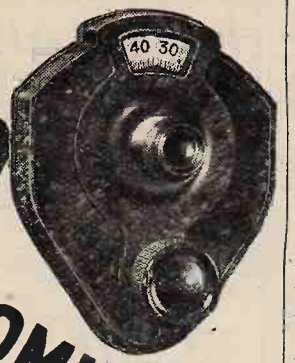

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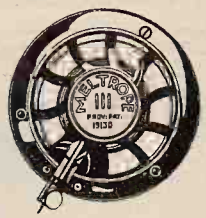

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Sorry another mistake. I turned over 2 pages together. Pages 70 + 71 are in wrong place need moving 2 places back to get in right order.

Dave